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NINE ELECTRICAL SCIENTISTS OF THE NINETEENTH CENTURY. (SEE PAGE 9.)

A Century of Electrical Progress.

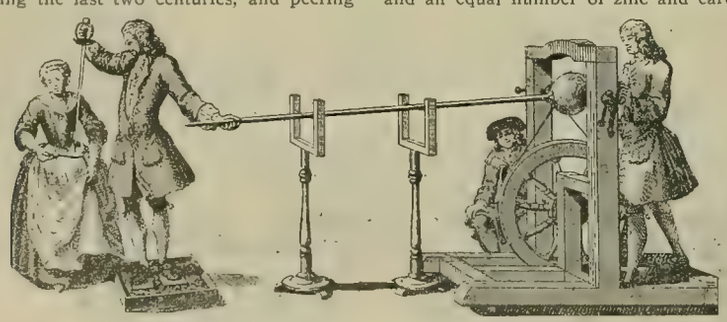
By E. E. Fournier d'Albe, B. Sc. (Lond.).

If the eighteenth century was one of political and intellectual awakening, the nineteenth century has been emphatically one of physical and material progress. It is as if the race of man, in the first glow of its emancipation and in the conscious strength of its maturity, had swept forward with a mighty rush to conquer and subdue the material universe by virtue of the superiority of mind over matter. Future generations, in soberer moments, may blame us for having lost sight of other worlds and more spiritual treasures in our triumph over that material universe with which our five senses bring us into contact, but they will acknowledge that in pursuing our immediate object we displayed an unprecedented energy, perseverance and sagacity.

The field of electrical research has been during the whole of the century the most fascinating for the man of science and the inventor. And rightly so. For the results of scientific inquiry have increasingly shown that electrical phenomena branch out through every department of physics, and that the key to the problems of light, heat, chemistry and chemical physics must be sought in the domain of electricity.

At the dawn of the nineteenth century we find two men looming large on the scientific horizon, both Italians, whose experiments were the subject of the liveliest controversy. Volta had just discovered what he called "contact electricity" between two different metals, and Galvani had preceded him by a few years in discovering what he mistakenly supposed to be a special kind of "animal" electricity. Both these philosophers had little to guide them in endeavoring to explain and prove their hypotheses. Electric theory was as yet in its infancy, and the experimental material accumulated was very limited. Much had, of course, been done since Thales, the Milesian, described the attractive virtue of amber, and since Wolimer, king of the Goths, "emitted sparks from his own body." Dr. Gilbert had discovered the "electric needle," a rod turning on a pivot like a compass needle. Boyle had devised the resinous cake. Otto von Guericke had discovered the first electric light, obtained by the friction of the hand on a ball of sulphur. Hawksbee, in 1705, obtained the first vacuum phenomenon, "the mercurial phosphorus," as he called it, in a Torricellian vacuum over two barometer tubes. Dufay, in 1729, suspended a baby by silk cords and electrified it, to the great astonishment of a select circle of philosophers. The French Academy conveyed a discharge through 12,000 feet of wire and an acre of water in the gardens of the Tuileries. Franklin made his famous kite experiment in 1750, and in 1759 Symmer put a black and a white silk stocking on the same leg, and on pulling them off noticed that they bulged out and attracted each other. In the year 1800 the electrician (if such there were) was in possession of Bennett's gold-leaf electroscope with "duplicator," Cavendish's torsion balance, Coulomb's magnetometer, Le Roy's electric machine with glass disk and amalgam cushion, Watson's coated jar and Lane's unit jar—not a bad cabinet of apparatus even for a modern country school. But the whole field of current electricity was practically unknown and unexplored, and Galvani's frog-legs and Volta's pile of metallic disks were just opening out the first prospect of the great achievements of the century now closed.

In reviewing the last two centuries, and peering



DUFAY'S EXPERIMENT (EIGHTEENTH CENTURY).

forward into the next, it seems appropriate, from the electrician's point of view, to call the eighteenth century the century of electric charges, the nineteenth the century of electric currents and the twentieth (perhaps) the century of electric waves.

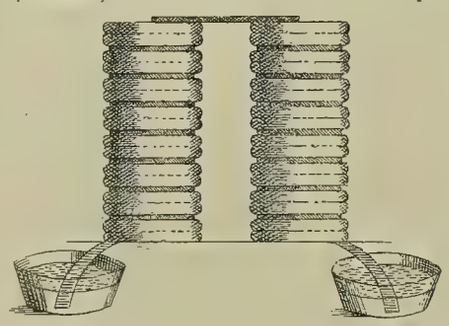
Volta himself retarded rather than advanced the theoretical knowledge of current electricity by his view concerning its nature, which was adopted by all the authorities of his time. That view is best given in his own words: "In the mutual contact of silver and tin an action or force is generated, by virtue of which the former yields the electric fluid to the latter, so that it flows from one into the other. This action, when the circuit is closed by means of a moist conductor, generates a current, or continuous circulation of this fluid, which, in accordance with the direction indicated, proceeds from the silver to the tin and thence through the moist conductor back to the silver, after which it repeats the same process by flowing into the tin."

The objection that this would realize a "perpetual motion" had no force at a time when the doctrine of the conservation of energy was unknown. And it must be remembered that Volta's whole efforts were directed toward explaining away Galvani's "animal electricity," which the latter supposed to account for the jerks in a frog's legs when the nerve was touched by a steel knife in contact with the bronze suspension.

It was Ritter, the translator of Volta's work into German, who first pointed out the chemical action going on in Volta's pile, and drew attention to the fact that the metals, in their relation with "galvanism," formed a series agreeing with the series in which the same metals precipitate each other from their salts. Ritter denied contact electricity altogether, and the persistence of Volta's adherents in ignoring the chemical action led to one of those angry disputes which appear so serious to the principal actors and so ludicrous to subsequent generations, when they find out that both were partly in the right.

Meanwhile Volta's pile underwent rapid modification and development. Volta himself substituted the crown of cups and thus facilitated manipulation. Cruikshank substituted salammoniac for the dilute acid or alkali. Wollaston invented the copper cylinder, and Oersted, in 1818, used three co-axial cylinders, the middle one being zinc.

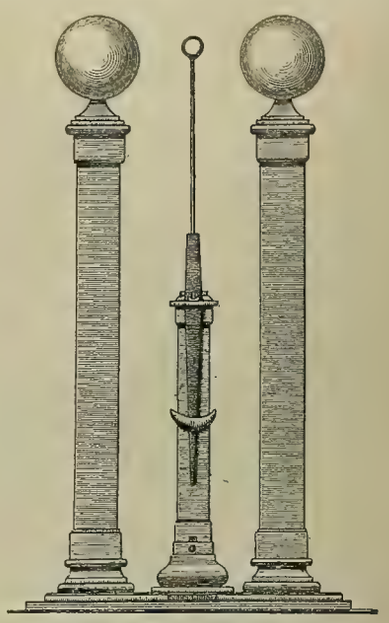
The electrolysis of water, already accomplished in 1789 by means of the Leyden jar, was carried out by means of Volta's pile very soon after its invention. Nicholson and Carlisle's words, written in 1800, are worth quoting: "Soon after commencing these experiments, Carlisle noticed that when a drop of



VOLTAIC PILE (DAWN OF THE NINETEENTH CENTURY).

water was placed on the upper plate, to make the contact more secure, gas was evolved at the wire joining the plates. However little there was of it, it seemed to me to smell like hydrogen, when the wire was of steel. This and other facts led us on May 2d to send the galvanic or electric current through two brass wires ending in a tube half an inch wide filled with fresh river water, the ends being 1¾ inches distant. One of the wires of this discharger was joined to the upper and the other to the lower end of a pile consisting of 26 crown pieces and an equal number of zinc and cardboard disks. Immediately a fine stream of small air bubbles arose from the point of the wire connected with the silver, and the other wire end began to oxidize. * * * The whole quantity of gas evolved in the course of an hour and a half amounted to two-thirds of a cubic inch. Mixed with an equal quantity of atmospheric air, it exploded on bringing a taper near it. On the first appearance of the hydrogen gas we had expected a decomposition of water in this experiment. But that the hydrogen only appeared at the one wire, while the oxygen went into combination with the other wire, at a distance of nearly two inches, surprised us considerably. This new phenomenon is unintelligible to us, and seems to indicate some general law of the mode of action of electricity in chemical processes."

Ritter made the same observations almost simultaneously, and devised the water voltameter in almost the identical form in which it is still currently used for lecture experiments. Simon, in 1802, used a more elaborate voltameter, which he called a "galvanoscope," and Humphrey Davy not only applied electrolysis to a large number of chemical compounds, but insisted that chemical action was



ZAMBONI'S "PERPETUAL MOTION."

the sole cause of the generation of "galvanism" or voltaic electricity.

Polarization was discovered by Gautherot, who noticed that when the leading wires of a crown of cups were taken out and brought into contact, and their ends were pressed against the tongue, the "galvanic taste" persisted for some time, although the cell was out of action. Ritter's experiments, undertaken with a view to bring polarization into agreement with the chemical theory, led him to the construction of the dry piles (so called), which, improved by Behrens and Zamboni, eventually caused a sensation, owing to the alleged construction of a real perpetual motion (see illustration above) based upon the slow discharge of a dry pile by an oscillating pendulum with a conducting upper knob. Harmless and practically useless as the device was, it drew the attention of philosophers to the value of the dry pile for electroscopic purposes.

A new era was begun in 1820, when Oersted of Copenhagen made his classical discovery of the connection between electricity and magnetism. He noticed that a magnetic needle was deflected by a wire carrying a current, the direction of deflection beng different accordingly as the wire was above or below the needle, and the tendency of the needle being to take up a position at right angles to this wire. The impulse given to electromagnetic research by this discovery was powerful and far-reaching. On September 16, 1820, Schweigger presented his "multiplier" to the French Academy, and two days afterward Ampère produced a similar instrument, consisting of a coil of wire containing a freely suspended magnetic needle, which he called a "galvanometer." This name, strange to say, has remained, and is at present the only monument to the name of Galvani which has been retained in current use.

Ampère's master mind, once brought to bear upon electromagnetic problems, did not rest until he had enriched experimental material by a number of classical experiments, and science by an electromagnetic theory which, though now replaced by the views of Maxwell and Heaviside, served at that time the great purpose of bringing some order into the chaos of multifarious phenomena, and making electromagnetic experiments amenable by mathematical treatment.

It was Ampère who defined the modern conception of an "electric current" as the flow of electricity through a conductor, the direction being, for purposes of convenience only, assumed to be that of the positive electricity. He simplified Oersted's observations by formulating the swimmer rule, devised the astatic combination of needles, and plunged into that series of brilliant researches which established the science of electrodynamics and cleared up the

action of currents upon currents and magnets upon currents. It is not surprising that he was led to view this interaction as primarily due to the action of one "current element" upon another. But this view, originally introduced simply for mathematical convenience, tended to put an unreal conception in the place which should have been occupied by the real thing, the circuit. The circuit was lost sight of until restored to its legitimate position by the genius of Faraday.

Oersted's "electric conflict" not only gave rise to electrodynamics and galvanometry, culminating in Barton's wheel, but it suggested Seebeck's researches, which resulted in the discovery of thermo-electricity, and indirectly the researches of Ohm, who noticed that the effect upon the magnetic needle varied with the number of thermo-elements in the circuit, and was affected in a linear manner by altering the length of the wire. The original form of Ohm's law, as announced in 1827, was

$$X = \frac{a}{b + x}$$

where X is the magnetic effect, x the length of the wire and a and b constants depending upon the exciting force and the "resistance" to conduction experienced by it.

This important discovery fell flat, until attention was drawn to it by Fechner in 1831 and Pouillet in 1837. At the present day it forms the root and foundation of electromagnetic measurement.

With the year 1830 we enter a period in which electricity begins to leave the philosopher's cabinet

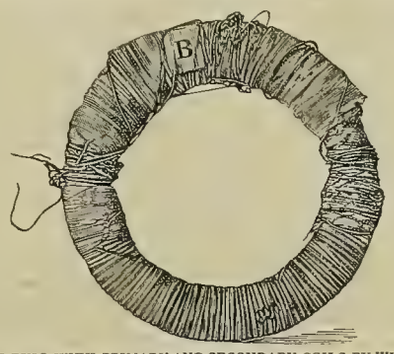
HENRY'S INTENSITY MAGNET (1828).
[Courtesy of the Scientific American.]

and intrude itself upon the larger world, soon to become the mightiest force of civilization. The fourth decade of the nineteenth century is marked by such names as Faraday, Henry, Morse, Daniell, Weber, Gauss, Steinheil, Cooke and Wheatstone—all so many prominent landmarks in the history of electrical discovery and invention. America, which had been almost a "silent sister" since Franklin's kite and lightning-rod and two-fluid theory, began to take up a position in the front rank among her compeers of the older world.

The decade of the thirties is marked by a bewildering series of discoveries, and I doubt whether any other decade of the century has excelled it in the intensity of its pioneering work. Michael Faraday had already acquired a reputation among chemists by his liquefaction of chlorine, and it may be that the ample material available for his use at the Royal Institution in London gave him a certain advantage over his contemporaries. But his chief advantage was his very limitation in the mathematical sense, combined, as it was, with an almost Newtonian perseverance, an unexampled genius for experiment, and what Tyndall calls "scientific imagination."

Failure attended Faraday's first attempt to induce an electric current in a wire by means of another conductor stretched alongside it. Such attempts were made in December, 1825, and in April, 1828. As we know now, the mistake he made was to suppose that a steady current would induce another steady current, just as a steady charge would induce a steady electrification of a neighboring conductor.

At last, on August 29, 1831, he was able to make the following record: "I have had an iron ring made (soft iron), iron round and seven-eighths inch thick, and ring six inches in external diameter. Wound many coils of copper round one-half of it, the coils being separated by twine and calico; there were three lengths of wire, each about 24 feet long, and they could be connected as one length or used as separate lengths. By trials with a trough, each was insulated from the other. Will call this side of the ring A. On the other side, but separated by an interval, was wound wire in two pieces, together amounting to about 60 feet in length, the direction being as with former coils. This side called B. Charged a battery of 10 pairs of plates four inches square. Made the coil B side one coil, and con-



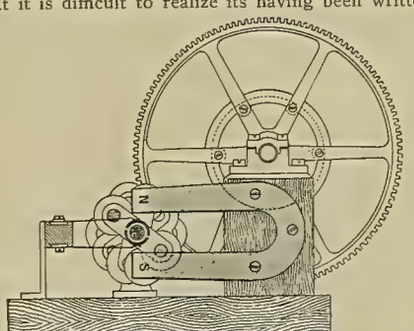
IRON RING WITH PRIMARY AND SECONDARY COILS BY WHICH FARADAY DISCOVERED ELECTROMAGNETIC INDUCTION (1831).
[From Fleming's "Alternate-current Transformer".]

nected its extremities by a copper wire passing to a distance and just over a magnetic needle (three feet from wire ring), then connected the ends of one of the pieces on A side with battery; immediately a sensible effect upon needle. It oscillated, and settled at last in original position. On breaking connection of A side with battery again a disturbance of the needle."

In 10 days of splendid and conclusive experiment, Faraday not only discovered the law of induction of currents, but the facts of magneto-electricity as well. He "not only accumulated a mass of experimental results, but reduced the whole valuable store of knowledge to one fundamental principle of exquisite simplicity, namely, that the passage of a line of magnetic force across a line of a conducting circuit generates in that portion of the circuit an electromotive force, or a force setting electricity, or tending to set electricity, in motion." (Fleming.)

While giving full credit to Faraday for his unexampled series of discoveries, we must not forget that some of his work was independently performed, and even anticipated, by a brilliant young American, Joseph Henry, already distinguished by his invention of the "intensity magnet," or modern electromagnet. He noticed that when an electromagnet was excited, a momentary current was induced in a coil of wire wound round the middle of its soft-iron armature. He concludes that "a current of electricity is produced for an instant in a helix of copper wire surrounding a piece of soft iron whenever magnetism is induced in the iron, and a current in the opposite direction when the magnetism ceases; also that an instantaneous current in one or other direction accompanies every change in the magnetic intensity of the iron."

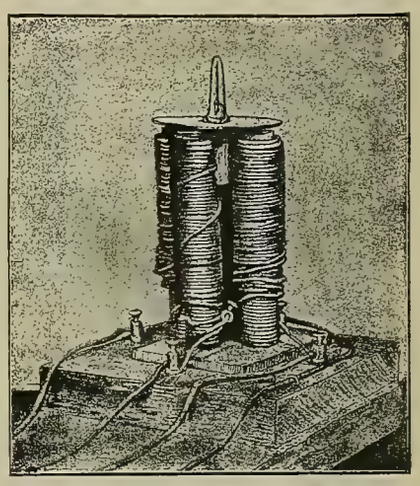
This language sounds so modern and up-to-date that it is difficult to realize its having been written



WHEATSTONE'S CONTINUOUS-CURRENT MACHINE (1850).

70 years ago. As a matter of fact, the area of operations covered by electrical research has become so vast that even the large army of workers now engaged in it does not suffice to exhaust the details of the phenomena roughly sketched out before 1840. It is as if a great territory had been annexed, and that its detailed survey absorbed all the energies of two generations of surveyors. The only fields not touched upon by the middle of this century were those of the telephone, the Roentgen rays and electromagnetic waves. The study of the last-named is yet in its infancy, and their complete elucidation and utilization will be one of the most fascinating pieces of work which await the twentieth century.

Among the electrical inventions which began to crowd the patent offices toward the middle of the century, the electric telegraph occupies the foremost place in public importance. It is true that the idea of utilizing electricity for the rapid transmission of messages was at that time 100 years old, for an anonymous writer in the Scots Magazine had suggested a system of 26 wires armed with pith balls—one for each letter—as early as 1753, and in 1809 Napoleon could sneer at Sömmering's electrochemical telegraph as "une idée Germanique" and go to beat the Austrians with the help of his semaphore telegraph instead. But toward 1840 a rapid development set in. Samuel F. B. Morse had been prosecuting his arduous work for nine years before he obtained any recognition in America. In England Cooke and Wheatstone about the same time introduced the needle telegraph, and both systems are still in vogue. In 1845 the first submarine, or, rather, sub-aqueous, telegraph cable was laid across the Ohio River, and in 1853 Gintl of Vienna first devised a system of duplex telegraphy. But both he and Siemens and Halske neglected the capacity of the cable, and transatlantic telegraphy only became possible in 1858, after Lord Kelvin (then plain William Thomson) had theoretically solved the problems involved in the speed of signaling. Even at that time, quadruplex telegraphy was familiar to electricians as a possibility, but to Edison belongs the credit of having devised the first practical system of quadruplex (or "diplex") telegraphy, which increased the utility of every line fourfold. Since then much progress has been made. We have the multiplex systems, including Kelvin's intermittent



BAILY'S POLYPHASE MOTOR (1879).

and Elisha Gray's harmonic multiplex; and Mercadier's recent work promises to increase the capacity of our lines almost indefinitely.

The telephone, too, is one of the great acquisitions of mankind which it owes to the century now past. First suggested in 1854 by Bourseul, imperfectly worked by Reis in 1861, and finally perfected, according to a new system, by Alexander Graham Bell, a Scottish-American, in 1874, the telephone is now one of those things which the business world cannot imagine itself to be without. Hughes' microphone (1878) and Bell and Tainter's radiaphone (1880) mark further stages of advance, though only the former has attained to practical importance.

But although the telegraph and the telephone have probably influenced modern life more profoundly than any other electrical invention of the century, increasing, so to speak, the range of human sight and hearing many thousand times, still the most stupendous engineering activity of modern electrical workshops has been concentrated upon the problems of finding a substitute for oil and gas illumination, of transmitting energy to unheard-of distances, and of rapidly and safely conveying goods and passengers without the tedium and cruelty of horse traffic or the smoke of the steam locomotive. The dynamo, from Pixii's first machine in 1832 down to the Niagara generator of 1893, has proved itself one of the most amazing and potent agencies ever placed in human hands for subduing the forces of nature. It is impossible even to summarize the immense amount of brain energy expended upon its improvement. Shuttle winding, self-excitation, open-coil working, multipolar and inductor construction, all these words mark so many epochs in its development. And its most valuable function has been to keep a mantle of brilliant light playing between two carbon points, or to keep a thin carbon fiber glowing in a little glass bulb. The arc and the

incandescent lamp may be ruinously inefficient from the theoretical point of view. They may in future be replaced by a Tesla device or a Nernst resistance or a "luminescence as of the glowworm," but they have for a quarter of a century marked the summit of human achievement in replacing "the greater light that shines by day" and in defying the powers of darkness.

Such progress could not have been attained without due regard to the fact that "science is measurement." Siemens, Gauss, Weber, Kohlrausch, Maxwell, Bunsen, Joule and Kelvin are some of the names concerned in reducing the subtle "electric fluid" to arithmetic. "Volt," "ampere," "watt" and "henry" are now common nouns instead of proper ones, and the ohm, the fundamental electrical unit, has been fixed to within a millionth part of its value.

Had it not been for Henry and Faraday, it is quite possible that electrical progress might have been confined for a much longer time to the chemical laboratory. But though electrochemistry has been largely overshadowed by electromagnetics, its progress has been no less substantial. Grotthus' hypothesis, put forward in 1805, has now been replaced by the ionic theory of Arrhenius, the osmotic pressure conceptions of van't Hoff, and Hittorf and Kohlrausch's ionic velocities. Planté's epoch-making discovery of the secondary cell in 1860, followed by the work of Faure, Tudor, Gandini, Schoop, Waddell-Entz and others, has enabled us to store up what we can now generate in such lavish quantities, although even now the weight of storeroom is quite out of proportion to the goods stored. Daniell's constant cell (1836) made electroplating and electrotyping possible, and Murray's graphite coating (1840) extended the range of bodies capable of electrometallurgical reproduction to the very flowers and insects.

But the chief value of electrochemical research lies not in its commercial applications. It is contained in its bearing upon the theory of electricity. The electric ion, that mysterious combination of material particle and electric charge, has been measured, weighed and followed through most of its devious transformations, although it is as yet quite invisible. The ionic theory, starting from the dilute solution, has gradually invaded the whole of chemical physics, until now it plays the chief part, not only in liquids, but in solids and gases as well. In this process of extension we have even caught a glimpse of something simpler than the ion, viz., the electric charge divorced from its accompanying matter, and traversing space with the velocity of light in a vacuum, or with a velocity of a few millimeters a second, as it laboriously picks its way among the colliding molecules of gross matter in the process of conduction through a wire. This free charge, now called the "electron," forms the subject of some of the most brilliant work of Thomson and of Drude. When Roentgen announced the discovery of " a new kind of rays" in November, 1895, the electron was found to be the body which impinges upon the "anti-cathode" and sends out ripples of X-waves in all directions. When, in 1897, Zeeman at last found a connection between magnetism and light, it was found that the orbit of the electron about its material center was the thing affected by the magnetic field. It is the electron whose motions through the ether generate the magnetic field and produce those waves which, since Maxwell foreshadowed them and Hertz (1888) discovered them, have emancipated telegraphy from the connecting wire and accounted for the secret of the generation of light.

And so we stand on the threshold of the twentieth century—its bright promises and undreamt-of possibilities. Aerial navigation, the direct utilization of solar energy, the transmission of sight and sound from end to end of the earth, communication with other planets—these are some of the many problems awaiting solution. And in another hundred years most of them will possibly be solved.

[View in the station of the Niagara Falls Power company. The dynamo room is 426 feet long and contains ten 5000-horsepower two-phase generators on vertical shafts connected to turbines.]

A 50,000-HORSEPOWER ELECTRICAL GENERATING PLANT OF 1900.

The Electrical Transmission of Intelligence.

By Kempster B. Miller.

Civilization advances not so much by exchange of commodities as by exchange of ideas. This has been true always, but it is the glory of the last hundred years to have brought into actual human touch the ends of the earth. The express train, the ocean greyhound, the electric wire annihilate the barriers of time and distance between man and man. It is with the last-named agency, the electric wire, or, more specifically, the telegraph and its crowning refinement, the telephone, that this article has especially to do.

At the beginning of the century telegraphy existed in the form of semaphore systems, by means of which visual signals were sent from hilltop to hilltop or from tower to tower. These employed pivoted arms, carried on high posts, so as to be seen in clear weather for several miles, and which could indicate different characters by their different positions. Many countries in Europe maintained semaphore lines between their capital cities and their most important seaboard towns. The longest of these extended from the Austrian frontier to St. Petersburg, and included 220 stations. Under most favorable conditions three or four signals per minute could be transmitted, and in bad weather none at all.

At the beginning of the century several electrical telegraphs were proposed; they were dependent on frictional electricity and required many wires between stations. In 1816 Francis Ronalds devised a single-wire telegraph, using frictional electricity. In this plan suspended pith balls were used at the receiving end, by the deflection of which the signals were interpreted. This particular system is here mentioned in order to show how little the world appreciated at that time what was in store for it. When Ronalds submitted his invention to the British government he was told that "telegraphs of any kind are now wholly unnecessary, and no other than the one now in use will be adopted."

The fundamental discovery in electromagnetism was made on July 20, 1820, by Oersted, and during the next few years rapid progress was made in the construction of, and knowledge concerning, electromagnets. Ampère developed the magnetic theory; Arago and Davy produced the first magnet; Sturgeon further developed it and called it by that name, and Joseph Henry, in 1827, showed how to work a magnet at the distant end of a long wire. It remained for Morse, however, to produce a practical telegraph, of which he conceived the idea in 1832 and made public the working apparatus in 1837. Morse's invention, it seems to me, stands on equal footing with those of Guttenburg and Watt, printing, the steam engine and the electric transmission of intelligence being probably the most important steps in the line of invention in the history of the world.

Morse's original idea involved a mechanical transmitter, the message being set up in dots and dashes and moved under a lever, which was thus caused to act on contact points in the circuit in such a manner as to make and break the circuit as required. His receiver involved a roll of paper tape moved by clockwork under a stylus, which made dashes or dots on the paper as it moved up and down under the influence of the electromagnet. Morse thought that as many as five words a minute might be transmitted by this method. It was soon found, however, that the messages could be sent by hand and received by sound. This is the system now most universally employed, and a speed of 30 words a minute is readily attained.

In 1858 telegraphic communication between Europe and America was first established, due to the indomitable will and courage of Cyrus W. Field. Notwithstanding the splendid success of the land telegraphy, the authenticity of dispatches over this cable was at first doubted by the public, and it was not until certain important news received by cable was confirmed two weeks later by mail that the public faith was secured. This cable was, however, defective and was operative for only a few weeks. In 1865 another cable was laid, which proved successful, and communication has been maintained ever since. To Field, as financier and promoter, and to Sir William Thomson (now Lord Kelvin) more than anyone else as an engineer, the world should pay tribute for the submarine cable.

Innumerable inventions have been made for increasing the efficiency of telegraphic transmission and the earning power of the wire. The various duplex and quadruplex systems accomplish this result by allowing the simultaneous sending of two or four messages over one wire. Systems for the simultaneous transmission of a much greater number of messages have been devised, but have not come into such extended use as have the quadruplex and duplex.

The so-called machine telegraphy promises much in the cheapening of telegraphic service. In these systems the messages are especially prepared to adapt them to operate the transmitters automatically. They are then run through the transmitting instruments at enormous speeds and the messages are automatically recorded at the receiving station and afterward transcribed.

One of these systems, invented by Messrs. Pollak and Virag of Budapest, Hungary, has sent 100,000 words in an hour, or about 16,500 words a minute. Another system, devised by Messrs. Squier and Crehore of this country, has attained a speed of 3,000 words a minute. This latter system uses a sinusoidal alternating current on the line and avoids sparking at the break, by causing the times of breaking of the circuit to coincide with the times when the current in the line is zero, i. e., when it is changing its sign.

The recent development of wireless telegraphy has been perhaps the most sensational, though not the most important, event in telegraphy since the invention of the telegraph. Messages have been sent over distances of slightly over 70 miles without any connecting wires. It is also reported that two messages have been sent at the same time between the same points without interference. Wireless telegraphy will probably have its greatest uses in warfare and between ships at sea, but it is indeed hard to conceive that a universal system of telegraphy without wires will ever replace our present network, expensive though it is.

As an indication of the extent of the development of telegraphy, one company alone in the United

States has nearly 1,000,000 miles of wire, nearly 23,000 offices, and during the last year transmitted for the public over 63,000,000 messages.

Morse's invention was the forerunner of the telephone, and the latter invention may be considered as nothing but a refinement of the telegraph, wherein the impulses or variations of current flowing in the line are made to conform to the waves producing the sound to be transmitted. The same elements are present in the simple form of each—a line circuit, a transmitter adapted to cause or to allow certain impulses of current to pass over the line, and a receiving instrument, consisting of an electromagnet with its armature adapted to respond to such impulses or variations of current.

Notwithstanding this, it was a difficult step from Morse's telegraph to the electric telephone, and it was not until 1854 that the latter was even suggested. In that year Charles Bourseul, a Frenchman, not only suggested it, but came near to telling how it was to be successfully brought about. He said: "Suppose a man speaks near a movable disk sufficiently flexible to lose none of the vibrations of the voice, and that this disk alternately makes and breaks the current from a battery, you may have at a distance another disk which will simultaneously execute the same vibrations."

Bourseul, for all that we know, did not try his method, but seven years later Philip Reis, a German, followed the same course, and but for his adherence to the make-and-break principle would probably have achieved success. He did adhere to it, however, and not until 15 years had elapsed, i. e., until 1876, was the telephone produced.

As is well known, Alexander Graham Bell is the accredited first inventor, although there were a number of claimants for the honor. Bell's receiver is practically the receiver of to-day. His transmitter, however, which was of the magneto type, was soon replaced by another operating on a different principle. Instead of the transmitter generating current within itself, the new transmitter served simply to vary the current from a battery, these variations corresponding to the waves of sound. Instead, however, of making and breaking the current outlined by Bourseul and tried by Reis, these new transmitters kept the circuit closed, the vibrations of the diaphragm serving only to vary its resistance.

David E. Hughes showed that such vibrations could most readily be produced by two or more electrodes in loose contact, and Edison showed that carbon was the material to use.

Since the production of these instruments no radical changes have occurred in methods of transmission so far as the instruments themselves are concerned. Of course, better instruments, that is, instruments designed to carry more perfectly into effect the principles on which they act, have been produced. An even greater improvement has been made in the transmission circuit or line. Instead of single grounded iron wire, such as was at first thought adequate, metallic circuits are now used, these often consisting of No. 8 copper wires, strung for thousands of miles in a manner which would suggest Niagara power transmission rather than the carrying of currents so feeble as almost to defy measurement.

Of the development of systems for connecting subscribers not much can be said in an article of this scope. Inventive genius has been taxed to the utmost to keep up with the demands. A little over 20 years ago switchboards for giving service to perhaps a hundred subscribers were required. The demand was met, but the crudity of what apparatus is left as relics of those days attests that it was met only with difficulty. Now the demand is not only for systems that will in a few seconds effect the connection of the lines of any two subscribers in a single group of many thousands, as in a great city, but the connection of two subscribers who may be in groups thousands of miles apart. The present systems accomplish this, and much more rapidly and efficiently, in spite of the vastly greater difficulties, than did the old systems with their very simple requirements.

The telephone industry is now growing more rapidly than ever before in its history, and it is in vain that we try to predict a limit to its possibilities. Where thousands of subscribers now exist, it is probable that tens of thousands will in the near future demand service. The present practical limit of long-distance telephone transmission over existing circuits is in the neighborhood of 2,000 miles. The work of the telephone engineer is not at an end.

To give some idea of the extent of the business in this country, the American Bell Telephone company had at the beginning of the year 1900 over 1½ million instruments in use and over 1,000,000 miles of wire. Among these telephones over 5,000,000 connections were made daily. In maintaining and operating this system over 25,000 persons were employed. In the Independent ranks there are in the neighborhood of 3,500 exchanges, large and small, and probably about 700,000 telephones.

The Electric Light.

By Richard H. Pierce

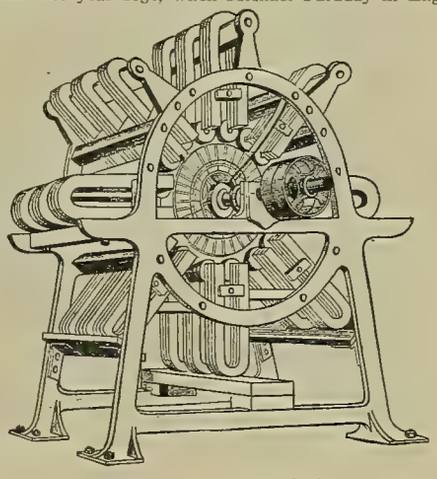
A history of the development of electric lighting in the nineteenth century is nothing more nor less than a history of the entire development of the art.

The door to discovery and invention was opened at the opening of the century, when Volta, in the year 1800, made his well-known discovery of the principle of the voltaic battery and placed the scientific world in possession of a means of producing dynamical electricity. To produce primary batteries for large currents and high electromotive forces was a simple step and one which was taken by Volta himself, who not only discovered the principle, but developed it so far as to make a good battery.

In the year 1808 Sir Humphrey Davy, having at his command the battery of the Royal Institute in London, which consisted of 2,000 pairs of plates, not only provided the first arc light by opening a circuit with two pieces of charcoal, but he also discovered that the powerful current at his command readily heated thin wires red hot. The principles of the arc and of incandescence being then readily understood, it only remained to work out their practical application to electric lighting on a commercial scale. This, however, was a long and complicated problem, and although it was constantly studied by the scientific world, it was over 70 years before it was solved.

Davy's experiment, while demonstrating scientific possibilities, at the same time showed the enormous and prohibitive cost of producing an arc lamp from a primary battery, and little attention was paid to incandescence until the arc was so far developed that its limitations were discovered.

The world waited for some cheaper method of producing an electric current. No method appeared until the year 1831, when Michael Faraday in England and Joseph Henry in the United States independently and almost simultaneously discovered the principles of electromagnetic induction and pointed out the way to produce electric currents mechanically instead of electrically. Both of these men were discoverers and not developers, and they left to others the practical solution of the problem. There was no lack of recruits. Clever men in all countries attacked the problem and almost every year someone contributed to the development of the art.



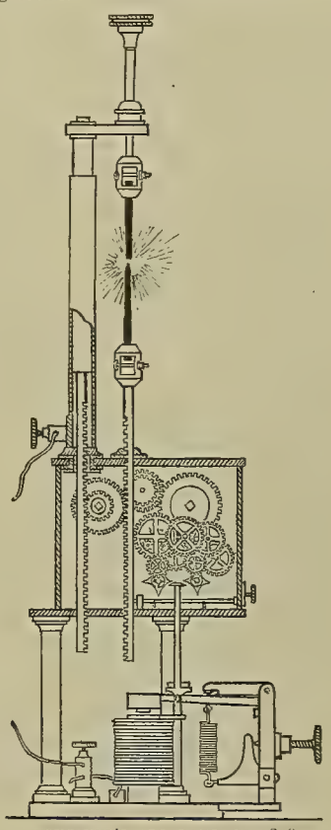
ALLIANCE MACHINE (1857)

In 1832 Pixii of Paris produced an electromagnetic machine or permanent-magnet generator having a revolving field, and in 1833 Saxton of Philadelphia constructed an electromagnetic machine with a revolving armature. In 1836 Clarke of London produced a similar machine, differing only in form, and soon after Breton made an electromagnetic machine in which the magnets and coils were both stationary, while the keeper revolved, i. e., an inductor generator. These machines were, indeed, only toys, but they were soon followed by machines designed for practical use.

In 1849 Professor Nollet of Brussels made the first attempt to produce a commercial machine. Although he died before his ideas could be carried out, his machine was brought out by a company known as the "Alliance company." The "Alliance" machine (see illustration) was used for operating arc lights for outdoor illumination and in lighthouses. It represented no new idea, as it was the same in principle as Clarke's machine, and obtained capacity only by increasing the size and the use of a great number of magnets and coils. The data of an Alliance machine show it to occupy a space of over four by five by five feet, and to have a weight of two tons. While taking something over three indicated horsepower, it produced one arc light, said to be of 2,500 candlepower; in fact, the machines were clearly out of the reach of the plain people and were used mostly on government jobs.

The next advance was the invention in 1857 of the Siemens armature by Dr. Siemens. This well-known form of armature, with its longitudinal winding, was a great improvement over the bobbins previously used. This was followed in 1860 by the invention by Dr. Antonio Pacinotti of the Pacinotti ring or toothed, ring-wound armature, a form of armature which, but slightly modified, represents present practice in some of our best machines.

Still, the commercial lighting machine was not developed, but in 1866 Wilde produced a dynamo-electric machine, having its field produced by electromagnets which were separately excited by a small magneto generator. In the same year Werner Siemens produced a dynamo-electric machine which was self-excited. In 1871 Gramme invented the well-known and commonly used Gramme armature, and the dynamo-electric machine was brought to a state of invention where all that remained was to develop existing forms.



FOUCAULT'S ARC LAMP OF 1878.

Up to this time the only light practically considered had been the arc light, each machine running one light; but it was apparent that electric lighting could not be a commercial success unless some means was devised of subdividing the light, and about 1878 many methods were attempted of accomplishing this result.

The arc lamp, though a success when each lamp had its own dynamo, had not been materially improved for 50 years. The incandescent existed in an experimental state, and neither the short-lived platinum-filament lamps nor those made with low-resistance carbon rods seemed to offer any solution of the problem.

The only attempt which came near enough to subdivision to come into practical use was the Jablochkoff candle, which was used for street lighting as early as 1878. The generators of that day were small, inefficient and of high internal resistance, and as the only lamps known were of low resistance, it was found that as the number of lamps was increased, the total amount of light decreased rapidly with the number on a machine, to say nothing of the difficulties of regulation of candlepower. As many as 16 Jablochkoff candles were, indeed, run from one machine, but this was only accomplished by the use of a multi-circuit machine having a separate circuit for each lamp. As the machine of that day had an efficiency at best of less than 40 per cent., and as the candles were expensive and burned for only a short time, when a new one had to be switched in by hand, this system did not come into very general use.

To trace the development of lighting from this time would be to write a book. Many conflicting claims are made for the invention of almost every improve-

ment. The art of incandescent lighting, however, certainly begins with the development, by Edison in the United States and by Swan in England, of the carbon high-resistance incandescent lamp, and in arc lighting the name of Brush stands pre-eminent as the inventor of machines which not only furnished a large number of arc lamps, but which were so well designed that they are manufactured to-day in almost their original form and represent the latest practice in the art of direct-current series lighting. The Edison lamp appeared in the winter of 1879 and 1880, and the success of the series-arc lamp dates from about the same time.

With the development of commercial arc and incandescent lamps came a clear conception of the requirements of successful dynamo design, and economical distribution of light was obtained. In this country, which seemed to have taken the lead in standardizing practice, distribution was accomplished by the adoption of the constant-current series-arc system and the constant-potential incandescent system. Development came rapidly, but advance was still step by step. Although Jablochkoff candles were operated from underground wires insulated with guttapercha as early as 1878, the first really commercial underground system for central stations was the Edison tube system, which was used in New York in 1883, and it was not until late in the '80s that insulating materials and methods were perfected so that arc lights could be commercially operated on underground circuits, for by this time arc-light machines had been developed so that they operated at a pressure of 2,000 to 2,500 volts, and occasionally such machines were operated in series.

With the rise of the central station arose the problems of transmission and distribution. Both were simple, as far as the series-arc system was concerned, at a time when a few 50-light dynamos with a few miles of circuit would take care of the business of almost any station; but with the increase of lighting business it was soon apparent that in a large station, even using the largest units which were practical, the business became complicated and expensive through the use of an immense number of machines and circuits.

In incandescent lighting the development of the direct-current generator kept pace with the growth of the stations and the multiple-arc system offered an ideal system of distribution. But here the question of how to transmit over long distances, even for moderate-sized stations, presented a serious problem. This was met for a time by the introduction of the Edison three-wire system, which reduced the cost of conductors to from 30 to 37½ per cent. of what was required for a two-wire multiple-arc system, and the cost of copper was further reduced by the use (particularly on the continent) of five-wire systems, although this latter system appears to have required large additional investment in storage battery to secure decent regulation. As the stations increased in size and the territory to be lighted increased still further, the only means of transmitting at anything but a prohibitive cost was to increase the line losses, and this brought on poor regulation of voltage and consequently of light. Poor regulation was avoided only by the use of main-line rheostats in feeders or other equivalent devices, which again meant both increased cost and decreased efficiency. The running of arc lamps on multiple-arc circuits, while doing away with the use of many small machines, was subject to the same difficulties as incandescent light in the matter of economical transmission. At last the alternating-current transformer arrived to solve the problem of transmission. This most useful device, first applied to lighting by Gaulard and Gibbs (though used only on series circuits), was immediately taken up by Zipernowsky and Deri in Europe and by Westinghouse in this country and applied as a ready means of transmitting large amounts of electrical energy to long distances with but small cost for conductors.

The improvement made in transformers in the last decade now permits of our obtaining most excellent regulation over large systems of distribution. The general adoption of alternating-current transformer systems for lighting, except in restricted areas in large cities, has led to the development of the alternating arc lamps, which first became commercial about 1893 and which have only been perfected so as to be considered satisfactory for general use within the last two years. With alternating-current transformers and large alternating machines, we have at last a complete system of electrical transmission and distribution by which we can, with a moderate cost for conductors, distribute lights over large areas and secure good regulation.

This would seem to solve the central-station-lighting problem, but another factor remained. Early in the art of central-station electric lighting it became apparent that an electric-lighting station, to make money and successfully compete with a gas plant having a small investment in generators and a large capacity for storage, must secure as great a revenue as possible and must operate its machinery with load as many hours as possible. To do this most large stations must furnish both light and power. For several years the lack of a satisfactory alternating-current motor blocked the development of alternating-current lighting. The problem of electrical transmission for both power and light was at last solved by the introduction of the polyphase alternator and motor. At the electrical exposition at Frankfort, held in 1891, power was successfully transmitted to a great distance by this system, and at the World's Fair in Chicago in 1893 there were exhibited in practical use large two-phase generators and induction motors, as well as three-phase motors and rotary transformers. The record of these inventions is too recent and the claims of inventors too numerous for us to consider them in this brief paper. In the same year the large Niagara two-phase plant was under contract, and the polyphase system had come to stay. It at once gave us a means of transmission of both light and power to great distances, and the rotary transformer gave a ready means of transmission, even where it was most economical and satisfactory to distribute by the use of direct currents.

The old controversy of alternating versus direct-current distribution for central stations is still carried on. At present it is certain that for transmission the polyphase alternating system is the ideal thing and that for distribution for all purposes the direct-current system is most satisfactory. However, the alternating field is broadening daily. The tendency is toward alternating distribution, but for some years to come both systems will prevail, and the final outcome will be determined by the scientists and engineers of this century. If alternating-current apparatus is developed in the next decade as it has been in the last one, we may look to see it universally used in new central-station work. On the other hand, what the art needs in order that electric lighting may keep pace in economy with gas lighting is a satisfactory system of storage. From the invention of the storage battery by Planté in 1860 and its improvement by Faure a few years later the development has been painfully slow, but the discovery of a method of storing current, with a reasonable investment, would go far toward determining the system to be used for distribution.

In the art of electric lighting the century has closed with the passing of the "open-arc" lamp, and there is every indication that the series direct-current arc lamp will soon practically disappear. For indoor lighting the use of the multiple-arc lamp has become standard practice, and for street lighting the alternating arc is already best adapted to most conditions.

The development of electric lighting has been made possible and has been assisted by the growth of other arts. The perfection of the air pump has rendered possible the perfection of the present form of incandescent lamp. The invention and improvement of rubber and paper-covered conductors has made possible the distribution of electricity in buildings and the distribution and transmission of high-tension currents underground. The development of the steam engine and the production of power from coal has kept pace with the development of the dynamo and has not only made electric lighting possible, but has enabled it to compete successfully with all other methods of illumination. The writer has neither the space nor the ability to prophesy what the twentieth century will produce. Attempts to produce light by vacuum tubes have not been enough of a success to encourage us to expect anything commercial along that line in the near future.

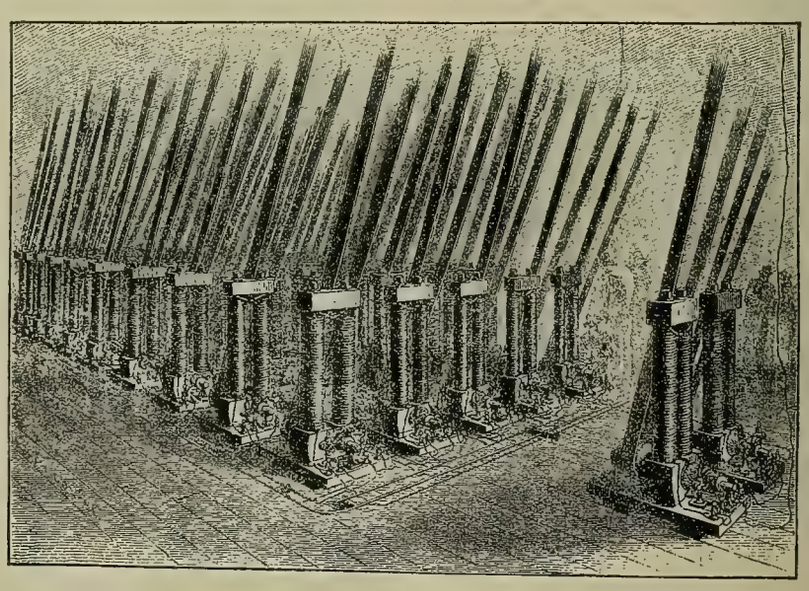
The latest electric-lighting invention of the century, and one which offers the greatest promise of revolutionizing the art, is the Nernst lamp. If the claims made for this lamp are even approximately realized, and there is every reason to think that they will be, the new device will mark a long step toward saving the enormous loss now experienced in transforming electrical energy into light.

When we reflect that to-day our electrical energy represents but from three to five per cent. of the energy contained in the coal from which it is produced and that an equally small proportion of the electricity is useful as light, we certainly need not fear that the improvements of this century will compare unfavorably with those of the one that has just passed.

Development of Electric Traction.

By Frank B. Rae.

When, in 1831, Faraday made the discovery that electricity could be generated from magnetism, he gave a wonderful impetus to the development of electrical work. The practical men in the electrical world, acting upon his discoveries and those of other scientists, have so utilized the new scientific facts for the benefit of mankind that the world must ever acknowledge its obligations to the nineteenth century for the wealth, comfort and pleasure derived.



THE CENTRAL STATION AS PROPOSED IN 1880.
[From an article on "Edison's Electric Light" in Scribner's Monthly, February, 1880.]

Not the least of the many important achievements of the nineteenth-century electrician is the development of electric traction, made commercially practicable by Faraday's discovery of induced currents. The effort to produce electric power, however, antedates Faraday's experiment in induction and was almost coincident with the discovery of electromagnetism by Oersted in 1820. However, this great discovery was not availed of in the form of a motor until 1834, when Jacobi produced an electromagnetic motor which, improved in 1838, successfully moved a small boat on the Neva at St. Petersburg.

The first application of the magnetic motor to the propulsion of a car seems to have been made by Thomas Davenport of Brandon, Vt., in 1835, and after some two or more years of experiment he constructed a circular railway for exhibition at Springfield, Mass.

The next effort to apply the electric motor to a car was that of Robert Davidson, a Scotchman, in 1838, who attacked the problem in the form of a locomotive of considerable size. Davidson's motor was of the magnetic type but differed somewhat from Jacobi's in that it had four revolving armatures operating through cranks on the axles of the locomotive. The car was about 16 feet long by four feet wide and weighed, with its batteries of 40 iron and zinc elements, about five tons, and attained a speed of four miles an hour. Magnetic

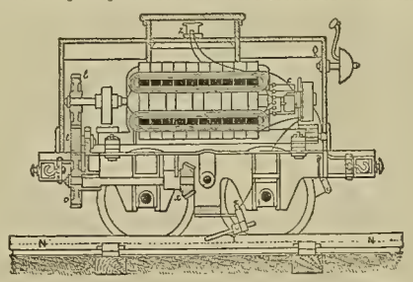
motors were produced by very many inventors from the time of Jacobi up to 1861, but were applied to the propulsion of cars only on a small scale, and with batteries as a source of electricity, apparently with the idea of illustrating one of the possibilities of the new power rather than with any hope of commercial success. It seems remarkable that, following the discovery of the principle of induction and the construction immediately thereafter of various forms of dynamic generators, electricity so produced was not utilized for driving magnetic motors of the time.

Pixii, in 1832, was first to illustrate Faraday's discovery in the form of a magneto generator, followed by Page, Clarke, Stoher and many others, in all of which the permanent magnet as the exciting force was retained. In 1854, Hjorth brought out a machine in which the exciting magnets were both permanent and electromagnets, the latter energized by the armature currents, and these currents were commutated to preserve the continuity of direction through the coils of the exciting magnets—a very considerable step in advance. It was not, however, until the invention of Pacinotti, in 1864, and his able paper published in relation to his machine at that time, that the reversibility of the generator and motor was known, and, what seems remarkable, it was some 10 years later before the principle was made use of practically by Fontaine and Breguet, at the Vienna Exposition of 1873. There, failing to obtain some battery with which to drive his Gramme motor on the opening day of the exposition, he conceived the idea of using current from a Gramme dynamo, and was gratified to see the motor operate with increased force.

The first real work in the application of the dynamo and motor to the propulsion of tram cars was that of Werner Siemens at the Berlin Exposition of 1879, and the first permanent construction by the firm founded by Werner Siemens was a line near Berlin, built in 1881.

American inventors had not been idle, however, and while the work had not progressed with them quite so rapidly in practical application, several prominent men, Field and Edison, particularly, were applicants in the Patent Office for inventions antedating the work of Siemens in Europe. After a three-cornered fight between Siemens, Edison and Field for priority of invention "of the combination of an electric motor operated by means of a current from a stationary source of electricity conducted through the rails," a decision was finally made in favor of Field, and there grew out of the controversy a combination of interests in the shape of the Electric Railway company of America, organized in 1883 to operate under the Field-Edison patents in the construction and equipment of electric railways. The writer, then associated with Field, was entrusted with the design and construction of the first road for the new company at the Exhibition of Railway Appliances at Chicago in May, 1883.

The track, of three-foot gauge, was constructed around the gallery of the Exposition Building, located on the present site of the Art Institute, at the foot of Adams street, and was 1,553 feet in length, with curves of 53-foot radius. Current was conveyed to the motor by means of a third rail laid in the center of the track, and consisting of 3 by ½-inch bar iron supported edgewise by cast-iron chairs, the return conductor being the track rails. Possible loss of power at the rail joints was considered and prevented by bonding. The center and one of the outer rails had a continuous No. 6 copper wire laid under the rail and fastened under the bolts at the joints; the other outer rail was similarly bonded with No. 8 iron wire. Current was taken from the center rail by series of phosphor-bronze wire brushes held in a



SECTION OF SIEMENS ELECTRIC LOCOMOTIVE OF 1879.

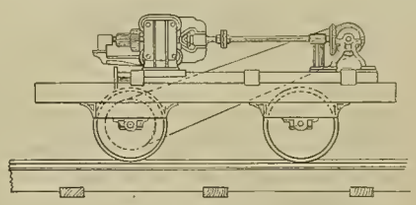
spring jaw device and bearing on each side of the vertical bar forming the third rail. Field had sent to Chicago two Weston incandescent-light dynamos rated at 100 lights each and shunt wound, one to be used as a generator and the other as a motor, and of which it may be said, in passing, that the designer of the modern dynamo has not improved upon them very greatly.

The motor was mounted crosswise upon a frame. The armature shaft was extended and geared to a cross shaft by bevel gears. Upon this shaft were two pulleys which were belted to friction pulleys on the rear axle. A lever in the cab was arranged to throw the friction pulley in and out of gear with the axle, which was considered necessary at the time in order to start the load with a shunt-wound motor. The motor itself was controlled by a rheostat of iron wire in the armature circuit, and a reversal of direction was had by a device for lifting off one set of brushes and adjusting another set leading in the opposite direction, reversing the direction of current in the armature circuit.

The locomotive was 12 feet long and five feet wide and weighed about three tons. Owing to the weakness of the gallery but one car, instead of two, was used, and because of the delay in strengthening the gallery, the train was not allowed to run until June 5th. It commenced carrying passengers on June 9th, and from this date until June 23d, the close of the exposition, 26,805 passengers were carried, 446 miles were made and $2,680 earned. This Chicago electric road was the first constructed in this country for business purposes. The first trainload of passengers carried were the directors of the Exposition of Railway Appliances. The train was put in motion by Mr. J. McGregor Adams, of the Adams-Westlake company, one of the exposition directors, and to whose enterprise the road owed its existence. After starting the train Mr. Adams acted as conductor, requiring everyone to pay fare. The dollar so collected was, after much change-making, reduced to two 50-cent pieces, of which the writer has one as a souvenir of a very memorable occasion.

In the fall of 1883 several exhibition roads were constructed, one by Vanderpoel at Toronto, one by Daft at Mount McGregor, N. Y. In 1884 several others were equipped by Daft, the Boston Mechanics' Fair and New Orleans Exposition roads being particularly notable.

The interest of owners of street-railway lines in the progress of electric traction was shown at once by their recognition of its possibilities as illustrated in the exposition roads. Horse-car lines were converted wholly or in part into electric railways. Inventors and "systems" came forward so rapidly that to attempt to treat them chronologically in the limit of a short article would be unfair. From



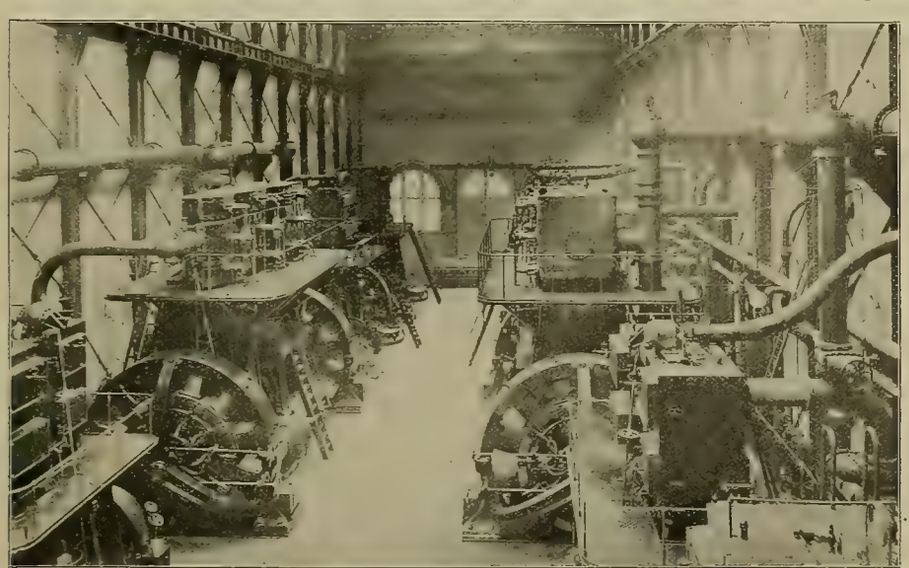
SIDE ELEVATION OF ELECTRIC MOTOR CAR OPERATED IN CHICAGO IN 1883.

1885 to 1890 the several systems of Daft, Vanderpoel, Short, Rae, Bentley-Knight, Thomson-Houston, Henry, Westinghouse, Sperry and Edison were demonstrated with more or less success by the construction of very many electric street railways. From 1890 to 1898 the "systems" were gradually absorbed by the Westinghouse and General Electric companies.

The safe pressure of 500 to 550 volts as adopted by the builders of apparatus has, until recent years, limited the use of electric traction to the comparatively short distances and small cars of city surface roads. The Intramural road designed by B. J. Arnold for the World's Fair, in 1892, marked another distinct step in the progress of electric traction in this country, demonstrating the successful use of electric power for the heavy work required by elevated railways and the practicability of the third-rail method of current delivery for this class of traction as shown by the splendid examples of elevated electric railways in Chicago to-day. In this branch of traction work the multiple-control system of Sprague, by which the motors in several cars in a train are simultaneously operated by one man, has increased the speed of acceleration of heavy trains without unduly increasing the current, as would otherwise be necessary.

Within the last few years a new era of progress has been inaugurated by the inventions of Tesla and others, by which the utilization of alternating current in traction work has been made possible and the radius of operation from a single power station greatly increased. The multiphase generator and rotary converter make the long-distance transmission of power for railway work successful of accomplishment, and the century closes with numerous examples of this application to long interurban roads for both passenger and freight, and the construction and equipment rapidly approach the best steam-railway practice.

Probably no achievement of the century, filled as it is with the progress of human endeavor, is greater, or has had a wider influence for good, than the development of electric traction.



[View in Harrison Street Station of the Chicago Edison Company.]

THE CENTRAL STATION OF TODAY.

Future of the Automobile.

In the opinion of Mr. Duell, commissioner of patents, recently expressed, the automobile will become as great a fad in a few years as the bicycle, and will outlive it, because of its universal utility. A few years ago, when the bicycle was on the high wave of popularity, the Patent Office was fairly deluged with applications for patents for new ideas and improvements in bicycles. To-day the office is passing through much the same experience. Hundreds of applications are being received each week, and the officials looks for a revolution in the motor-vehicle art within a short time. The inventive genius of American inventors is second to none in the world, and the inventors are evolving even now a vehicle which Commissioner Duell believes will rival the world. American makers of motor carriages have entered upon the new industry with a valiant spirit, and have already set new and higher standards of construction, finish and general excellence.

The desideratum in a motor-vehicle, in the opinion of Commissioner Duell, is that it shall combine simplicity and durability with cheapness. By simplicity is meant no complicated mechanism, heavy and cumbersome and liable to get out of order; durable in that it will wear a reasonable length of time, and cheap enough to permit of its purchase by those who now have to content themselves with a horse and buggy. These are the great difficulties which must be overcome before the motor-vehicle becomes universally used, but Commissioner Duell believes that the inventive genius of those who are interested in the future of the motor-vehicle will at no late day solve the problem. He is strongly inclined to believe that the vehicle of the future will be operated upon the storage-battery principle

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Electrical progress in the nineteenth century may be summed up in one short sentence: Electricity has been put to work. When the century began philosophers were wondering what electricity was. To-day the exact nature of electricity is still unknown, but the nineteenth century has shown some of the things that electricity can do. The apparatus of that time consisted of experimental devices used solely by scholars and scientific teachers. The apparatus of the twentieth century exists in many applications that make the life of the common people better worth living. We have only to consider the electric telegraph, the telephone, the electric light, the electric railway, electroplating and electrotyping, electrometallurgy, the electrical transmission of power and even the humble push-button, to realize that among civilized men there are few who do not receive the benefits of applied electricity in the transport of themselves, their messages or their goods, in the form of light upon their pathway, or in other ways that make for betterment in industrial processes or in the refinements of life.

The electrical scientist has not been superseded; the value of his services is realized now as never before; but the electrical engineer, who follows the scientist and applies the results of the arduous labors of the savant to the improvement of existing conditions, has become a mighty factor in the advancement of the world. The electrical engineer is entirely a product of the latter half of the nineteenth century. Who shall say to what vast enterprises he will have applied his knowledge and skill before the new century becomes itself a thing of the past? Probably our accomplishments of to-day will seem but feeble beginnings when viewed from the vantage point of a hundred years hence.

But no one can deny that the nineteenth century has been one of splendid advancement in the use of electricity. An effort is made in this issue of the Western Electrician to give some conception of the great work that has been done. Many names are mentioned in the articles relating to the various branches of the subject, but how many more there are, unknown and unhonored, that would be revealed if a complete history of the electrical accomplishment of the century could be written! All histories and textbooks are but summaries; the writers necessarily skip from peak to peak of achievement. It needs but a superficial examination of the subject to show that hundreds of workers have filled up the gaps, and that, with few exceptions, what seem startling discoveries are in reality gradual developments in which the great discoverer or inventor has placed the keystone of the arch. Let us not forget our debt of gratitude to the humbler electrical investigators while still honoring the great names.

No one can foretell what the electrical development of the twentieth century will be. Mr. d'Albe well says, in an article in this issue, that the eighteenth century may be called one of electric charges, the nineteenth one of electric currents and the twentieth, perhaps, a century of electric waves. Beyond this few will have the temerity to go. That there is much to be done in improving electrical methods and apparatus is certain. We may suppose that the new century will even surpass its immediate predecessor in contributions to the material well-being of the human race. And so we enter upon it joyfully and with the bright anticipations of hope.

The Western Electrician feels confident that the reader will be interested in some reference to the special features of the issue that lies before him. Not a little effort has been expended in making this number really what it purports to be—a suitable souvenir, from an electrical point of view, of the transition from the nineteenth to the twentieth century. We hope that our friends will conclude that we have striven worthily to this end.

First, a few words about the specially designed cover in colors will be of interest. Mr. Mulhaupt, the artist, has given his conception of electricity as one of the greatest of the natural forces at the dawn of the twentieth century. The inventor, an eager, hopeful youth, is represented, with his already marvelous inventions, at the feet of the Goddess of Electricity, awaiting the promptings of necessity that may suggest wherein this wonderful force may be still further employed. Electricity is enthroned, as she has been from all time, awaiting the genius of the inventor to transmit her blessings to mankind. In the background the blue sky and the black silhouetted trees suggest the dying of the nineteenth century. Back of the head of the goddess the zodiac represents the incoming twentieth century by the advent of the year 1901. The globes of light at each side bring to mind electricity as an illuminant, while the scepter in the hand of the central figure represents electricity unused. The winged wheel suggests the same force as applied to locomotion, and in the inventor's hand may be noticed a telephone receiver, typifying electrical communication. The youth of the inventor hints that much may yet be expected of him in utilizing the powers of his patron.

We think that we have reason to be proud of the interviews with Edison and Tesla, which were procured especially for this issue of the Western Electrician. Both will be read with great interest. Mr. d'Albe, a capable technical writer; contributes a general article on the progress of the century. Mr. K. B. Miller, the author of "American Telephone Practice," writes on the development of the telegraph and the telephone. Mr. R. H. Pierce, a well-known electrical engineer, outlines the growth of the electric light, and Mr. Frank B. Rae does a similar service for electric traction. Mr. Charles A. Brown of the Chicago patent bar sketches briefly but interestingly the electrical patent litigation of the century, and Mr. Forée Bain concludes the series of articles by a consideration of what may happen in the future of electrical development.

The Western Electrician gives its customary New Years review and presents its third annual estimate of the electrical manufacturing business of the United States. The value of manufactured products used in the industry, as produced in 1900, is placed at $153,000,000, as compared with $123,800,000 in 1899. This shows an increase of 23½ per cent. over the total for the preceding year, which was a very prosperous year and held the record until that time. The collection and preparation of these statistical estimates is a task of considerable magnitude, as may easily be imagined; but the results are important, as showing the extent of the industry in its various departments, and well repay the labor expended. A large number of letters from electrical manufacturers and dealers review the business conditions of the year just passed.

Other special features add to the value of this number. Noteworthy among them are the contributions from Messrs. Peck and Drake on the significance of the Paris Exposition, and the portraits and biographical sketches of nine representative electrical scientists of the nineteenth century. All told, the student of the year 2000 who consults the twentieth-century edition of the Western Electrician will have a pretty fair idea of the electrical activities of the present day and of the steps that led up to them during the last century.

Edison on the Electrical Outlook.

An authentic interview with Thomas A. Edison is rare indeed in these days. The following account of a visit to the great inventor is from the pen of Mr. Frank L. Perry of the staff of the Western Electrician, and may be accepted as exactly accurate in all respects. Indeed, so far as the report of what was actually said is concerned, the interview was submitted to Mr. Edison and is here printed with his approval and as he approved it. The Western Electrician feels gratified that by its enterprise the readers of the Twentieth Century Souvenir Number are enabled to obtain the views of the greatest living inventor—the man whose genius has done so much to develop telegraphy, telephony, electric lighting, electric-railway work and electrometallurgy during the last quarter of the nineteenth century.

On Thursday, January 3d, a representative of the Western Electrician made a second trip to Orange and, through the courtesy of Mr. Edison, was allowed time for an interview. As Mr. Edison had been suffering from a temporary indisposition, the conversation was of necessity short and to the point.

Arriving at the big red-brick building on the outskirts of Orange proper, the newspaper man finds himself in a moment within the little office "in the fence" outside the laboratory. A young workman takes in the visitor's card to Mr. Edison; a short wait, and then: "Come along; I'll take you to Mr. Edison," or, perhaps, sometimes just the reverse; for, as the young man at the door explained, Mr. Edison dislikes interviews intensely, from the fact that newspaper men are so incessantly after him that they rob him of much valuable time. If the paper be enterprising and its representative likewise, those who have had experience will tell you that no one is more sympathetic or more willing to show appreciation of energetic work.

In the present instance the delay was short. Although having previously expressed a strong disinclination to be interviewed, Mr. Edison made this exception prove the rule. The representative of the Western Electrician was shown into the large laboratory, library and sitting room that has been so often described in the daily press, and, with the words "Mr. Edison will be down in a moment," was left to await the coming of the great man.

After a delay of only a few moments a quick step was heard and Mr. Edison entered the room. With his hat on his head, just from his investigations, and in his dirt-besmeared, old working clothes, the inventor was a living realization of forceful energy. And the genial manner, the smile and the handshake all told at once of a kindly nature as well as a brainy one, and that it was easier for Mr. Edison to help, to allow an interview, than to refuse.

After an explanation of the scope of the Western Electrician's Twentieth Century Number, Mr. Edison consented to say a few words as to what he thought would be the progress in several branches of electrical development during, say, the first half of the twentieth century.

Incidentally, Mr. Edison prefaced the short interview by laughingly explaining how, nowadays, some of the papers in New York interview him, and even sign his name to articles, without condescending to call upon him, or in any way communicating with him, or even suggesting that they propose to appropriate this privilege.

He mentioned particularly the name of one New York periodical that had just done this in its century number. Mr. Edison was assured that the Western Electrician would not adopt such reprehensible tactics, nor even press the matter of an interview, were he indisposed or otherwise reluctant to allow the privilege.

Three questions were asked Mr. Edison, and three short and very much-to-the-point answers were given.

"Mr. Edison, will you kindly state whether you believe that, during, say, the next 50 years, there will be what you might call truly great progress with the electric telegraph? And if this progress is made, will it be with the instruments or will it be in line construction, as is indicated to-day by the advanced methods of line construction being introduced by the telephone companies?"

Mr. Edison quickly answered: "I believe that the progress in telegraphy will lie particularly in the adoption of greatly improved methods of automatic sending, and receiving in type letters. There will undoubtedly be, as in the case of the present more refined outside construction work of the telephone companies, greatly improved telegraph line construction. This will, of course, have its effect in abetting the increased rapidity of the electrical impulses, which will have to be transmitted, particularly over the long-distance lines. But"—and here Mr. Edison smiled rather deprecatingly—"there is no incentive to-day to anyone to devote time or money in attempting to increase the rapidity of telegraphic transmission in this country. As you well know, telegraphy in the United States is in the hands of the financiers, and any business man will understand me when I say that it is only too evident that the present policy of the great companies is to 'let well enough alone.'"

"In what direction will electric lighting improve?"

"Yes; the incandescent lamp is still my pet. I feel that the best of those who are working with the lamp, even to-day, really know little or nothing about it. We should adhere to selling the public light, not current. The improvement, I feel, will come largely in the increased efficiency of the incandescent lamp. Why," quickly continued Mr. Edison, "I have seen a number of two-watt lamps that lasted each several hundred hours; mark you, not many of them—several among millions. What gave this efficiency we don't know; but we have reached it several times, and you know enough about the business to understand what such a result points to."

"Mr. Edison, do you think that the next 50 years, or yet the next century, will see the picture-at-a-distance machine?"

"As far as this device is concerned, or any machine of what you might call so poetic a nature, I have given it little or no thought. I never waste my mind or my energy on any problem or machine which I do not believe, when successfully developed, will be of paramount value to mankind."

Tesla's Twentieth-Century Views.

Since, in 1887, Mr. Tesla conceived and applied the rotating magnetic field to alternating-current power transmission, this remarkable man has received a large share of public attention. He possesses what has been termed a "scientific imagination," and his bold views of natural phenomena have been given wide publicity. The subjoined interview was obtained exclusively for the Western Electrician by Mr. Frank L. Perry and was telegraphed to Chicago at the last moment for insertion in the Twentieth Century issue.

Nikola Tesla was seen at the Waldorf-Astoria in New York late on Friday evening, January 4th. He consented to answer one pertinent question relating to his researches, and his reply indicates a perfect confidence that astonishing, but, nevertheless, practical, results will be achieved during the earlier part of the twentieth century, through the skilful utilization of electric "tuning" or resonance effects, with circuits carrying oscillating currents of high frequency.

The question put to Mr. Tesla was this: "From your own investigations with high-frequency currents and the transmission of electrical energy through their aid, as revealed by you to date, it would seem that there was a great future along this line. Therefore, will you not tell me, Does not the question of syntony, or, as the layman would put it, 'electrical tuning,' of circuits become a most important one, and one that indicates the direction investigations must take during, say, the next 10 or 15 years? Will not the greatest progress be made with what could very properly be called 'resonance effects?'"

"You have put a question," answered Mr. Tesla, "which not only is of great importance in many arts of the present day, but also throughout the mechanism of the universe. The phenomena of sound and light afford striking examples. I believe that ultimately even nerve action will be proved to involve the principles of 'sympathetic response.' Spencer's idea of the unstable nerve matter is ingenious in its conception, but difficult to be admitted as a reality. The cones of the retina, with their fibers, must likewise behave as elastic systems, responding sympathetically. If this be so, the undulatory theory can hardly be true, because the periods of oscillation of these vibratory systems would be far too great for those of the light waves. Nor can we stop at the simple nerve action, for, in the entire complex movement of humanity, the same universal principle forces itself upon our observation as unmistakably as in the vibrations of a tuning fork.

"My own experiments in electrical and mechanical vibration have impressed me deeply with the tremendous possibilities in this direction. With a small engine capable of pressing a piston back and forth with a force of but two pounds, I have set an entire block of modern buildings, by careful attunement, into such a violent swaying that people rushed out affrighted. With an impressed force of only a fraction of a pound, I have caused steel rings of several square inches cross-section, capable of supporting several hundred tons, to vibrate and form loops like thin piano wires, until they finally broke.

"In electrical vibration I have frequently obtained results even more wonderful. The tuning of electric circuits is becoming more and more important with the advancement of the arts and refinement of methods. The layman can have but a vague idea of what can be accomplished in this line by men possessed of knowledge and skill. As to the former, it is acquired easily enough. The principles are very simple and do not require an exceptionally high scientific training. Perhaps the clearest expositions have been given by Dr. Oliver Lodge and Prof. Pupin. The latter, particularly, was fortunate in dealing with the subject, and a beginner can find no better source of information.

"But the skill is not acquired as quickly or as easily as the knowledge of the simple principles. It comes slowly, requires great patience and untiring application. Owing to this fact, of necessity but few are proficient in this art to-day. This is the reason why the greater part of contemporaneous literature on this subject is pervaded with the grossest errors. Many experimenters do not seem to realize that an electrical system cannot vibrate through an imperfect contact or path of high resistance. Still many more overlook the necessity of placing the excited system in a condition permitting free oscillation, yet everybody knows that if he grips a spring firmly and pushes it back and forth it cannot perform its own vibrations. Similarly, an excited electrical system, as the secondary of a transformer, cannot oscillate freely if the exciting primary circuit is linked closely with it.

"While the establishment of the best relations between the physical constants of electric circuits is imposed by economy, yet the chief object will be the attainment of specific results, as, for instance, a very high electromotive force, a current of great intensity or the magnification of feeble impulses. The transmission of electrical energy through the earth, for whatever purpose it may be, offers, in my opinion, the greatest possibilities of development.

"The time is not far off when electrical oscillations will speed in all directions through the globe, innumerable, yet each separate and distinct and each fulfilling its mission. The seemingly simple subject expands as one advances in its study, until he feels as if the wide ocean were opening up before his eyes. Some five years ago, to test the capacities of a system of telegraphy, I 'tuned' repeatedly 150 circuits, calling up each one in turn, without disturbing the others. And I thought then I had mastered the art. As I look back on those experiences now I realize that I was then only just beginning to learn."

Nine Electrical Scientists of the Nineteenth Century.

Excluding men who died before the beginning of the century just expired, persons now living and inventors or investigators who confined their efforts solely to one department of the field of electricity, there seem to remain nine men of exceptional preeminence on whose work, very largely, the superstructure of applied electricity has been reared to its already stately proportions. These men are Volta, Ampère, Oersted, Ohm, Faraday, Henry, Werner Siemens, Maxwell and Hertz, and their portraits fittingly constitute the frontispiece of the Twentieth Century Number of the Western Electrician. Other eminent men, as Davy, Arago, Weber, Gauss, Sturgeon, Gramme, Planté, Pacinotti, Wheatstone, Jacobi, Helmholtz and others, have rendered distinguished service to the science and art of electricity; but after careful consideration it is thought that, so far as electricity is concerned, and within the conditions prescribed, the nine men named are the nineteenth century's stars of the first magnitude.

Brief biographical notes are subjoined in chronological order.

Alessandro Volta was well known as a pioneer in electrical research before the nineteenth century began, having been born at Como, Italy, in 1745, but he lived until 1827, and his greatest invention, the voltaic pile, the forerunner of all primary batteries, which were for many years the only source of electricity not produced by friction, was first described in 1800 and became generally known only in the nineteenth century. Volta also invented the electrophorus, the condenser and the straw electrometer. He received many honors, and his name is commemorated by the practical unit of electromotive force.

André Marie Ampère (1775-1836) was a brilliant French physicist and mathematician. By mathematical analysis he outlined, after Oersted's discovery, the science of electromagnetism, which he called electrodynamics. He proved that magnetic effects can be produced without magnets by means of electricity alone. Ampère anticipated the telegraph and invented the solenoid. His researches had a profound effect on the electrical development of the century and his name is worthily preserved in the ampere.

Hans Christian Oersted was born in 1777 and died in 1851. He was a Dane and professor of physics in the University of Copenhagen. He possessed the true scientific spirit, but his fame principally rests on his discovery of electromagnetism in 1820. By an experiment before his class in the university he proved that a wire carrying an electric current will, when properly placed, deflect a magnetic needle. The importance of this great discovery was immediately recognized by Ampère and others.

Georg Simon Ohm, a German physicist and mathematician, bequeathed to posterity "Ohm's law" (that the strength of a continuous electric current in any circuit is directly proportional to the electromotive force acting on that circuit and inversely proportional to the resistance of the circuit), and his name has been given to the practical unit of resistance. He was born in Erlangen, Bavaria, in 1787 (or 1789) and died in Munich in 1854. His famous pamphlet, in which his law was propounded, was published in 1827. Ohm's work made it possible to define and measure, with accuracy, electromotive force, current strength and resistance.

Michael Faraday is, all things considered, perhaps the greatest figure in the electrical development of the nineteenth century. He discovered the induction of electric currents, and as on this principle all modern dynamo-electric machinery and all static transformers are based, no man did more than Faraday to make the transmission of power by electricity economical and practicable. Curiously enough, many of Faraday's discoveries in electromagnetism and induction were anticipated or made about the same time (1827-1831) independently by his great contemporary, Henry, in America. The names of Faraday and Henry are thus linked together as those of the pioneers in investigating the fundamental laws on which the dynamos and motors of the succeeding generation were built. Faraday also made important discoveries in electrochemistry and invented the voltameter. His classic work, "Experimental Researches in Electricity," was first published in collected form in 1839, although some of the papers in it appeared in the "Philosophical Transactions" as early as 1831. Faraday was an Englishman, the son of a poor blacksmith. He was born in 1791 and died in 1867, and his life and character are an inspiration for every electrician. The farad, the practical unit of capacity, was named after him.

Joseph Henry is the only American on the list. He was born in 1797 and died in 1878, and was undoubtedly the most eminent of the American natural scientists of the nineteenth century. He was a graduate of the Albany (N. Y.) Academy, and after teaching mathematics at that institution became professor of natural philosophy at Princeton. From 1846 until his death he was the director of the Smithsonian Institution at Washington. Henry's contributions to electrical science were numerous and very valuable. He made powerful electromagnets as far back as 1828 that are substantially the same as those in use to-day. He discovered important laws in relation to the winding of electromagnets and demonstrated (in 1831) the possibility of transmitting the magnetizing power from a distance, thus becoming, as many contend, the real father of the electromagnetic telegraph. Henry discovered self-induction and also made very important experiments (1841-1850) on the oscillatory character of the discharge from a Leyden jar. The importance of these experiments was not recognized at the time, but the later work of Maxwell and Hertz demonstrated their value. Henry, like Faraday, was noted for his pure and unselfish devotion to science. He gave his discoveries freely to the world and refused to patent his inventions. His "Contributions to Electricity and Magnetism" was published in 1839, the date of the appearance of Faraday's great work. The henry, the practical unit of self-induction, perpetuates Henry's name.

Ernst Werner Siemens (1816-1892) was a man of somewhat different character from the others on this list. He may be fairly called a scientist, it is true, but he is given place in the present aggregation mainly because of his eminent services in promoting the technical applications of electrical science. Born in Hanover, Germany, Siemens was a Prussian engineer army officer for 14 years. During this period he made great advances in the art of electroplating and many improvements in telegraphy, being, with his brother William, one of the first to use guttapercha insulation. About 1850 Siemens began a career of independent scientific industry. His greatest achievement was the construction of a practicable self-exciting dynamo-electric machine in 1866. Siemens also coined the name "dynamo-electric machine." In 1879 he built and operated a third-rail electric railway in Berlin, which was the first successful electric railway. He wrote many scientific papers and elaborated the plans of the renowned Reichsanstalt in Charlottenburg.

James Clerk Maxwell, the expositor of Faraday and the author of what is still the greatest textbook of the science of electricity, is certainly entitled to a place among the leaders of electrical thought in the nineteenth century. He was a Scotch physicist and mathematician, born in 1831 and dying untimely in 1879. He was professor of experimental physics in the University of Cambridge, England, from 1871 until the time of his death. His great work, "A Treatise on Electricity and Magnetism," first appeared in 1873. Maxwell gave the most complete statement to the mathematical theory of electrostatics and magnetism that has yet appeared. His book is still the standard of reference. He also suggested the electromagnetic theory of light propagation. Professor Maxwell was a man of charming character and he had the faculty of treating abstruse subjects in a clear and lucid manner. At the Paris Electrical Congress of 1900 the name maxwell was given to the unit of magnetic flux.

Heinrich Hertz, whose early death is still lamented, was born in Hamburg, Germany, in 1857 and died in 1894. In the domain of pure physics his career was a brilliant one. Helmholtz exercised a great influence over Hertz and suggested some of his investigations. Hertz became professor of physics in the University of Bonn in 1889. His great work was "On Electric Waves." He verified Maxwell's electromagnetic theory of light propagation and showed that electrical waves exist and also how to measure their wave length and period. Hertz paved the way for the late demonstrations in space telegraphy and also, to a large extent, for Roentgen's discovery of the X-ray. It is not too much to say that Hertz brought the world nearer a knowledge of the exact nature of electricity than any other man. A continuation of his researches offers a rich opportunity for the twentieth century.

An interesting experiment was recently made at Key West, Fla., according to the daily press. In the presence of several prominent persons the officers of a telephone company connected the telephone wires there and at Havana with the gulf cable between the two cities. For a few minutes a roaring noise prevented any communication, but finally this subsided and the officials heard from Havana distinctly the words, "I cannot understand you," clearly transmitted. Havana, however, failed to understand clearly. The experiment was regarded as highly successful.

Electrical Patent Litigation.

By Charles A. Brown.

The litigation over electrical inventions has fully kept pace with the advance in the electrical art during the nineteenth century. As the electrical art has developed to an unprecedented degree, so electrical patent litigation has assumed its place as the most important of all litigation in matters relating to patents.

First in rank of all patent suits is the patent on the Bell telephone, the report of which, in the United States Supreme Court reports, occupies the whole of one volume. No other case of any kind has been accorded so much space in the United States Supreme Court reports. This case stands as a monument to the learning, skill and determination of the late James J. Storrow, and is remarkable, whether it is considered from the point of view of the invention itself, the legal questions involved, or the amount of the interests at stake. No such determined defense in a patent suit was ever presented to a court, and no such determined prosecution of infringers was ever urged; and the fate of the case hung in the balance, as is shown by the fact that the Supreme Court sustained the patent by a bare majority of one.

The case of O'Reilly vs. Morse, in which the Morse telegraph patent was involved, was a pioneer suit upon electrical patents, but the interests at that time involved were not great. This case does not rank in importance with the telephone cases.

The litigation over the Edison incandescent lamp was another important and intensely interesting litigation. The patent was sustained, but so near the end of the life of the patent that the effectiveness of the decree of the court was marred; and a decision adverse to the patentee, upon a motion for preliminary injunction, was quite effectual in robbing the owners of the Edison patent of the fruits of their victory.

Among other important electrical patents which have been keenly contested in lawsuits are the Thomson and Houston patent on the automatic regulator for electric arc-light dynamos, the Brush double-carbon lamp patent, the Edison compound-wound dynamo patent, the Edison three-wire patent, the Gaulard and Gibbs transformer patent and the Edison feeder-and-main patent.

The litigation upon these electrical patents has not been particularly successful, principally on account of errors made in soliciting patents. Thus the Thomson and Houston regulator patent was declared invalid because of a prior patent granted to Thomson and Houston, the inventors having acted as their own patent solicitors and not having understood thoroughly the legal requirements of a valid patent. The Brush double-carbon lamp patent was sustained, but was ultimately given a narrow construction, owing to the use of unnecessary restricting language in the claims of the patent. The Edison compound-wound dynamo patent was declared anticipated by Brush. Brush undoubtedly was the first one to build a compound-wound dynamo capable of regulating the potential to constancy for varying numbers of translating devices in multiple arc. The Edison three-wire patent was never submitted to the court on final hearing. It was used effectually by the owners of the patent as a means of preventing competition and was, to a considerable extent, respected by competitors of the Edison company. The Edison feeder-and-main patent, after having been declared valid by the Circuit Court, was found invalid by the Court of Appeals for lack of patentable invention, in view of prior patented systems of electrical distribution. The Gaulard and Gibbs transformer patent was found not to cover the system of electrical distribution in which the transformers are connected in multiple.

A number of alleged pioneer patents on electric railway, taken out by Green, Finney and others, have been involved in litigation, but these patents have not commended themselves to the favorable attention of the court, as the most of them preceded the actual work of developing the electric-railway industry, and were, to a certain extent, open to the criticism that they were paper patents, not based upon or showing actual operative apparatus.

At the close of the nineteenth century most of the fundamental patents have either been declared invalid or have expired.

There is still in existence the broad Berliner patent, the decision of the court upon which is now being awaited with interest. The Tesla polyphase-motor patents have been sustained by the Circuit Court in Connecticut. The Court of Appeals is expected soon to pass upon these same patents, and it will then be judicially determined whether or not Tesla is entitled to the credit of having made the invention of the alternating-current polyphase motor. The Tesla split-phase-motor patents are also involved in

litigation which is now pending, and the outcome of which will be awaited with interest.

In looking over the whole field, it is a matter of surprise that so great and rapid strides could have been made in an industry as have been made in the applications of electricity, with so little monopoly depending upon patents. It is perhaps fair to say that no serious and complete monopoly has been established under any patent, except the original Bell telephone patent, and at the present time the field is growing less, rather than more, restricted on account of patent claims. It can scarcely be said that any department of electrical enterprise is or can be long exclusively controlled now by patents. Anyone can make, use and sell dynamos, arc and incandescent lamps, direct-current motors, magneto telephones, electric meters of certain kinds, switchboards and telephonic appliances, etc., without infringement of any broad patent. Whether or not the battery telephone transmitter and the induction motor are open to the public may soon be determined, and ultimately the electrical industry in all its branches will reach the position where only subsidiary specific patents have to be considered.

Some Improvements Needed in the Philippines.

By G. D. Rice.

The recent orders of the military authorities to the effect that cities and towns of the Philippines must be lighted in the streets and public grounds throughout the night has caused some new developments in the matter of establishing electric-power stations for the working of electrical street lights.

The writer has investigated the plans which have been long proposed for the operating of electric-light power stations by waterpower. These islands are thickly traversed by streams of water, the sources of which are in the many springs of the mountains, and as the flow of water continues down the mountainside to the valleys the volume increases to such an extent in many cases that some excellent waterfalls exist for running either the overshot type of wheel or the more modern and powerful turbine. There have been a considerable number of home-made overshot wheels put in at various waterpowers, and always with success. There are not as yet any turbines in the islands, known to engineers, although there may be some at a few of the power plants of the larger sugar refineries. On the island of Mindanao, in the vicinity of Davao, the military officials are formulating plans for the operation of an electric-light plant by waterpower. The same conditions prevail in the vicinity of Iloilo, on Panay Island, where some decisive steps have been taken lately toward the utilization of the waterpowers of the Jaro and other rivers. The watercourses in very many of the rivers are of sufficient depth, volume and power to be relied upon for the operation of waterwheels permanently throughout both the wet and the dry seasons. This dry-and-wet-season idea is, by the way, not so prominent as one might suppose. The writer has been here a year, and has noticed very little more rainfall in the wet season than we get in the United States. The country is by no means overflown and turned into a spongy mass, as I was told.

Manila may be used as an example of the steady advancement of electric lights for the Philippines. The company having the electric lights in charge has arranged to double its plant. No sooner is an electric-light plant put in one of the leading cities of the Philippines than almost immediate steps have to be taken to double the plant, owing to the demand upon the company for more lights than was calculated upon, and the request for lights by surrounding towns. The company in Manila is to put in two more dynamos of 300 kilowatts each, four 300-horsepower boilers and related machinery for furnishing lights to the city of Manila, the coast system and surrounding cities and towns. The present system of lighting in service by the company is entirely inadequate to meet with the requirements. Thousands of concerns, private residences and streets are without lights simply because they cannot be obtained.

In Manila there are now 10 dynamos of 60 kilowatts each in service, supplying something more than 1,000 incandescent street lights and about 200 arc lights. Paco, a suburb, and Sampaloc want lights, and have plenty of money with which to pay charges, but no more lights can be supplied until the General Electric company of the United States hastens the additional machines here.

The government officials are planning to have lights furnished for the government buildings, and as soon as this plan is carried into effect in Manila, such places as Iloilo, Cebu and other of the leading cities and towns of the archipelago, in which there are numerous government buildings, will follow suit. The establishment of military posts, with modern sanitary arrangements, in the Philippines has also opened up a means for the disposition of electric lights. These military camps will in time be provided with electric lights, for the reason that here in the Philippines other modes of lighting are very inferior. The illuminating oils are costly and smoky, while the candles are hardly suitable to use.

Demand for Electric Meters.

It may be interesting to note that there is quite a demand in the Philippines for electric meters. When electric lights were first introduced in the islands the custom of charging at a certain fixed rate per month was followed. But since the introduction of varied lights in different capacities, there has been quite a call for recording meters. It is right that wherever electrical current is sold there should be some means adopted for making accurate measurements. The flat-rate system, as used in stores, public buildings, street lighting and in manufacturing industries is not effective, often playing havoc with bills and creating trouble all around. It would be a paying investment for mechanical concerns of the islands to carry lines of electric meters.

Tools for Electrical Men.

There is another point which should be brought out in this article, and that concerns the supplying of such tools as are particularly adaptable to use in connection with electrical work. A year ago it was very difficult to purchase any tools except a few crude and inferior kinds, which were supplied by the tool makers of Spain. Spanish tools, like Spanish machinery, are very badly made. They have no strength, and one can take a Spanish screwdriver and break it with his hands, while a wrench from the Spanish shops will be twisted out of shape often at the first trial. The tools from the Spanish shops are evidently finished by apprentices, for the parts seldom fit well. I have seen parts so tight as to prevent working, and again so loose as to be wobbly. Tools for use in electrical work from England, Japan, Russia and one or two other countries are of fairly good construction, but I have seen no tools in the islands so suitable for the work intended as those from America. The first move that an electrical concern intending to operate in the Philippines should make ought to be in the line of tools. There should be supplies of dies, taps and similar devices for thread-cutting provided. It would almost pay one to go into the business of furnishing electrical tools and supplies for the islands, even if he did not carry other lines of mechanical tools and devices. I have seen so much poor work resulting from the use of inferior description of boring tools, bad files, poorly tempered cutting tools and the like that it seems to me to be high time for some enterprising machinist to lay the foundation for a fortune for himself by a establishing a tool and supply store in Manila with branches in Ilolio, Cebu and in the capital cities of Negros, Mindanao, Gimeras and other islands. The demand for these special tools for electrical work may be illustrated by the fact that the writer has frequently seen machinists devoting several days' time to the making of a special tool, which might be purchased in America for less than one dollar.

Bolts, Screws, Pins, Etc

The demand for small bolts, screws, keys, pins, nuts, washers, spiral springs, wire and general mechanical small supplies for electrical machinery and electrical work in the Philippines has been gradually increasing for many months. I can recollect that about a year ago there was hardly anything relating to electricity in the islands, and, of course, there was no call for electrical equipments, tools or supplies. Since then, there have been important changes in the situation, and the demand for these small fittings, tools, etc., is very large. When electrical machinists are obliged to give up considerable time to shaping small screws for woodwork of switchboards, and the said screws can be purchased for a few cents per dozen, if machine made, it would seem that the time has come for the services of a supply department in the islands. Owing to lack of tools, it is not easy for the machinists to make the needed parts of electrical machines or the fittings.

Oils.

neers, that is, those who have had the attending of the mechanical work at the sugar refineries and wood and metal-working shops of the past, have been in the habit of using cocoanut oils and inferior fats from the caribao and other animals for purposes of lubrication of frictional bearings. These cheap fats and inferior oils are fairly serviceable in connection with the lubrication of slow-turning shafts of sugar machines, where the bearings of the crushing rolls are several inches in diameter, but they are unfit for oiling the fine, high-speeded shafts of electrical machinery. Many good electrical machines have been put out of service through lack of proper lubricating oils. There is plenty of money available for buying good oils, but there are very few oils carried by the machinery-supply stores. I have had trouble in getting oil for a bicycle I have here, and have been using the gummy cocoanut oils for months on the bearings, with the result that they are clogged and in poor shape. Good lubricating oils should be sent here and kept in stock by the machinery-supply houses, and sold at fair prices.

Belting.

Leather, rubber, canvas and other forms of flat and round belting should also be provided for the machinery which is constantly arriving. There are now large numbers of electrically driven fans in service in Manila and other places, where they had arranged to drive the fans by other power, and these fans are in most instances driven with flat leather belts. The belting from America is superior in every way and it sells well and at good prices. The native tanners have lately attempted to manufacture leather belting, using hides of cattle and of caribao. The hides of the cattle here make fairly good leather belts if properly treated, and, in some cases, I have seen belting almost as good as that sent in from America. But the native leather-belt makers have no rivets with which to join the laps, and do not understand the art of gluing the ends or sewing them properly. Their best belts are spoiled through defective laps. Still the native belting is used, and in some sections of the islands it is the only kind available. Spain also sends leather belting here, but it is too thin. It breaks quickly. Spain seems to make nothing but mistakes. Some of their best leather belting is ruined by merely shaving it down so thin that the fiber of the leather is destroyed, and the belt becomes unserviceable in a short time. Russia, England and other countries send a limited amount of belting here. The only canvas and rubber belts I have seen are from the United States, and they sell at very good prices. The prices on the native belting are extremely low, as the cost of labor in making the belting is only about 15 cents per day per man. There are round belts in service, and all from America. Japan has a form of woven belt which it sends here, but these belts seem to chafe and wear out quickly, and the machinery on which they are run is covered with fibrous, linty stock all the time.

Looking Forward.

By Forée Bain.

Turn the calendar of time back 100 years, stand upon the brink of the new century, then just about to begin, gaze with steadfast attention through the uncertain meshes of the veil that enshrouds the future and obscures the vision from the events that are destined to be unfolded gradually and revealed as the mists clear away by the passage of time, and what seer in the wildest flight of the most vivid imagination could have foretold the grand results that have been realized by the application of human endeavor within the short span of five-score years?

In the eighteenth century the manifestation of electricity was only known, to all practical intents and purposes, by its static effects. The year 1800 brought the knowledge that other electrical manifestations were the result of chemical effort, but it was many years after that before similar effects were produced by mechanical means. Therefore nearly one-half of the century had passed before a very marked development of the wonderful possibilities of that peculiar phase of activity known as electricity had been begun. It was not until the enunciation of the great fundamental law of nature, the product of many profound and contemporaneous minds, the conservation and correlation of energy, that the indefatigable workers secured the combination that permitted them to unlock the door to the hidden treasures in the storehouse of nature.

Let us advance our observer a century with the lapsing time, or, if you please, select one of this day and generation, and let him proclaim the events that are to mark the advancement of science and methods within the coming period of 100 years. Our prophet will have us understand that one of the immutable laws in the economy of nature popularly expressed is "the eternal fitness of things." Great developments, the result of invention and discovery, are always brought about by reason of a necessity. There never was a truer aphorism than that expressed by the old saw that "Necessity is the mother of invention." The application of this truism may be observed in the gradual evolution in the means of transportation, from the ox-cart of the earliest times to the "lightning express" of to-day. The various modes employed at the several stages of the development have been the necessity of the time at which they were introduced. Would it not be incongruous to suppose that the slow-plodding primitive man could have availed himself of or appreciated the modern flyer? The education and refinement of man must be consonant with the developments of his time. The statement is placed in this form because it is the appreciation or utilization of an invention or demonstration that makes it great. Many disheartened inventors and scientists have gone to their graves poor and unhonored because a necessity for the result or product of their great skill or genius did not exist at the time of its production. The casting of pearls before swine is a parable that illustrates the meaning intended to be conveyed.

When peering into the future in an effort to foretell the advance that will be made within another century, the most important factor to be taken into consideration is the question of the ability of the civilized world to accept, assimilate and appreciate the advances that will be made from time to time by the enthusiastic, restless dreamers always in the vanguard of the procession of enlightenment.

When Zoroaster, the ancient Persian, announced the doctrines afterward taught in the Zenda-Avesta,

seven centuries before Christ, the natural laws of the universe prevailed to the same extent that they do to-day. The garden inhabited by our first parents, according to the biblical narrative, could have been as brilliantly illuminated by use of a dynamo-electric machine and arc lamps on a dark night as State street during the holiday week. Eve could have called Adam home to luncheon from a distant point in Eden by use of the telephone then, had that wonderful instrument been known at that time and had she been educated to its use. Nature's laws do not change, but adaptation of nature to meet changed conditions is constantly progressing. Two examples are sufficient to illustrate the statement. Fish taken from the underground river which flows through the Mammoth Cave of Kentucky have no eyes. The waters are always dark and in such water eyes to the fish would be of no use. Therefore nature, in the application of the law of economy, withholds the sense of sight from these little subterranean dwellers, and no doubt endows them with another sense in compensation for the absence of the organs of vision. Nature originally provided man with a natural covering for the head. The artificial means which he has adopted has caused nature to withdraw slowly, gradually, but surely, this portion of man's makeup, which has been superseded by the hat. The wild men of the plains enjoy the natural covering for the head without exception. Who has ever seen a bald-headed Indian?

The future development of electrical phenomena will be along the line of high vibration. Further research and a better understanding of the subject will develop the fact that all of the manifestations of nature are superinduced through the medium of vibration.

The fact that the eye and ear perceive objects at a distance has led to a close investigation of the mechanism of the propagation of light and sound, and thus was laid the foundation of the undulatory theories that form so large a part of the teachings of modern science. Heat is a mode of motion—a form of radiant energy. So is light, and colors are said to be distinguishable because of the varying character of the vibration or wave lengths that determine them. Within the last few months it has been very clearly proven that that most mysterious of the five senses, that of smell, or the ability to detect odor, is a manifestation of vibration. Why should it not be so? The olfactory nerves have the same cerebral origin as the optic nerves; it is probable that their functions are also similar.

There seems to be no longer a doubt of the fact that the expression of nature is manifested entirely and only through the agency of some form of kinetic energy.

The most recent illustration of a form of radiant energy is noticed in the operation of wireless telegraphy. In the working of this system gross material is caused to propagate and project a form of energy, radiant from a given point and mayhap reaching to infinity, and similar material devices are attuned to respond to the impulses of their primogenitor, and by this means the thoughts of man may be projected and interpreted at a distance from their origin through an ethereal medium. Since man controls the operation of material or matter to such an extent and can by its use communicate through space between two distant points, it seems consistent to believe that thought, the product of the highest creation known to man, the mind, should be capable of performing any function which is possible with a lower order of creation, and that, before the present century has attained its majority, man need not change his geographical location in order to hold communion between distant points.

Another advancement that may be looked for within the coming years is the improvement of man as a machine. The old machine has a very low efficiency. The digestive organs and the organs of assimilation, which are the boiler portion of the plant, have an efficiency much lower than a steam boiler plant. The fact is that the old machine consumes too much vital energy in preparing the fuel (food) for assimilation. Nearly all of this work can be done by artificial means, and as this is a chemical process and as electricity promotes and hastens chemical activity, no doubt this agency will be utilized as an assistant to the natural forces of the body, so that a larger portion of the blood may be retained to supply the necessary food to the brain. Only such food as is needed to supply the necessary tissues and muscles of the body or the corpuscles of the blood, as required by the laborer or the philosopher, as the case may be, will be taken into the system.

A necessity for some means of producing power other than by the use of coal will soon arise. The demand will be supplied when it is pressingly required. The energy from the sun, the source of all life and all activity, will be intercepted before it is absorbed by the earth, and it will be diverted into the proper channels for supplying the power "that makes the wheels go round." The energy intercepted may be received as electricity, and may be utilized directly in the present motors, which will at once displace all other means for producing power. When a proper device has been produced that will respond to the radiant undulatory energy of the sun, as the wireless telegraph receiver absorbs the radiant energy emitted from the transmitter and converts it into useful effect, this intercepter of the sun's energy will convert the received forces into useful effect, which will directly or indirectly turn the wheels of commerce. This is not unreasonable in the light of the accomplished marvels of recent date through the operation of electrical phenomena.

We are beginning to realize that our sensations come not directly from the material body, but from the surrounding medium, in the same manner that electricity is conducted by a wire—not by the material wire, but through the surrounding medium. All manifestations are the result of vibration; therefore, if the cause of the vibrations is controllable the character of the vibrations, such as manifested by heat, light, electricity, magnetism and chemical effect, may be changed at will, as they are interconvertible forces, or the result of one force.

A development that awaits an urgent necessity is the direct conversion of electricity into light to a degree equal to the direct conversion of electricity into motion. When this has been done the electric light will be comparatively heatless and more than 100 16-candlepower lamps may be produced per horsepower.

Underwriters' National Electric Association.

At the recent December meeting of the Underwriters' National Electric association in New York city there were present all the 11 members of the electrical committee of the association, with the exception of President H. C. Eddy, and from 30 to 40 other gentlemen, including insurance inspectors and municipal inspectors and representatives of the National Conference on Electric Rules, American Institute of Electrical Engineers, General Electric company, Westinghouse Electric and Manufacturing company, the Stanley Electric Manufacturing company and other companies.

The most important work done at the meeting was the adoption of the report on grounding low-potential circuits presented by C. M. Goddard, E. V. French and F. E. Cabot. This report recommended that all circuits except such as are permanently grounded in accordance with Rule 13A of the National Electrical Code must be provided with reliable ground detectors. Detectors which indicate continuously and give an instant and permanent indication of a ground are preferable. Ground wires from detectors must not be attached to gas pipes within the building. The exception (Rule 13A) provides that the neutral wire of direct-current, three-wire systems and the neutral point of transformers or the neutral wire of distributing systems of alternating-current, secondary systems may be grounded, only when so arranged that under normal conditions there will be no flow of current through the ground wire. The limit of low-potential systems was raised in the report from 300 to 550 volts. A valuable feature of the report was an abstract prepared by Professor W. L. Puffer of the Massachusetts Institute of Technology of his remarks on the subject.

The specifications for knife switches, snap switches and open-link fuses as found in the October supplement of the National Code were adopted, practically as printed. There were also a few slight changes in the rules of the code, but nothing of special importance.

Chicago City Railway Plans.

Improvements in car sheds and power house to the value of nearly $2,000,000 have been partially provided for by the Chicago City Railway company through the purchase of 15 acres of property at Seventy-seventh street and Vincennes avenue and a tract of land 278 by 376 feet at Halsted and Thirty-eighth streets, Chicago.

The plans of the company provide for car sheds on the former tract to cost from $500,000 to $600,000, and for the erection on the latter tract of a power house to cost more than $1,000,000. It is probable that the two electric power houses of the company will be consolidated into the new one, and the machinery in the three cable houses will be driven by motors fed from Thirty-eighth and Halsted streets, instead of by steam, as at present.

In course of construction in St. Louis, and almost ready for delivery to the Chicago City company, are five cars built according to plans made by Superintendent Robert McCulloch. They will be put into service on different divisions of the road to give the directors an opportunity of judging of the advisability of equipping the entire system with similar cars. Mr. McCulloch says that the cars are as good as can be built, and that they will cost nearly $6,000 each. They are 46 feet long, have cross seats, double trucks, air brakes, electric light and heat, electric signal buttons at each seat, and will be finished inside in mahogany. They will be of the vestibule type with large platforms. The framework of the cars will be of steel.

New Telephone Company in Detroit.

The Detroit City Council has granted a 30-year franchise to interests represented by J. W. Martin, president of the Oakland County Telephone company of Pontiac, Mich., for an Independent telephone system in Detroit to compete with the Michigan Telephone company. The restrictions on the use of telephones in the city have become so numerous and annoying that the citizens have been urging the council to grant a franchise to anyone who could convince them that his intentions were honestly directed toward the betterment of the service.

The ordinance contains a carefully drawn provision against consolidation with other companies. It also provides for underground metallic circuits within a radius of one mile from the City Hall. The rates are to be $25 a year for residence telephones and $40 for business instruments. The ordinance prohibits pay stations in all parts of the city. The new concern will be called the People's Telephone company.

Ohio Telephone Notes.

The Village Council of Hudson, Ohio, has granted a franchise to the People's Telephone company to establish a plant in the town. The company has promised to give its patrons free use of the county service as soon as the business in the town will permit it.

The Batavia Telephone company, Batavia, Ohio, has opened its exchange for business in that town. It has also arranged for a service in the county, as well. This line will connect with the long-distance service at Loveland as soon as the connections can be made.

Manager Robinson of the Central Union office at Urbana has arranged a signal light in the window of his office to notify the police that they are wanted. The operator takes the call and turns the light. She also calls up headquarters.

E. M. Boynton, who has been district superintendent of the Central District and Printing company at Newcastle, has been made general superintendent of construction and right-of-way for the company at Pittsburg. J. Clark Boynton takes his place at Newcastle. The change takes effect the first of the year. O. M. C.

American Chemical Society.

The twenty-second general meeting of the American Chemical society was held in Chicago on December 27th and 28th. The retiring president, William McMurtrie, delivered his annual address on the evening of the first day on the "Condition, Prospects and Future Educational Requirements of the Chemical Industries," in which he spoke of the general knowledge that was necessary for chemists to have and advocated the combination of the engineering courses with those of chemistry in preparing young men for the coming demands of the industry. Resolutions were adopted, calling upon Congress to establish a national standardizing bureau. The following-named officers were elected for the ensuing year: President, F. W. Clarke, Washington, D. C.; secretary, A. C. Hale, Brooklyn, N. Y.; treasurer, A. P. Hallock, New York; librarian, E. G. Love, New York; councilors for three years, Dr. W. A. Noyes, Terre Haute, Ind.; Dr. F. A. Gooch, New Haven, Conn.; Dr. T. W. Richards, Cambridge, Mass.; Dr. H. L. Wells, New Haven.

Consolidation in Boston.

It is reported that the Boston Electric Light company and the Edison Electric Illuminating company of Boston are to consolidate. President Frederick A. Gilbert of the Boston Electric Light company said in respect to the deal: "The move is in the interest of economy and has been pending for about four years. J. P. Morgan, who is a heavy owner of the Edison stock, has made several propositions looking toward the purchase of the stock of the Boston Electric Light company and we have embodied his latest offer in the circular which we shall send out to-day."

The first-named company is capitalized at $3,000,000 and earned $400,000 last year, while the Edison company is capitalized at $3,200,000, and its last year's earnings amounted to $450,000.

The street-railway lines of Scranton, Pa., were for several days tied up by a strike of conductors and motormen. The strike was settled by a compromise. The men demanded what was equivalent to an advance of three cents an hour. They were allowed two cents. The old rates of wages were 12½ cents for the first six months, 13½ cents for the second six months, 14 cents for the second year, 15 cents for the third year, 15 83-100 cents for the fourth year, and 16 67-100 cents for the fifth year. The new rates are 14, 15, 16, 17½, 18½ and 19 cents. The men are also allowed a 10-hour day.

THE CLOSING YEAR OF THE CENTURY.

Future electrical historians will have no such epoch-making discovery as the voltaic pile of 1800 to describe in considering the closing year of the nineteenth century. Nevertheless, electrical advancement has been general, healthy and satisfactory. In pure science investigation is making along the various wave theories of electricity and in considering the intimate relation of electricity, light, heat, chemical effects and other natural forces. In applied electricity the tendency is toward a larger use of polyphase systems, larger dynamo-electric machines and longer power-transmission circuits. Along commercial lines the year has been a very prosperous one to electrical interests, both at home and abroad. A table showing the electrical manufacturing business of the year in the United States is given in the next column.

At the Paris Exposition of 1900 Paulsen's telegraphone was the electrical novelty. By this device the sounds in a telephone receiver are magnetically reproduced, making a sort of telephone and phonograph combination, and many persons think that it may be the forerunner of the long-sought telephone relay. Szczepanik's "telectroscope," to enable one to see distant objects by the electrical transmission of light-wave impulses, was not exhibited. This device has been talked about for several years, but appears to have no tangible existence as yet. A feature of the Paris Exposition was the attention paid to polyphase systems. There were a number of large generators of this type, the largest being of 3,000 kilowattts' capacity. One dynamo was wound for an output of 30,000 volts. Three-phase induction motors of all sizes and for voltages up to 6,000 were shown in variety. There were also some single-phase motors on exhibition. Three-phase motors have been applied to railway work (mounted on the cars) in Switzerland, and a two-phase, 5,000-volt motor of the large capacity of 1,000 horsepower has been installed in the municipal pumping station at Geneva in that country.

At the Paris International Congress the names "gauss" for the practical unit of magnetic intensity and "maxwell" for the practical unit of magnetic flux were adopted. Pleasant meetings of American and English electrical engineers were held in London and Paris.

Electric railroading continues to show a marvelous extension in all civilized countries. Long lines with alternating-current transmission, substations and direct-current motors are building in various parts of the United States. Many cities and towns are now connected by electric railways, and it will not be long before the missing links between Chicago and Milwaukee, Chicago and Detroit, Boston and New York and New York and Philadelphia will be built. Then will come, doubtless, a consolidation of systems. The electric-railway situation in the United States to-day is much like the short-line building of the early days of the steam railroad. Foreign activity in electric-railway building is hardly less marked. The Central London underground system and the Metropolitan underground road of Paris were both put in operation during the year, as well as the Northwestern Elevated in Chicago. Work was begun on the New York rapid-transit subway, and satisfactory progress has been made in equipping the Manhattan elevated-railroad system in New York for electrical operation. A suspended electric railway was built and put in operation in Elberfeld, Germany. Great projects for electric underground railways in London are under consideration. One interesting feature of the year was the final abandonment of the storage-battery traction experiment in Chicago.

In lighting, the Nernst lamp shows much improvement, but is not yet on the market. Much attention has been paid to the alternating-current series arc lamp, and the position of the direct-current arc, whether open or enclosed, is seriously threatened for outdoor lighting.

During the year the British government signed a contract for the laying of an all-British Pacific cable. The American transpacific-cable projects are still in abeyance, unfortunately. In telegraphy improvements in Rowland's printing telegraph, the Pollak-Virag system and the telautograph are to be noted. There has been considerable advancement in typewriting telegraphs.

In the telephone field, particularly in the United States, great activity is shown. Extensions and improvements are making in all directions, both by Bell companies and the Independents. One increasing use of the telephone is in the transmission of train orders on railroad systems, and a promising field seems to be opening up in this direction. During the year the American Bell Telephone company has been merged into the American Telephone and Telegraph company, and in February the Erie Telegraph and Telephone company was absorbed by the Telephone, Telegraph and Cable company. The latter event was especially important, indicating, as it did, the strength and importance of the non-Bell interests. The famous Berliner case was argued in November, 1899, and a decision was expected during the year, but has not yet appeared.

Space telegraphy is making way slowly. Marconi is reported to have dispensed with the upright wires or antennæ, and distances up to 90 miles have been covered.

Electric power transmission is now accomplished, in practice, up to 80 miles, and at the Snoqualmie Falls plant, in the state of Washington, a motor was operated over a circuit of 153 miles during the year. This was done merely as an experiment on existing lines to Seattle and Tacoma, coupled together, and is believed to be the longest power transmission yet attained. Some increase in the use of aluminum for bare-wire transmission circuits is reported.

Electric automobiles were somewhat improved and greatly increased in number during 1900. They are now widespread in the United States, France, Germany and other countries and promise to play a conspicuous part in the new century, although some desirable improvements are still to be made. A number of important automobile exhibitions during the year demonstrated the extent and importance of the motor-vehicle industry.

Other features of the year of especial interest are the absorption of the Siemens & Halske Electric company of America by the General Electric company in April, the decision sustaining the Tesla polyphase-motor patent by the United States Circuit Court of Connecticut in August, and the awarding of a contract for an electric elevator for the Washington monument, to have a lift of 498 feet.

Western Electrician's Estimates of Electrical Manufactures.

Class of Apparatus.	1900. Made in the U. S.	1900. Imported.	1899. Made in the U. S.	1899. Imported.
Arc lamps, enclosed	$ 1,200,000	.....	$ 800,000	.....
Arc lamps, open	125,000	.....	150,000	.....
Auxiliary steam plant for electric installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc.	1,500,000	.....	1,250,000	.....
Bells, buzzers, push-buttons, call-boxes, annunciators	600,000	.....	500,000	.....
Belting used in electrical plants	550,000	.....	550,000	.....
Boilers for electrical plants (water-tube)	4,000,000	.....	3,000,000	.....
Boilers for electrical plants (other than water-tube)	1,100,000	.....	700,000	.....
Cables, underground, aerial and submarine	15,000,000	.....	12,500,000	.....
Carbons for lamps, batteries or motors	1,625,000	$250,000	1,350,000	$160,000
Cars and trucks for electric railways	3,000,000	.....	2,000,000	.....
Conduits (underground) and similar material	1,600,000	.....	1,200,000	.....
Conveyors, coal and ash, used in electrical plants	350,000	.....	200,000	.....
Cranes and hoists, electrically operated	2,400,000	.....	1,600,000	.....
Dynamos and motors, including parts of machines, boosters, rotary converters, etc., and all motor applications not specifically enumerated in this list	36,000,000	.....	28,000,000	.....
Electroplating and other electrolytic apparatus not elsewhere specified	250,000	.....	250,000	.....
Electrostatic machines, induction coils, medical sets, etc.	150,000	15,000	150,000	20,000
Elevators, electric (mechanism only)	2,500,000	.....	2,000,000	.....
Engines—(elec. use) Gas	900,000	.....	700,000	.....
Engines—(elec. use) Steam	15,000,000	.....	16,000,000	.....
Fans, electrically operated and direct-connected	1,100,000	.....	900,000	.....
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc.	700,000	.....	550,000	.....
Fixtures for electric lighting	3,850,000	50,000	3,500,000	50,000
Heating and cooking apparatus, electrical	225,000	.....	200,000	500
Incandescent lamps	3,400,000	7,000	2,700,000	9,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc.	2,500,000	3150,000	1,500,000	100,000
Insulating material, fiber, tape, etc.	1,200,000	.....	1,100,000	.....
Insulators (glass and porcelain)	1,325,000	.....	1,100,000	5,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, etc.	850,000	.....	500,000	.....
Lightning arresters	310,000	.....	225,000	.....
Poles, cross-arms, brackets and pins	2,900,000	.....	800,000	.....
Primary batteries	450,000	20,000	375,000	30,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail bonds, etc.	950,000	.....	600,000	.....
Rheostats, car controllers, motor starters, etc.	775,000	.....	525,000	.....
Shafting, pulleys, clutches, etc., used in electrical plants	500,000	.....	550,000	.....
Sockets, switches, cut-outs	1,500,000	.....	1,200,000	.....
Storage batteries	3,500,000	1,000	2,700,000	.....
Telegraph instruments and apparatus	115,000	3,000	125,000	5,000
Telephone apparatus	*17,500,000	125,000	15,000,000	125,000
Transformers, stationary	2,600,000	.....	1,850,000	.....
Water wheels, used to drive electrical machinery	850,000	.....	700,000	.....
Wire, bare	7,250,000	.....	6,500,000	.....
Wire, rubber-covered	3,100,000	30,000	2,200,000	25,000
Wire, weatherproof	6,250,000	.....	5,500,000	10,000
Wire, magnet and all other	1,250,000	.....	No est.	.....
Miscellaneous	200,000	.....	No est.	.....
Total	$153,000,000	$651,000	$123,800,000	$539,500

*Of which about $13,500,000 represents Bell apparatus and $4,000,000 Independent apparatus.

Electrical Manufacturing Business.

The electrical manufacturing business of the United States—including non-electrical apparatus used essentially and exclusively in the generation or utilization of electricity—shows, for 1900, an increase of 23½ per cent. in the value of the output, as compared with 1899, the figures being $153,000,000 and $123,800,000, respectively. In the adjoining table careful estimates of the value of electrical and strictly allied manufactures made in or imported into the United States in the years 1900 and 1899 are given.

All of the estimates are conservative and prepared from a large number of sources. They represent the best approximation of electrical manufactures that it is possible to obtain, and show that, prosperous as was the year 1899, the year 1900 has exceeded it in a very satisfactory manner.

Electrical Exports.

The classification of the Treasury Department is such that it is difficult to obtain exact statistics of the exports of electrical goods from the United States. From figures that are obtainable, however, it is known that the electrical exports of 1900 amounted to about $11,000,000 in value, compared with about $7,000,000 in 1899. This increase of 57 per cent. is most gratifying. The $11,000,000 is about equally divided between electrical machinery, on the one hand, and telephones, telegraphs, instruments, line material and other classes of electrical apparatus on the other. Estimates of imports are given in the table, and show a total of $651,000 for 1900. It is very clear that the United States is a seller of electrical goods, rather than a buyer.

Deaths of the Year.

The most noted name among those of electrical men who have died during the year is that of David E. Hughes, the inventor of the microphone, who died in London on January 23d, aged 69. Other foreign electrical men of prominence who passed away in 1900 were Emile Andreoli, French electrician, noted for work in storage batteries and electrolytic processes, who died in February, aged 65, and Bruno Abdank-Abakanowicz, a well-known Polish electrical engineer, who died at his home in Paris in September, at the age of 45.

Among Americans the following-named may be mentioned:

January 8th—S. Dana Greene of Schenectady, N. Y., general sales manager General Electric company, aged 36.

February 8th—George L. Beetle of Chicago, prominently identified with the business development of the telephone in the West, aged 67.

April—John C. Love of New York, inventor of the Love conduit electric-railway system.

July 26th—John E. Zeublin of Chicago, general superintendent of the Chicago Telephone company, aged 58.

August 19th—Col. J. J. S. Wilson of Chicago, veteran telegrapher and electrical man, aged 65.

October 1st—John E. Hudson of Boston, president American Telephone and Telegraph company, aged 61.

October 31st—George H. Bliss of Chicago, electric-lighting pioneer in the West, aged 60.

November 12th—Henry Villard of New York, financier of electrical properties in the period from 1878 to 1892, aged 65.

November 12th—Frank Jarvis Patten of New York, well-known electrical inventor, aged 48.

November 16th—F. W. Royce of Washington, D. C., electrical inventor and business man, aged 61.

November 23d—Washington H. Lawrence of Cleveland, president National Carbon company, aged 60.

BUSINESS CONDITIONS.

Reports from a number of electrical manufacturers and dealers and from business houses in allied lines show conclusively that the year 1900 was an eminently satisfactory one to electrical business interests. The volume of trade was very large, despite the election, and prices were excellent. The expansion of the electrical export trade continues to be a gratifying feature of the situation. The business of the old year and the outlook for the new are canvassed in the following statements, which are alphabetically arranged:

American Electric Fuse Company, Chicago (Fuses): The business outlook for 1901 is the most promising within our recollection. We have been surprised at the increase in inquiries and actual business since the election. Our business is intimately connected with the general business situation, as our trade is distributed throughout every state in the Union, and we are confident, from the indications already noted, that the business, at least for the next year, in the electrical industry will be the largest in the history of the United States. We have noted also another matter of interest in the business of 1900, and that is a growing demand for articles of sterling worth and a better following regarding cost of standard goods. Ruinous competition, which has injured so many other lines, has harmed the electrical business by bringing out cheap and shoddy goods. Our experience leads us to believe that the people will have none of these substitutes, but will insist, in every electrical line, upon having the best. We feel very confident of a successful and prosperous year to come.

American Electric Vehicle Company, New York (Electric Vehicles): While this company removed its entire plant from Chicago to a larger plant in the East, and established headquarters in New York city, in January, 1900, and was thus compelled to reorganize its shop force and sales department, yet the amount of business done during the last year has exceeded its expectations. The management is convinced that the automobile industry is a permanent and large one. The prospective business for 1901 has already reached large proportions, and we have already taken up the question of enlarging our shop facilities.

American Steel and Wire Company, Chicago (Wire): The production and sales of telegraph and telephone wires, bare and insulated copper wires and cables for electrical purposes and of rail bonds on the part of this company during the year 1900 have been more than satisfactory. The business of the company in these lines is the greatest in the history of the Washburn & Moen plants, where all the company's insulated wires and bonds are made. The increases noted are in all departments of electrical work, bare and insulated, while in feeder cables of large capacity and in bonds the output has more than taxed the full day and night capacity of the plants involved. Orders have come from all sections of the country, while the increase in export has been very marked. So far as the outlook for 1901 is concerned, everything indicates an even greater business than during the last year. There appears to be a very general renewal of activity in lines that, from various causes, have lain more or less dormant for some months past. So favorable, indeed, does the American Steel and Wire company consider the outlook that propositions for largely increasing the capacity of the electrical plants are under consideration and plans looking to this end will, doubtless, mature during the early months of the year 1901.

Anderson (Albert and J. M.) Manufacturing Company, Boston (Electrical Specialties): We have made every preparation for a good business for the coming year and have no idea that we shall be disappointed.

Blue Ridge Locust Pin Company, Asheville, N. C. (Pins and Brackets): The year 1900 has been, on the whole, a very satisfactory one. We think there has been more development along electrical lines than in any preceding year. The latter part of 1900 has been somewhat dull, owing, perhaps, to the presidential election. Since the election, however, inquiries have come in much more freely, and everything indicates a fair trade for 1901.

Bryan-Marsh Company, New York (Incandescent Lamps): We have been compelled to arrange with the suburban electric roads centering in Marlboro, Mass., to run special cars from adjacent towns in order to secure an increased labor market, since our own demands and those of manufacturers in other lines have depleted the local labor market. The year 1900 will go down as the red-letter year with us as to the total output of incandescent lamps. To be accurate, from December 1, 1899, to December 1, 1900, the total output of lamps has been 48 per cent. in excess of any previous year. This result is attributable to a largely increased foreign demand, the awakening of many isolated plants as to superiority of results to be obtained from lamps which are slightly higher, initially, in price over cheap lamps, heretofore largely used by the smaller consumers, and heavy sales incident to the opening up of new territory.

Bullock Electric Manufacturing Company, New York (Electric-light and Power Machinery): We have had a most satisfactory trade during 1900, the last six months of which show a greater volume of business done than the entire year of 1899. We have found it necessary to enlarge twice upon our facilities during the year, which will make the capacity January 1, 1901, fully double that which it was January 1st of last year. One gratifying feature of our business during last year was the large increase in export trade. Orders have come to us from Great Britain, continental Europe, Russia, South America and Mexico, with every indication that there will be a gradual and very satisfactory increase in the future. Another feature regarding our business is that during 1899 our largest unit was of 800 kilowatts, while at the present moment we are prepared to build generators of 2,000 kilowatts, and larger, if necessary. We are to-day crowded with orders for large units.

Carlisle & Finch Company, Cincinnati (Searchlights and Novelties): Business in 1900 has been about 50 per cent. better than in any preceding year. In fact, all our lines have grown and we are busier in every department than we ever have been. From all appearances the year 1901 will be even better.

Charter Gas Engine Company, Sterling, Ill. (Gas and Gasoline Engines): Up to the first of December we did as much or more business than we did in the whole of 1899, which was the largest year in our history. December held its own with the rest of the year, so that we are expecting to increase our output very materially over past years. Our anticipation for 1901 is that there will be good business, fair prices, and that collections will be good.

Consolidated Railway Electric Lighting and Equipment Company, New York (Train Lighting): Among the most important advances during the last year in the development and application of electricity to commercial ends has been the use and perfection of electrical lighting of railway trains and vehicles. Accepted in theory for years past, the mechanical difficulties, which at first appeared formidable, have been overcome successfully and there has been placed at the service of the traveling public a method of lighting railway coaches incontestably superior to any other from the point of view of economy, comfort, simplicity and safety. At the recent session of the International Railway Congress in Paris it was decided that "electric lighting of railway carriages produced by means of a dynamo driven by the axle during the run of the train realizes, in principle, a complete and rational system of car lighting." It has been the good fortune of American science and invention to realize that principle in practical utility and to apply it successfully where it will be appreciated by the countless thousands of travelers as lessening or, it may be said, eliminating the dangers of fire and explosion, absent from no other method of car or train lighting. The utilization of electrical principles and appliances which obtain in this country has been widely availed of in other countries, and it is simply a matter of time when the electric lighting of railway trains will be as much a matter of course as the present method of car heating in place of the old-fashioned car stove.

Crocker-Wheeler Company, Ampere, N. J. (Electrical Machinery): The year just past has undoubtedly been the greatest in the history of electrical and allied industries, and from present indications the demand for apparatus for the first year of the new century will be at least as large as, and even promises to exceed, that of 1900. In point of output the last twelve months have far exceeded any previous years. The field of electric power transmission for mills and factories has been very active and the inquiries for installations of this character are increasing daily. Our works have been taxed to the utmost during the year now terminating, and though in the last few months we materially increased our facilities for handling work, we are unable to satisfy the demand.

Driver-Harris Wire Company, Newark, N. J. (Resistance Wires): The electrical branch of our business has been quite satisfactory during the last year and we look for a material increase during 1901. We sell resistance wire to most of the electrical manufacturers, and we find that our customers are all preparing for a good trade during the coming year. With every sign in its favor, we do not see how business can be otherwise than very prosperous.

Electro-Dynamic Company, Philadelphia (Electrical Machinery): We believe we but repeat the opinions of the other manufacturers by stating that the present year has been the most prosperous ever known to the electrical trade. Not only has the volume of business been greater, but the profit to the manufacturers has improved. Our own business, which is principally devoted to the production of electrical machinery for marine purposes and to special electrical engineering work, has been exceedingly prosperous, and we have every reason to hope for a continuation of this prosperity during the ensuing year.

Emerson Electric Manufacturing Company, St. Louis (Motors): The season of 1900 was not the best for fan motors and such appliances, but even with that drawback, we registered large gains in volume of business done, largely due to the general prosperity of our country and its citizens, and to the fact that our line of goods has come to be considered as necessities, instead of actual luxuries. An early limited canvass of our trade shows a general feeling of satisfaction at the future prospects, and we look forward to the season of 1901 for the greatest and most profitable year in the history of the entire electrical trade.

Ericsson Telephone Company, New York (Telephone Apparatus): The growth in the demand for electrical goods, and especially telephones, which was looked for at the close of 1899 has materialized in 1900, and in even greater volume than was anticipated. The year of presidential election and the close of the nineteenth century will be one to remember as exceptional because it was not an "off year" for business. Doubtless nearly every house in this line has had its busy times and its quiet times in the last twelve months, but the average has been so good as to be the cause for congratulations. Perhaps the South has given the largest portion of any one part of the country, but fortunately the whole country has been so prosperous that very few, if any, have reason to complain. For ourselves we might say that, beginning a campaign of education with the organization of this company and insisting that real economy means using only the best, we have persistently pursued the idea with ever-increasing converts to its truth. The last year has brought us many new friends whose confidence we value, and a substantial increase in our trade. We look forward to the opening year of the new century with great confidence, feeling that business conditions are very favorable, and with the general prosperity of the country a good trade is assured.

Evans, Almirall & Co., New York (Heating, Ventilating and Power Plants): Having but recently established an office in the West, we would say that the business that we have done in that section in the first year has more than met our expectations, and we consider the outlook for the coming year very bright. We are at the present time extremely busy and have more contracts on hand than were reasonably anticipated.

Falls Rivet and Machinery Company, Cuyahoga Falls, Ohio (Power Transmitting Machinery): The bulk of our trade is not at the present time with electrical companies, the direct-connected plants having practically closed that line of trade. We would say, however, that while that line of business has been cut out, we have been very busy the last year.

Farr Telephone and Construction Supply Company, Chicago (Telephone Apparatus): In the outlook for the telephone and electrical business for the coming new year everything indicates a very active market. We are informed from our correspondence from all parts of the country that there are great preparations being made to rebuild lines and exchanges. Many exchanges are preparing to put in new outfits throughout. We look forward to a brisk and prosperous trade early in the new year.

Fitchburg Steam Engine Company, Fitchburg, Mass. (Steam Engines and Boilers): As we stated last year, we do not make a specialty of electric-light work, but we furnish more or less every year for this purpose, and the demand the last year has been more than for any previous year, we having supplied a good deal of direct-connected, as well as belted, work. As we have looked over the field it has seemed to us that the demand everywhere was larger than ever before, and we can see no reason why there should not be a still larger increase in the year just before us. The development in the use of electrical power is simply marvelous, and there seems to be hardly any limit to it.

General Electric Company, Schenectady, N. Y. (Electrical Machinery): The business of the year 1900 shows a large increase over that done in 1899, notwithstanding the fact that the latter year's business was the best in its history. By means of enlarged facilities in its workshops this company has been enabled to make deliveries keep pace with increased orders. The number of new projects requiring large quantities of electrical apparatus and supplies have been numerous during the year, and final deliveries have been made on several large outstanding orders. The prices of the raw materials chiefly used in the electrical work remained at the high record made during the year 1899, until November last. Since then actual advances have been demanded on these prices, which, if continued, must ultimately lead to increased prices for finished electrical products. During the year noted improvements have been made in the equipment of central-station lighting apparatus, the older and more inefficient types of generators and devices having been discarded and replaced by larger units of higher efficiency and of a more substantial character. In electric-railway work there has been a decided tendency to use equipments of four motors instead of two, thus giving greater power, higher speed and generally more satisfactory service. The increasing demand for railway equipments for suburban and interurban work shows clearly the tendency on the part of all railway companies to extend their lines, thereby placing the suburbs of large cities within easy reach of business centers and relieving the congestion of densely populated districts. Great advances have been made during the year in the equipment of large manufacturing plants with electric motors. The time is not far distant when the distribution of power by electricity will become universal in mills and factories. Great progress has been made in the equipment of each tool with its individual motor in machine shops of recent construction. So rapid have been the strides in the successful transmission of power by electricity over considerable distances, that the limiting factor is no longer the length of the transmission line, but is now merely a question of the market price at which the power can be sold. Power at a loss of only 5 per cent. on the line is to-day being transmitted 80 miles in California. The electrical equipment of waterpowers heretofore considered so inaccessible as to be of no commercial value is today making these waterpowers among the most desired of all properties. The electrical transmission of power from coal mines—using slack for fuel—is now beginning to attract the attention of capitalists, and at the close of the year 1900 there are several plants of this character in different sections of the country, which have proved to be great commercial successes. To-day the introduction of electrical apparatus into new fields, as well as its expansion in places where entry has already been made, seems to be limited only by the number of competent engineers who can give to the promotion of such work that breadth of comprehension of economies and that understanding of mechanical applications which are so essential to a ready grasp of the advantages of those things which are new. It can be stated as a broad proposition that the use of electrical apparatus will invariably promote economies, and advancement in nearly all the fields of industrial endeavor may best be marked by the number of undertakings brought under the influence of the progressive electrical engineer.

Great Western Smelting and Refining Company, Chicago (Metals): The year 1899 was a phenomenal one in all lines of trade, and we were not sanguine enough to expect to duplicate it in 1900, but in this we have been happily disappointed, and our business, especially in the high-grade babbitt, solders, etc., will, in all probability, reach 50 per cent. more in volume than in 1899.

Gregory Electric Company, Chicago (Electrical Machinery and Supplies): We have had a very satisfactory year, the increase in our business being constant and very gratifying. Through the increase of business we were compelled to enlarge our quarters and have added a new building to our works. During the year we have made numerous improvements throughout our works, thereby facilitating the handling of apparatus, and we believe we now have a model electrical work plant. We note a large demand for up-to-date apparatus, the average customer now being well posted on what constitutes good apparatus. Collections have been very satisfactory this year and we are looking forward to the coming year as one of exceptional promise. We believe the electrical industry has never been in a more satisfactory condition.

Hobart Electric Manufacturing Company, Troy, Ohio (Dynamos and Motors): We take pleasure in stating that our business in 1900 has been a little more than 50 per cent. greater than for 1899. The increase would have been greater had we been in shape to take care of what we could have had.

Holtzer-Cabot Electric Company, Brookline, Mass. (Telephones and Motors): Our business during the past year has been satisfactory, notwithstanding political and trade conditions. While there has been a slight reaction from the unusual trade of the previous year, the electrical business from our standpoint seems to be in a healthy and progressive state. The rapid growth of large central-agency systems is well shown by the great demand for charging sets, noiseless dynamos for direct connection and boosters, while the smaller exchanges, interior systems, etc., continue to furnish a good market for the magneto. Our motor department has been recently enlarged to meet the increasing demand for both alternating and direct-current apparatus. A good indication of the satisfactory condition of trade in general is shown by the tendency toward slower speeds and better grade of apparatus, thus indicating that cheapness is not the important consideration it was a few years ago. Our export business is very satisfactory, and the inquiries of a year or so ago are now being followed by orders. In conclusion, we may state that we are well satisfied with the outlook for the coming year in all departments.

Lambert Schmidt Telephone Manufacturing Company, New York (Telephone Apparatus): During the last year our business has increased considerably and we have been forced to move to larger quarters at our new factory at Weehawken, N. J. It has been very gratifying to us to see the rapid increase in business in every direction in the telephone field and also the numerous improvements that have been introduced by the Independent manufacturers. We should certainly consider the last year as reaching the highest mark thus far in the development of the Independent telephone business, and we shall be very much disappointed if the coming year does not show increased prosperity. Now that the cities of the first class have taken up Independent telephone exchanges and manufacturers have worked out the problem of furnishing quick and satisfactory service in large systems, the development of the business should be very rapid.

Leonard (Ward) Electric Company, Bronxville, N. Y. (Rheostats and Circuit-Breakers): The year 1900 has been a very good one in the line of rheostats and circuit-breakers. Our business has been very satisfac-

tory indeed, especially our foreign business, which has been surprisingly good of late. This is in a large measure due to the fact that we secured at the Paris Exposition the only gold medal awarded in our line of goods. The year 1901 will no doubt be even better than 1900.

McKinlock (George A.), President Central Electric Company, Chicago (Electrical Supplies): If it were not for the fact that the year 1900 was a presidential year, it is my opinion that the business of the year would have shown even a greater volume of increase over the year 1899, which is the high-water mark of the tide of industrial and commercial progress. The ebb of this tide was barely perceptible during the year, and the distant roar of the flood of 1901 is already heard, and it would be a work of supererogation to review or to mention the causes that foretell the years of plenty which seem to be upon us. The politico-financial question having been so effectively disposed of, and the expansion idea having met with such popular endorsement, there do not seem to be any sentimental or material obstacles that will prevent the successful working out or development of legitimate commercial enterprises. The increase in our country's population, while gratifying, has not kept pace with the increase in the production of gold, which seems to indicate that we have a wider margin for exchanges than ever, and apparently ample for the world's requirements. In our own city, the labor question seems to be settling itself, and with the growth in the population of the city, which is increasing rapidly, the advantages of Chicago as a manufacturing and distributing point are made manifest more than ever.

Matthews (W. N.) & Bro., St. Louis (Electrical Specialties): Our business being principally specialties, we feel from the large number of orders we have received for all of these that it indicates an era of prosperity in the electrical line which has never been known before. We have received orders from all over the United States and from Honolulu, Canada and Germany, which would indicate that there has been a great deal of new work put in or that the old electric lines are being rebuilt and that there is a tendency to use the highest grade material in this work. From all indications we believe that there will be a large amount of extension of both electric-light and street-railway work, as well as in telephone, during the next year.

Michigan Electric Company, Detroit, Mich. (Electrical Supplies): We have done all the business which we have had facilities for securing and handling in all the various electric lines we are interested in, in 1900, and we find the total shows a very satisfactory increase over the total of any previous year. This increase we find is not confined to any one or two lines, but is general in all the lines we handle. We are, therefore, well satisfied with what we have so far accomplished, and look forward with confidence to doing even a better business in 1901, and we believe that in all electrical lines there is plenty of business for those who go after it properly and are equipped to handle it.

Montauk Multiphase Cable Company, New York (Wire): From our contact with other electrical industries and by reading the electrical journals, we can draw but one conclusion, namely, that 1900 was a very prosperous year among the electrical fraternity. As to our business, we are glad to report that the orders have been much larger than for any previous year. Regarding the outlook for 1901, we would say that it is very flattering, and we believe that during this period fire-detecting wire will come into universal use for fire-alarm purposes, not only in residences, but in mills, factories and warehouses. During 1900 we brought out a simple but efficient branch and splice box, which enables the electrical man to install our fire-detecting wire almost as fast as he would two ordinary wires. In the early part of 1901 we intend bringing our a new and improved manual alarm box, the fittings to be mounted entirely on glazed porcelain.

Munson (Charles) Belting Company, Chicago (Leather Belting): The business transactions of the last year have been of a very gratifying nature. We have, especially in the line of electric-light plants in different parts of the country, been very successful in securing contracts and orders. Also, in connection with the various street railways in different cities, we have secured considerable trade, indicating that business has an upward tendency. In regard to the outlook for 1901, from a conservative standpoint we feel that the prospects are very good. We have secured a number of yearly contracts from large corporations and smaller ones, indicating that trade will be good during the year 1901, and that business will continue in a healthy condition, as it has been during this last year. In fact, from our standpoint, we feel that, if anything, there will be a decided advance along all lines.

National Conduit and Cable Company, New York (Wires and Cables): The year 1900 has been one of the best years in the history of our business, and has been most satisfactory to us. The outlook for 1901 is quite as promising.

North Electric Company, Cleveland, Ohio (Telephone Apparatus): The last year has seen the capacity of this institution almost quadrupled. We are working night and day, and have had the pleasure of placing on the market several improvements, most of which have been innovations in their line in the field of Independent telephony. Our business has been satisfactory from a financial standpoint, as well as the increase in the growth of the output. The outlook for 1901 is that we will be compelled at least to double our present capacity, we being warranted in this opinion from the present outlook of business already in hand or promised.

Nowotny (John S.), Cincinnati (Dynamos and Motors): We have enjoyed a splendid business in the last year; in fact, the business that we have done has far exceeded our most sanguine expectations. As to the future, we feel that the present administration in public affairs is sufficient to guarantee the whole country safe, conservative, economical and sound government. Our relations with Europe and foreign countries in general were never in better condition, justifying us in looking forward to a great increase in our export business, as American products are now being recognized throughout the civilized world as the best. Within the boundaries of our own country, there have been exceptional seasons, enabling the farmers throughout the country to enrich themselves. The wheels of industry have not been idle and there has been employment for all at unusually good wages. It would seem that we are just passing into an era of prosperity that will be enjoyed by all, such as this country has never experienced.

Phoenix Iron Works Company, Meadville, Pa. (Steam Engines and Boilers): Our business for the year 1900 has been very satisfactory, the volume, both in engines and boilers, being larger than in previous years, although there was some let-down due to the reaction from the high prices of material, as well as the conservatism due to the near approach of a presidential election. Since election we have booked a large number of orders, both domestic and foreign, and from the inquiries we have received, and the contracts that are pending, we look for a very large amount of business the coming year. We consider that the business of the United States, in the electrical and allied lines, is in a more healthy condition than we have ever known it. There is going to be a great deal of activity in electric-railway building. The mining industries are particularly active, and the large office buildings being erected in our principal cities are going to make a very large demand for the class of machinery we manufacture.

Providence Engineering Works, Providence, R. I. (Steam Engines): The last year has been one of the most prosperous ever experienced in the history of the engine business as carried on at our works, and the coming year seems to us to give evidence of equal prosperity. Purchasers of machines throughout the country are evincing a higher appreciation of good work and excellence in design, which we take to be an encouraging feature of the situation and one tending to increase progress in all lines of industry. We have every reason to be satisfied with the outlook.

Shelby Electric Company, Shelby, Ohio (Incandescent Lamps): We are pleased to advise you that never, during the experience of this company, has there been such a demand for incandescent lamps that deliver the largest quantity of light through the end opposite the base as there is now. The useful-light argument produced by this company has made a great impression on the trade, and we believe that we can expect, during the coming year, more orders than ever. There seems to be a tendency among central-station operators and large users of electricity for illumination to pay more attention to economy in operation and they naturally begin with the lamp. We have been making an educational campaign, and this, undoubtedly, has considerable bearing on the success we are having.

Shultz Belting Company, St. Louis (Belting): Our business for the year just closed has been the largest we have had in 24 years. Business has been good in all lines; in electrical lines we have had a very much increased business. We think the outlook for several years to come is very good, and that all lines of trade in the United States will be increased, and that the foreign demand for American goods will also be good.

Sprague Electric Company, New York (Electrical Machinery): The outlook for electrical business is extremely good, so far as this company is concerned. The year 1900, although what is known as a campaign year, was one of the best that this company has ever had, and the demand for our products is increasing at a very gratifying rate. We have been obliged to enlarge our general offices to accommodate the growth in business, and have recently established a branch office in St. Louis, and on the first of January we shall open another branch office in Baltimore. With the overwhelming majority given to President McKinley on his re-election, the confidence of the business men throughout the country is established, and undoubtedly there will be in the next four years an unusual amount of progress made. The application of electricity to machinery driving of all kinds will receive a great impetus, and the Sprague Electric company anticipates getting a large share of the business.

Standard Telephone and Electric Company, Madison, Wis. (Telephone Apparatus): We have found during the year just closed a decided advance on the part of the Independent telephone companies in every way. Employes, particularly in the electrical branches of the work, are becoming daily better acquainted with their duties, and as a result there is a steady decrease of complaints from subscribers, because of better service and the improved class of apparatus sold to the Independent telephone people by the manufacturing companies. This company has had a very successful year, and unless all indications fail, 1901 should be a banner year in the Independent field. The Bell company is making strenuous efforts to overcome competition, but with the capital, determination and ability in management, together with the loyalty of the people, to contend with, the Bell interests will have just as hard a proposition to deal with in the future as they have had in the past. The sale of a few Independent exchanges during the last year to the Bell company or its licensees has, of course, in some instances, occasioned unfavorable comment, but where rates have not been increased and toll connections continued with the Independent companies, no great harm has resulted. It is to be assumed, however, that this condition will not continue, and that sooner or later higher rates will be demanded, and the public will not forget that for many years they were very generally deprived of telephone service, because of excessive rates, and in many localities were compelled to accept such service as they could get. Realizing this, the Bell company is, of course, reconstructing many of its plants at a great outlay. It remains to be seen, however, what the outcome of this move will be. We feel that locally telephone subscribers prefer to support home industries, talk with more people, and at lower rates than the Bell company has ever made in the past.

Standard Underground Cable Company, Pittsburg (Wires and Cables): We believe the business of the year 1900 in the electrical and allied lines to have been the most prosperous in the history of those industries. While we consider the outlook for 1901 to be quite good, we do not believe that business will be so large in the electrical and allied lines this year as it was in 1900.

Stephenson Manufacturing Company, Albany, N. Y. (Belt Dressing): Conditions never appeared so healthful as they are at the present time. We attribute this quite largely to the steadily growing demand for products of American manufacture abroad, which stimulates all lines of industry. Manufacturers, as a class, are under deep obligations, first, to the builders of the Oregon, and second, to the government authorities, who ordered that ship from San Francisco to Cuba. That trip demonstrated to the civilized world that "we are the people." Men who read the signs of the times will, during the next year, use their utmost endeavors to make their products known and appreciated in new markets.

Stromberg-Carlson Telephone Manufacturing Company, Chicago (Telephone Apparatus): The business in the last year in our line has made a remarkable advancement and has had a steady and healthy growth continuously. From present indications the growth of the Independent telephone business during the year 1901 will far surpass all past records.

Sunny, (B. E.), western manager General Electric Company, Chicago (Electrical Machinery): The electrical business for the year has been very satisfactory. It has been of a very large volume, and most of it has been apparatus of a high character, bought with reference to efficiency, economy and durability. The work of rebuilding central stations equipped with old-type and uneconomical apparatus has gone on steadily, and there are very few plants indeed built a dozen years ago that have not been partly or wholly rebuilt. The year 1901 promises to be full of activity with reference to electrical installations. Plans are being made on every hand for enlarging existing properties, and especially for the building of interurban lines of railway. One of the particularly gratifying things in connection with the current year is the complete restoration of confidence in electrical securities. First-mortgage bonds secured by first-class railway and lighting properties, even in comparatively small towns, have been selling at from par to 105. This indicates clearly and convincingly that electrical securities have taken their proper place in the list of investments that can be relied upon.

Texas Arm and Pin Company, Beaumont, Texas (Cross-arms and Brackets): For the year we have handled a volume of business entirely satisfactory to ourselves. Our institution is but little more than a year old, but we have met with success much beyond our expectations and we believe that our business for 1901 will double that for this year. We think this for two reasons: First, we are now established, which was not the case a year ago, and secondly, we think that next year will see the greatest telephone and telegraph construction era that we have yet known, to say nothing of electrical plants of other character that require our material. We, like most of our brethren, are winding up the old year with best wishes and kind feeling for the departed one and a joyous welcome and glad heart for the new.

Tower-Binford Electric and Manufacturing Company, Richmond, Va. (Electrical Supplies): The prospect for increase of business in this section is exceptionally bright in every line of the electrical business.

Triumph Electric Company, Cincinnati (Electric Light and Power Machinery): It is our opinion that the year 1900 will prove a banner one. We have been working full time all of the year, and have been, a great part of the time, behind orders. We have more than doubled our output over the year previous. The prices, in the main, have been satisfactory. We have, during the year, brought out a line of three-bearing machines, which have been very favorably received; also a line of small bipolars of the encased pattern. There is more agitation of the subject of electrical transformers than ever before, and a great many large contracts will undoubtedly be placed within the next few months. The outlook for 1901 is very bright, and unless there is a heavy boom in the prices of material, which would curtail buying, there is little doubt but that 1901 will at least equal 1900.

Warren Electric and Specialty Company, Warren, Ohio (Incandescent Lamps): With us trade in each of the lines we are interested in has been more than satisfactory, and each month during the year has shown an increase over the corresponding month of 1899, and from present indications the same will hold true during the coming year. We think that the electrical business in general is in a very prosperous condition and that the ones who really deserve to prosper will continue to do so during the coming year at least. We trust that we can be numbered among these.

Western Electrical Supply Company, St. Louis (Electrical Supplies): We hardly think it necessary to elaborate on the last year's business, as everyone in our line fully appreciates that the last year has been an unprecedented year of general prosperity, and, in fact, a very much more satisfactory year than 1899, for the reason that it was a good, even business the year through without any boom such as we experienced in the fall of 1899, and we feel that everyone will agree with us that a good, steady business the year through is very much better than a big boom at any one season; that, while booms are good in their way, they are rather calculated to disorganize business than to improve it. We feel very hopeful for the coming year, and if the prices of building material and iron products, such as are generally used in the construction of street railways, electric light and telephone plants, is kept at a fair, even price, we do not think there is any question but what the coming year will be the largest in the history of the electrical business, as from our investigation we are satisfied that there have been a great many enterprises that have been held back due to the exceedingly high prices that prevailed up to midsummer of this year, and we think that the manufacturers of all classes of building materials will best serve their own interests by restricting their profits to a fair percentage and thereby getting a large volume of business, rather than by asking a large percentage of profit and restricting their sales. We feel that there is going to be good general business all through the year of 1901 and we are preparing for a brisk demand.

Western Telephone Construction Company, Chicago (Telephone Apparatus): Without furnishing statistics to bear out the assertion, we believe we can safely say, without contradiction, that in all electrical lines of work, especially in the telephone field, the old year has been the most successful the business world has ever had. The gradual increase and expansion of trade, both at home and abroad, is unprecedented, and we believe from past, present and future indications that the outlook for a still better trade in 1901 is assured beyond doubt. Individually we are highly gratified with the amount of telephone business we have done, and also with the number of large orders now booked and those prospective. Money appears plentiful in all sections of the country, which is indicative of renewed confidence and guarantees continued prosperity for 1901. With this favorable condition confronting the business world, it behooves the manufacturers of different lines of electrical goods to take advantage of the opportunities offered. With good, honest effort, backed up with intelligent advertising, we believe that collectively a larger business will be done in 1901 than ever before in the history of the country.

Zimdars & Hunt, New York (Electric Light and Power Specialties): With us the last year has been satisfactory. While the period immediately preceding the election is usually one of diminished activity, there was this year little if any diminution in the volume of business handled at this time. The year 1900, we believe will be considered by the majority an eminently satisfactory one for the electrical industries, and the outlook for the coming year is decidedly encouraging.

Northwestern Electrical Association.

The list of papers thus far announced by Secretary Thomas R. Mercein for the convention of the Northwestern Electrical association, to be held in Milwaukee on January 16th to 18th, is as follows: "The Rate Question," by Henry L. Doherty, Denver; "Synchronous Converters," by Prof. W. E. Goldsborough, Purdue University; "The Series Incandescent-lighting System of the Future," by P. D. Wagoner, Schenectady, N. Y.; "Practical Line Construction," by Loren W. Burch, Madison, Wis.; "Education of Central-station Employes," by Prof. D. C. Jackson, University of Wisconsin. Other papers may be announced later.

Significance of the Paris Exposition.

Mr. Ferdinand Peck, the commissioner-general of the United States Commission to the Paris Exposition, recently returned to this country. He was interviewed by a representative of the Western Electrician in New York relative to his impressions of the Paris Exposition as bearing on the possible progress of electrical development during the twentieth century. Mr. Peck said:

"Of course, you recognize that, questioning me, as you are, as a representative of a technical publication, and one so thoroughly technical as an electrical journal, I should most properly refer you to our director of machinery and electricity, Mr. Drake. However, I shall be glad to give you my impressions as a layman or business man acting in a supervisory capacity over the United States exhibit in its entirety.

"One thing that greatly impressed me was the exhibition made by the Germans of large electrical power units. It was what you might call the immensity of the electrical distribution that made me wonder to what an extent electrical distribution could be carried, say, during the next 50 years. Bear in mind that this specific reference of mine to the German apparatus is in nowise meant as disparagement of, or even comparison with, the electrical products in the way of power apparatus from other countries, and particularly from the United States. The Germans did such a large amount of power distribution for the exposition and presented so much magnificent machinery that, as a matter of course, I can't help referring to them as an example.

"Another point: I was very much impressed with the good that I am now firmly convinced will come to the manufacturer of American electrical apparatus through what I am sure will be a rapid increase in the shipment from the United States to foreign countries of all sorts of electrical apparatus. The foreigners have always won our admiration in their production of fine and intricate scientific apparatus. Our exhibits in Paris during the exposition surprised our foreign cousins and were a constant reminder of the fact that the ingenious Yankee had not been content to stop at the production of automatic shoe machinery and the like, but that the United States electrical man had even to-day brought his wares to such a state of perfection that it is safe to predict along this line a rapid increase of exports and a corresponding diminution of imports in electrical instruments of the finer classes."

Francis E. Drake, who was director of machinery and electricity for the United States Commission to the Paris Exposition, expressed himself as follows:

The close of the nineteenth century has just been celebrated by a colossal international exposition conducted by the French government in the great city of Paris, the foster-mother of modern industrial exhibitions. This great industrial conclave unquestionably expressed by its general and detailed exhibits the great progress of the civilized nations during the last 100 years, and in its many marvelous collections and varied installations epitomized the excellence of the commercial attainments of the principal nations in their special and most progressive industries.

One of the great lessons practiced for the first time by any exposition of arts, science and industry was made possible by the use of electricity in its varied applications, resulting in a classification bringing together within the same building and section the raw product, the process of manufacture and the finished product. Formerly, when mechanical power, by means of shafting, etc., was the only means of supplying motive force, such a classification was impracticable and impossible. At Paris, in the Textile Palace, the raw silk or cotton, the machinery for preparing, the looms and the finished garments were placed in immediate contiguity, enabling the public to identify the process with the product. This is but one example of the application of electric power. No matter how remote the building or exhibit from the central source of power, this principle could be, and was, generously applied.

The record of the century as established by the Paris Exposition illustrates in a most forceful manner the inventions and improvements in electrical industries and applications, among which are the principal divisions, as follows:

1. Telegraphy.
2. Telephony.
3. Arc lighting.
4. Incandescent lighting.
5. Electric-tramway applications.
6. Power transmission.
7. Electrometallurgy.

To assert that the United States has developed to a greater practical degree the first five divisions would certainly be within the limits of perfect truth. There may be those who would deny our right to claim the last two, although our accomplishments in these lines are by no means secondary to any of the others.

The inferences one might draw from the Paris Exposition would be startling if projected by the thinker on the industrial screen of 25 or 50 years hence, to say nothing of 100 years. Each investigator would be prone to predict the adoption of his own pet theories by the succeeding generations. In general, however, the most skeptical mind must allow that in generating units larger sizes will be the rule and not the exception; that telegraphy to remote distances without wires will be generally practiced; that the contemporaneous investigations in incandescent lamps will certainly develop a much more efficient type operated at higher voltage; that electric propulsion of tramways and trunk lines will be universal. With the increase in demand for power in the industrial world will come the centralization of electric power stations in the coal fields and the building up of new chemical and industrial centers at and near every waterpower of reliability. These are only a few of the predictions recorded by the observers at Paris and are drawn much milder by the writer than the enthusiasm of the speakers would warrant, if a true reflection were given in this brief article.

My personal feeling is that the careful standardizing of apparatus and the reduction in price, as made possible by improved manufacturing methods, will greatly enlarge the industries even on the line of present designs and applications. To the business man and manufacturer desiring to enlarge his markets abroad it is pertinent to assert that if he will seek to discover exactly what the foreign buyers are now buying elsewhere, and endeavor to meet their wishes in detail so far as the little things go, then exercise his usual energy in filling those orders to the letter, he will have no fault to find with the financial rewards of his coming century's business.

National Standardizing Bureau.

A sub-committee of the United States Senate Committee on Commerce gave a hearing in Washington last week to persons interested in the establishment of the proposed National Standardizing Bureau. The definite work of the new bureau, as presented in the bill before Congress, is the custody of the standards; the comparison of those used in scientific investigations, engineering, manufacturing, commerce and educational institutions with those adopted and recognized by the government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards, and the determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere.

Secretary Gage, of the Treasury Department, who fathers the bill, called attention to the fact that it was intended that this bureau, if established, should be an enlargement of the present Bureau of Weights and Measures. At present this bureau is very incomplete and far behind the needs of modern scientific and commercial requirements. In the particular of standardizing weights and measures and testing apparatus of every kind the older countries are far ahead of the United States. We are dependent upon Germany, France and England for our measurements and other standards which we are obliged to resort to in testing and comparing when we enter into competition against them.

Prof. S. W. Stratton, formerly of the University of Chicago, who is at present in charge of the Bureau of Weights and Measures, called attention to the salaries and the number of employes provided in the bill, and protested against any reduction.

Prof. O. H. Tippman, superintendent of the Coast and Geodetic Survey, expressed himself as in favor of the bill.

Prof. Henry A. Rowland, professor of physics at Johns Hopkins University, spoke of the electrical features of the case and the absence of any standards for electrical units, it being necessary under present conditions to send to Germany for them and to France for standards of length and thermometrics.

Carl Hering, president of the American Institute of Electrical Engineers, brought the indorsement of the Institute. There are at present no official electrical standards in this country, said Mr. Hering. Some of the electrical companies have their own standards. They originally adopted the standards used in England, but they were indefinite, and at present the companies are working on standards reduced from that and adopted by Germany, to which all others can be referred. The electrical industries represent about $2,000,000,000 in this country, and it is but right that there should be a means of establishing standards for such a large interest. The German institution for this class of work was established at a cost of $1,000,000, and is carried on at an annual outlay of $80,000, as against our own yearly expenditure of about $9,500 for a similar purpose. It is a matter of special importance to American manufacturers when our export trade is so rapidly increasing that we should be able to stamp our goods as being accurate by the government standard.

J. W. Lieb, Jr., general manager of the Edison Electric Illuminating company of New York and president of the Association of Edison Electric Illuminating companies, spoke of the calibrating of meters under the present system, which required the standards to be brought from Germany. He also spoke of the formation of the Lamp Testing Bureau and the unsatisfactory standard of illumination now in use. He remarked that it is necessary now to stipulate in contracts that the standards of current and voltage specified shall be those of the Weston Electrical Instrument company, and the standard of illumination shall be the English Parliamentary candlepower. All these units, he believed, should be reduced to a scientific basis by the government and be readily available to all interested. Mr. Lieb went on to say that the development of electricity has necessitated the production of measuring apparatus more accurate in its construction than any heretofore used. Some standard by which correct measurements may be made for alternating currents is badly needed. At the present time it is not difficult to obtain correct measurements for direct currents, but with alternating, according to present methods, there are wide variations.

Some of the gentlemen present called attention to the loose laws at present existing on the statute books relating to our standards of both weights and measures, and it is thought that reform in this direction will be one of the most important works of the new bureau should it be established. So far the only authorized and defined unit of either weight or volume is the troy pound, adopted and authorized for the use of the mints in 1821.

Proposed Philippine Tariff.

The draft of a new tariff for the Philippine Islands, which has been prepared by a special board of officers recently convened at Manila, has been made public by the secretary of war. A reasonable length of time will be allowed interested persons in the United States and Philippines to examine the rates and classifications recommended, and representations made to the War Department in writing, says the Iron Age, will receive due consideration before this tentative tariff is officially promulgated.

The duties upon heavy iron and steel, such as is used for structural and railroad purposes, and upon copper wires and electrical supplies have been materially reduced in pursuance of the policy to encourage wherever possible the advancement of the islands. The metric system of weights and measures has been retained and the peso as the monetary unit in the computation of customs duties and charges has been adopted. This latter is on the basis of two pesos being equal to one American dollar.

Of the duties recommended that are of special interest to the electrical fraternity the following may be mentioned:

	Pesos.
Wrought-iron and steel boilers of all kinds, whether for vessels or stationary plants, including boilers for locomotives, 100 kilograms	1.75
Copper wire, insulated, 100 kilograms	5.00
Copper, brass or bronze wire, not insulated, 100 kilograms	14.00
Portable boilers mounted on wheels, to be moved by horse-power or automatica ly, 100 kilograms	2.47
Dynamos, electric and other motors, not elsewhere specially provided for, 100 kilograms	6.00
All other electrical machinery and appliances used for lighting, motor and traction purposes, not otherwise specified, including lamps, switches, fuse wire and the like, 100 kilograms	15.00
Telephone transmitters and receivers, each	2.00
Automobile carriages and wagons of all kinds, each	50.00
Submarine telegraph cables	Free.

The following articles, when imported direct by a person or corporation residing or transacting business in the Philippine Islands for the exclusive use of such person or corporation within six years from the promulgation of this tariff, shall be entitled to free entry under such conditions and guaranty as the collector of customs for the islands may exact or direct:

Passenger coaches, freight cars, electric motors, locomotives and tenders complete, erected or knocked down, including tracks, wheels, axles, locomotive boilers, tanks, and generally all forgings, fixtures and machinery therefor; turntables, bridges, bridge work, steel rails, points, crossines, metal ties, and generally all structural iron and steel for building wharves, bridges, culverts, tanks and the like.

Report of Illinois Railroad Commission.

The Railroad and Warehouse Commission of Illinois has submitted its thirtieth annual report. Considerable new legislation is recommended, one change asked being that the commission be given the same authority over electric lines outside of corporate limits as it now has over steam railroads. A law is asked for, giving the commission the same authority over crossings of street-railway lines with steam roads that is now held over crossings of two steam roads. Another new law recommended is one giving the commission the power to compel steam railways to place electric bells at highway crossings, where the commission may deem the public safety demands it. The report showed that the steam roads hauled 42,158,557 passengers in the last year and the elevated and electric roads hauled 74,415,158.

Laboratory and Experimental Work at the Kellogg Telephone Factory.

Few people are aware that the Kellogg Switchboard and Supply company of Chicago is maintaining a complete telephone laboratory and experimental department, with an equipment and experimental force fully up to the standard of excellence, though perhaps not quite as large as that maintained by the American Bell Telephone company in Boston, which latter is under the direct supervision of Dr. Hammond V. Hayes. The Kellogg laboratory and experimental department is a part of the engineering department of the Kellogg company, and has for its purpose to do for the Independent telephone interests practically what Dr. Hayes' department of the American Bell Telephone company has done and is doing for the benefit of the Bell interests.

The engineering department of the Kellogg company comprises several men, well known in the telephone field.

Francis W. Dunbar, M. E., is a member of the American Institute of Electrical Engineers, a graduate in electrical engineering of the Massachusetts Institute of Technology, and for a long time was connected with the engineering department of the American Telephone and Telegraph company, more commonly known as the Bell Long-distance company. Mr. Dunbar was one of the two experts employed for the government in the famous Berliner patent case.

Kempster B. Miller, M. E., is an associate member of the American Institute of Electrical Engineers and a graduate in electrical engineering at Cornell University. He was employed in the United States Patent Office, in charge of the class of inventions relating to telephony, and later by the Western Telephone Construction company. Mr. Miller is the author of "American Telephone Practice"—a book which has been in great demand. He is widely known throughout the country as a telephone writer, instructor and engineer.

Franz J. Dommerque, M. E., is a graduate of the Mathematical Institute at Zurich, Switzerland, and the Technical University of Munich, Bavaria. He is a member of the American Institute of Electrical Engineers and several engineering and mathematical societies. He was formerly connected with the Western Electric company and for six years with the Chicago Telephone company, besides having been employed with other large electrical and mechanical engineering firms in Europe and the United States. Mr. Dommerque did much of the engineering work in laying out the present and future systems of the Chicago Telephone company.

William W. Dean was for a long time chief electrician of the Bell Telephone company of Missouri and did important work for that company. Later he was in the laboratory of the American Bell Telephone company at Boston and more recently in the experimental laboratory of the Western Electric company of Chicago. Mr. Dean is the inventor and patentee of a large number of important devices and systems relating to telephony, being the originator of the automatic ringing systems. His work in the common-battery field is especially well known.

The laboratory and the experimental department are under the immediate supervision of Mr. Dean, whose principal assistants in the laboratory are J. Henry Lendi, a graduate of the Rose Polytechnic Institute and formerly with the Chicago Telephone company; W. A. Taylor, a graduate of Cornell, and formerly with the Central Union Telephone company, and R. H. Manson, a graduate of the University of Maine and formerly in the laboratory of the Western Electric company. J. C. Neely of the advertising department of the company sometimes assists in the experimental department. In this department all new circuits and apparatus are set up and tested under even more severe conditions than those of actual practice, with the idea of discovering all defects that are present or that may in the future develop. If found faulty, mechanically, or lacking in efficiency in any manner, the piece is redesigned, a new model made and the process is repeated. It is only after going through the experimental department and the laboratory, and after having been approved by the engineering department, that any piece of apparatus reaches the manufacturing stage. models being built from the preliminary sketches. These models are carefully tested, and rejected or accepted, according to whether they are thought susceptible to further improvement or not. Frequently dozens of models of practically the same piece of apparatus are made, each embodying some little device or improvement which it is desired to put through the test of actual practice before final acceptance. All models are carefully preserved and a record kept of the behavior of each on test.

The foreman of this department is William Kaisling, who is one of the most competent experimental mechanics in this country. He first worked in this country for the Westinghouse Electric and Manufacturing company, where he made many models for Nikola Tesla, including his first alternating-current arc lamps, and also some of his early induction motors. Mr. Kaisling next helped to develop the Shallenberger meter, and was in charge of the floor at the Westinghouse factory on which these were manufactured. He next entered the employment of the Western Electric company, where he worked for eight years in the experimental department, developing inventions of Mr. Scribner and others.

Mr. Kaisling has four assistants in his department, viz., Charles Hoghlander, formerly with the Western Electric company doing experimental work; A. Ritchie, for 12 years with Professor Elisha Gray of the Gray Telautograph company; Peter Fadeler, who has done experimental work for a number of large concerns, including Siemens & Halske, Bausch & Lomb and the Western Electric company, and Matt Klos, who has spent many years in the same line of work with Siemens & Halske, Westinghouse and the Western Electric company. All of these men are experts in their line of work, and one has only to see a few of their models to appreciate the high development which they have attained in the experimental art.

Lendi. Neely. Dean. Dunbar. Miller. Taylor. Manson.

FIG. 1. LABORATORY AND EXPERIMENTAL WORK AT THE KELLOGG TELEPHONE FACTORY.—CORNER OF LABORATORY.

In Fig. 1 is shown a corner of the Kellogg laboratory, with a complicated telephone circuit set up in experimental form on the table in the foreground. The gentlemen mentioned above are all seen in the picture, with the exception of Mr. Dommerque. The photograph was taken just after an important test had been made of the apparatus and circuits on the table, requiring the presence and assistance of almost the entire engineering and laboratory force. On the right of the picture is shown a battery of 20 American storage cells and at the left two charging and ringing machines used in this department. The switchboard shown in the center of the picture is of marble and specially designed for the purposes of the laboratory. On it any direct-current voltage from two to 260 volts may be obtained, as well as alternating and pulsating currents of different voltages.

Fig. 2. Experimental Department.

Fig. 3. Testing Room.

LABORATORY AND EXPERIMENTAL WORK AT THE KELLOGG TELEPHONE FACTORY.

This laboratory is well equipped with all standard telephone apparatus, not only of the Kellogg company's make, but a great deal of that of other companies, including the Western Electric company, complete sets of testing instruments, such as Weston ammeters and voltmeters, d'Arsonval galvanometers, bridges, standard condensers and resistances; and all other apparatus that is found in complete laboratories is available.

In connection with the laboratory is the experimental department, also a branch of the engineering department. A portion of this room is shown in Fig. 2. Here all apparatus designed in the engineering department or elsewhere is perfected, working

All manufactured articles, after passing through the various channels of the factory, are sent, before shipment, to the testing room, of which a view is shown in Fig. 3. This room is in charge of J. G. Brobeck, a graduate of Cornell University, who,

acting in conjunction with the members of the engineering department, passes upon all apparatus before shipment. As the men in this department are all specially trained for this work, a complete check is placed on all apparatus both at the beginning and at the end of the manufacturing process.

Willyoung Electrical Test Instruments.

The accompanying illustrations show a few of the more important among the many high-class test and measuring instruments marketed by Elmer G. Willyoung, New York. Mr. Willyoung is well known to the trade and profession as having been associated with the development of instrument manufacture in this country for many years and as having been instrumental, in no small degree, in bringing about the great prestige which American instruments have attained.

Fig. 1 shows the Postal standard bridge set recently adopted by the Postal Telegraph-cable company as the only standard Wheatstone bridge for general fault and conductivity testing in its various offices. A considerable number of these sets have already been installed in the larger city offices, and it is the intention, eventually, to have one in every operating office of the Postal company. The design is that of F. W. Jones, chief electrical engineer of the Postal company, with some modifications by Mr. Willyoung, who is the sole manufacturer, and who, by the consent of Mr. Jones, now offers the set to the general market. The leading feature of the set is, perhaps, the form of switch which replaces the plugs generally employed. Experience with the sets in use has proven that the contact resistance in these switches is fully as low as that in first-class plugs, so that even the bridge ratios are set by switches. The switch is platinum-faced, working over silver-faced studs. The rheostat has four switches, working over a set of 10 units, 10 tens, 10 hundreds and 10 thousands—11,110 ohms in all. Each bridge arm has one 10, one 100 and one 1,000-ohm coil, giving ratios $\frac{10}{1000}$ to $\frac{1000}{10}$.

Added ratios of $\frac{1}{1000}$ and $\frac{1000}{1}$ may be had if desired. Special switches are provided for Varley and Murray tests, as also for other special tests peculiar to telegraph practice. The set measures 10 by nine by five inches in size and weighs nine pounds.

The Willyoung portable d'Arsonval galvanometer is said to be the most sensitive, strictly portable galvanometer ever made. The system is jewel-mounted and dead-beat. The scale is about two inches long and is divided into 50 divisions. With one volt the index (3½ inches long) will deflect one division through one to 1½ megohms. The particular instrument mentioned has shunts of one-half, one-third and one-fifth. It is also put up in combination with five or 50 test cells, as the case may be, all in one box, and so mounted is popular for insulation tests by the "direct-deflection" method. method.

A very widely used instrument is the H. S. galvanometer shown in Fig. 2. This type of d'Arsonval galvanometer was brought out by Mr. Willyoung a number of years ago and has always been a very favorite instrument for cable testing and other work demanding great sensitiveness, particularly in commercial practice, where there is considerable mechanical or magnetic disturbance, by which this instrument is practically not affected. Various coils with varying characteristics can be had for this instrument as ordered, each coil being contained in a tube (Fig. 3), which instantly slips in and out of the frame of the instrument, making its own connections. When not in use a milled head positively clamps the coil, so that it and its suspension cannot suffer injury. In the rare event of a broken suspension, the same can be replaced with great ease, as the "sheath" of the system slips away, leaving the coil perfectly accessible. In the latest model of the Willyoung instrument the systems are distinguished by their small period, combined with their great sensitiveness, so that the galvanometer is very quick to work with. When used for out-of-door cable testing, etc., the instrument is mounted with its own telescope and scale and upon a tripod, as shown in Fig. 4. So mounted, these instruments have recently been supplied to the New York and New Jersey Telephone company, the Knickerbocker Telephone company, the National Conduit and Cable company and other companies.

The apparatus shown in Fig. 5 is a Willyoung power X-ray machine. The making of X-ray machines has been a specialty of the Willyoung house since the first discovery of the X-ray, and it is said that most of the radical improvements in the induction-coil type of apparatus originated with Mr. Willyoung. He now makes machines for either battery or power circuits, in the latter case running on any commercial direct-current circuit up to 250 volts. The machines may also be run on Wehnelt or Caldwell electrolytic interrupters, if so desired, and in such cases it is stated that they will give beautiful results on commercial alternating-current circuits. Recently a new line of machines has been brought out by Mr. Willyoung known as the type H machines. These machines are distinguished chiefly by the use of large-sectioned wire on the secondary, thus giving much heavier discharges, i. e., a larger secondary current at the same electromotive force. During the last month the following important sales, among others, have been made by the maker: A 15-inch type H machine to Roosevelt Hospital, New York; 18-inch type P to Cooper Hospital, San Francisco; 12-inch type P to The Dalles, Ore.; 10-inch type P to All Souls' Hospital, Morristown, N. J.; 10-inch type H to University of Virginia, medical department. A 32-page catalogue of X-ray apparatus is sent free on application by Mr. Willyoung, as well as circular matter descriptive of his other apparatus.

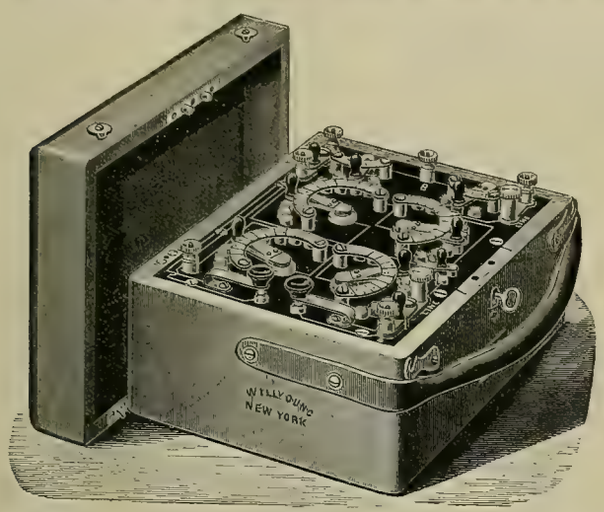


Fig. 1.

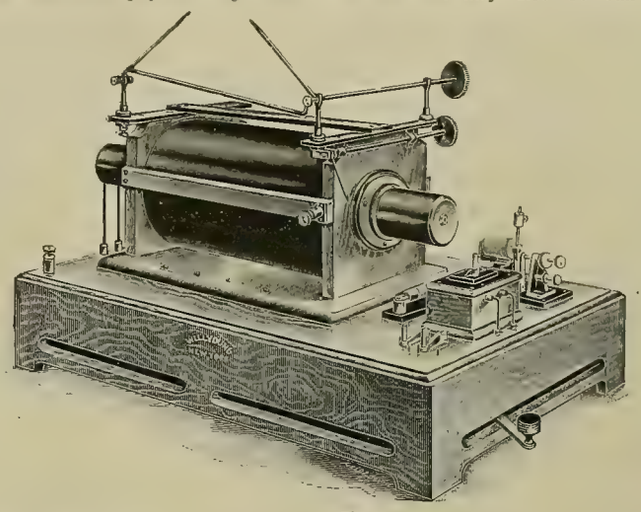


Fig. 5.

WILLYOUNG ELECTRICAL TEST INSTRUMENTS.

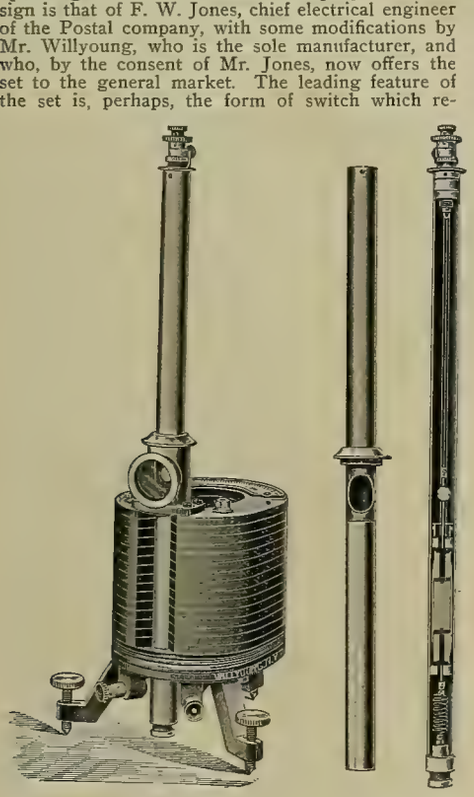


Fig. 2

Fig. 3.

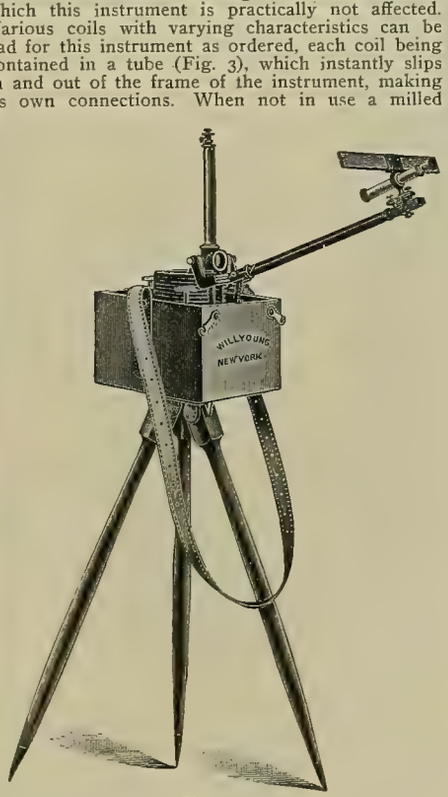


Fig. 4.

WILLYOUNG ELECTRICAL TEST INSTRUMENTS.

Indiana Telephone Items.

A telephone exchange is being erected at Nashville.

The Home Telephone company of Crawfordsville is making arrangements to extend its service eight miles into the country on every road, no toll to be charged for the out-of-town service. This company is said to have the largest number of telephones in use, compared to the population of the town, of any other company in the country. There are in the corporate limits of Crawfordsville over 700 subscribers to the system.

The telephone war that has been waged from time to time during the last four years at Shelbyville is again becoming interesting. The attempt of the Bell company to run out or cripple the home company has proven futile, but in order to maintain its hold with its patrons, the Bell company is now making contracts for residence telephones for 50 cents a month, the contract to run for a year. The home company, however, will continue to extend its service and it proposes to construct a line to Greenfield. The result of this warfare is that Shelbyville now has more than 1,000 telephones, with lines reaching to every corner of the county.

The new Citizens' Independent Telephone company that recently put in operation its $30,000 telephone plant in the city of Kokomo has met with success far beyond its expectations, and is extending its lines rapidly to all the surrounding towns. Six hundred and twenty-five telephones are now in use in Kokomo and Superintendent Turner says the company will have 1,000 instruments in use by the middle of January. Hugh J. McGown of Indianapolis, who is a director in the Telephone, Telegraph and Cable company of America, says that the company is responsible for the consolidation of telephone interests recently made in the South. He says the company is progressing favorably with its plan of extending the use of the telephone to the rural districts. The extension work will be pushed more rapidly when the company brings about closer relations between existing telephone companies now controlling large districts in the eastern, central and

central-western states. Mr. McGown says the plans of Mr. Latta, president of the compauy, are ideal, and if they be carried out, he thinks that the patrons of the telephone will see the advantages of a big company—one able to carry out its schemes. "The practical uses of the telephone in rural districts and in mining regions, where mountains, forests and ravines make railroad building almost impossible, are so many that the real advantages of telephone lines are yet to be seen," said he. F.

Ericsson Multiple Switchboard.

Those who are interested in telephone switchboards will be interested in the following explanation of a board said to be mechanically and electrically as near perfection as any ever made for exchange use. The board was manufactured by L. M. Ericsson & Co., Stockholm, Sweden, for the Pittsburg Telephone company of Pittsburg, Kan. The manufacturer is represented in the United States by the Ericsson Telephone company of New York.

The illustration (Fig. 1) shows one section of the board having a capacity of 300 instruments or subscribers, and arranged with positions for three operators. By adding other sections of the same size, the capacity may be increased to 600, 900, 1,200 or any multiple of 300, up to an ultimate capacity of 3,000 instruments. Boards of even larger capacity are made by the Ericsson firm, but they vary somewhat from this one, which is a metallic board and full multiple, simple, rapid and positive in operation, readily accessible in every part for connections, changes or repairs, and in every respect a most durable board. A full multiple board is so arranged that the operator can connect directly any instrument in her section with any other instrument either in her own or any other section, thus giving her command over the whole switchboard. A great saving of time is thus effected over other systems, and to the subscriber this is of the utmost importance.

For convenience the board is divided into five panels and the plugs are placed on two different planes. It is provided with series jacks, and the subscribers' drops are restored by the operator. There are 18 pairs of cords and plugs for each operator, and the clearing-out drops are automatically restored. The lines coming from the cross-connecting board pass through jacks in the first multiple, then continue to the next corresponding multiple. From the multiple jacks the wires go to the soldering tags on the intermediate field on the back of the board. This makes it possible to distribute the labor between the operators, which is done by removing busy subscribers from one operator and placing them with another who has more time. From these tags the wires are connected with the home jacks, which are placed on a sloping plane just above the table leaf, and from there they go to the subscribers' drops.

When the subscriber calls the exchange, the drop falls, and the operator places the answering plug, which is placed on the table leaf, in the home jack, and at the same time pulls the lever of the table key toward the edge of the table to the speaking position. After ascertaining the desired number, the operator takes the ringing plug, which is on the sloping plane between the subscribers' jacks and the clearing-out drops, and touches the jack in the multiple which corresponds with the desired line. If it is busy, there is a click heard in the operator's telephone; but if it is disengaged, there is no sound, and in that case the plug is placed in the jack and the second subscriber is called by pushing the lever of the table key toward the board to the ringing position. The table key returns automatically to its ordinary position and the two subscribers are connected with each other. When the conversation is finished the ring-off signal is given and the clearing-out drops fall and the plugs are removed by the operator.

Each operator has a counter which automatically counts the calls issuing from the exchange. Six keys marked in pairs are fitted in front of each section. They are used for speaking and ringing to each of the two connected subscribers, separately. If the operator desires to listen-in or to speak to both the subscribers, the table key is pushed into its speaking position; but if connection with only one of them is desired, the keys are used. The call is generally given by the table key, but it can also be given by means of the other keys. Both the subscribers' and the clearing-out drops are provided with night contact, so that the night bell is rung when they are dropped.

The diagram of circuits (Fig. 2) shows a portion of the connections in this multiple board. Referring to this diagram (L) represents the line; (M J), the multiple jack; (L J), home jack; (S K), subscribers' drop; (A K), clearing-out drop; (I F), intermediate field; (S P), speaking plug; (R P), ringing plug; (I), generator; (M), microphone; (T), telephone; (O), table key; (N B), night bell; (V), busy-test coil; (L B), test battery, and (M B), the microphone battery.

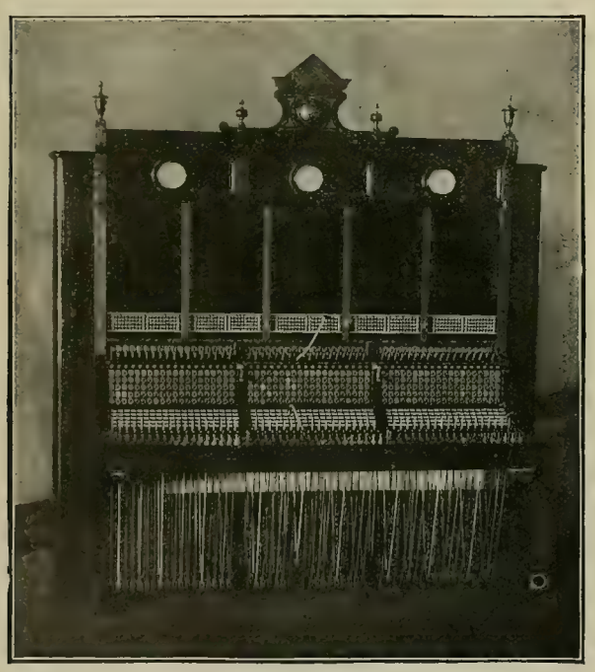


Fig. 1. Section of 300 Numbers.

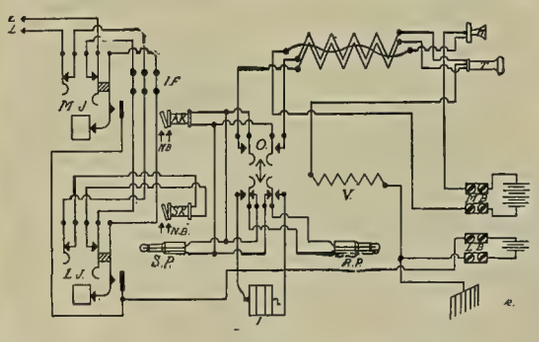


Fig. 2. Diagram of Connections.

ERICSSON MULTIPLE SWITCHBOARD.

The Situation in Denver.

As there seems to be promise of lively competition in the electric-light and power field in Denver, a résumé of the situation may be of interest.

In March, 1900, Charles F. Lacombe secured a franchise for an opposition lighting plant in Denver, and 10 cents a kilowatt was named as the maximum rate for incandescent lighting and four cents a kilowatt for power. The ordinance also granted to Charles F. Lacombe and his assigns a 10-year city street-lighting contract at $95.04 a lamp a year for 1,000 lights and $70 a lamp a year for additional lights. This contract was afterward modified to the extent of reducing the first 1,000 lights to $90 a year. In April suit was brought by P. L. Hubbard in the District Court contesting the right of the city to contract for its street lighting beyond the life of the present municipal legislative bodies. The Denver Gas and Electric company at this time owned all of the operating central-station interests in Denver, and it is supposed that this suit was brought in its interest. The Denver Gas and Electric company is controlled by Emerson McMillin of New York, who also controls many other gas, electric-light and street-railway companies in various cities in the United States and Canada.

In June Henry L. Doherty, who is Mr. McMillin's personal representative, visited Denver and announced that in event of competition prices would be cut below cost of operation, even if funds from external sources had to be furnished to maintain the Denver Gas and Electric company. In August a decision was given by Judge LeFevor in the Hubbard suit, sustaining the city's right to make a contract beyond the life of the contracting municipal bodies. An appeal was taken from this decision on August 22d. Within 30 days from the date of the passage of the Lacombe franchise, work was started on the erection of an arc-lighting plant for that company and it has been diligently pursued and the Lacombe company now has its plant under roof and most of its poles set and wire strung. It was the reported intention of the Lacombe company to erect a large generating station at the coal fields (about 20 miles from Denver) and transmit power to Denver for commercial lighting and power. This project has been abandoned apparently and the company is now erecting a central station in the city adjacent to its city arc-lighting plant.

In October Mr. Doherty was elected president of the Denver Gas and Electric company and has since made his headquarters in Denver. In November an ordinance was passed ordering all electric companies to place their wires underground in all of the business district, comprising a large area. The construction of the Lacombe company is of an excellent character, and to abandon it in the next five years will mean an unnecessary loss. On December 13th a suit in quo warranto was filed against the Lacombe Electric company by Lillie C. Ames, contesting the validity of the ordinance granting the Lacombe ordinance and authorizing the 10-year contract with the city, it being asserted that irregularities exist in methods of advertising and amending this franchise.

It is understood that neither company is open to a compromise, and it is believed that a rate war will result if the Lacombe company succeeds in successfully defending the two suits which are pending. Mr. Lacombe, the president of the Lacombe Electric company, is successfully operating plants in other cities in Colorado, and Mr. Doherty, president of the Denver Gas and Electric company, is well known to electrical men as a successful manager of electrical properties.

Smith's Incandescent-lamp Adjuster.

The accompanying illustrations show a new device for adjusting incandescent lamps, invented by Theodore Smith, 151 Throop street, Chicago. Fig. 1 shows the adjuster, which is simple in construction, light and neat, and weighs less than five ounces. By its aid an incandescent lamp may be adjusted up or down or to any desired angle. The lamp can also be swung around from right to left, throwing the reflection where wanted. The gripping block is made of hardwood. The controlling rod is 12 inches long and the socket attachment is fastened to a loop on the rod with a thumb-screw so as to adjust the lamp up or down. The loop is loose on the rod, so that it swings around free from right to left. This may be done by throwing the lower end of the rod away from where the reflection is wanted, or it can be turned by hand. The operation is quickly done, and there is no danger of the lamp falling. The device will hold on any-sized cord. The gripping block makes a sharp curve in the cord, and, pulling down on the cord and rod at the same time, makes it impossible to slip. Fig. 2 shows the device with a half shade. Any kind of shade can be used and put in any position.

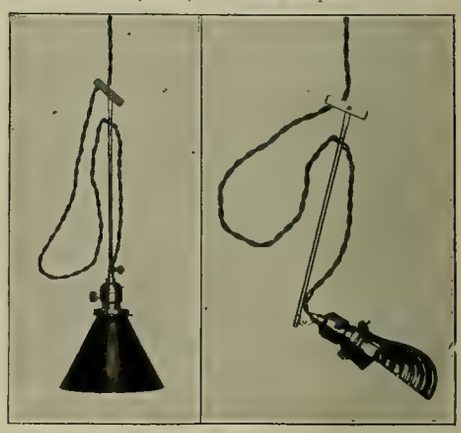


Fig. 1. With Conical Shade. Fig. 2. With Half Shade.

SMITH'S INCANDESCENT-LAMP ADJUSTER.

Prosperous Farmers' Telephone System.

Enterprising farmers have conducted a telephone system in the town of Heath in northwestern Massachusetts for over three years. The company began with 14 miles of wire and 19 instruments, at a total cost of $780. There are nearly 200 subscribers now, while the company is capitalized at $12,000. The instruments rent for $12 a year. The amount of stock sold to any one person is limited and the system is entirely owned and managed by farmers. During the last two years 10 per cent. dividends have been declared and the system is a pronounced success. The central exchange of the telephone system is in the postoffice at Heath Center, and to save long journeys, it is stated that the farmers often have their letters read to them over the telephone, dictating replies, which the postmaster good-naturedly takes down and mails. The farmers keep in close touch with the markets in the various towns with which they are connected, and are thus enabled to dispose of produce where and when conditions are favorable, often saving the cost of their telephone in a single transaction. The line runs from Shelburne Falls through Colerain, Heath, Charlemont, Jacksonville, Vt., to Davisbridge, Vt., where connection is made with the Wilmington and Hoosac tunnel telephone line.

Matanzas, Cuba, is advertising for electric street-railway bids.

New Commutatorless Dynamo or Motor.

By James Asher

It is my aim to show in this article how to construct a dynamo which has neither brushes, commutator nor slip rings, and which will give a perfectly steady current of high tension. The machine may also be used as a continuous-current motor.

Take the Siemens bipolar machine, having the shuttle armature. Remove the armature and substitute therefor a cylindrical, laminated iron core on the shaft of the machine. The length of this cylinder should be somewhat less than the breadth of either polar face of the magnet, in order to permit us to wind wire from pole to pole. Into either slots properly shaped, or holes parallel to the shaft and cut in the polar faces of the magnet, let insulated wire be strung across through, say, the lowest channel in the south pole-piece, then directly across to the same side of the north polar face, then through the slot in this polar face and across to the south polar face whence we started, then through either the same or another slot as that occupied by the first passage of wire; pass the wire once more across the south polar face; string it across to the same side of the north polar face and pass it through a slot in this face; return the wire to the south polar face; in the same way continue the winding until the greater part of both polar faces or pole-pieces have been threaded through with wire near their inner circular surfaces. On a level with the shaft the windings may be omitted, to enable us to string all the wire straight across from one pole-piece to the other. The winding is to be performed after the cylinder has been set in its place. Connect the two ends of the wire, then on rotating cylinder, by any suitable motive power, a perfectly steady current of electricity will flow in this wire. Or, connect the ends of the wire to a battery or a dynamo, then the cylinder will be set in rapid motion. The torque or turning tendency in this cylinder will be perfectly uniform at all points of its revolution.

The machine may have the wires in the pole-pieces either continuous or in groups of turns. By having the wire coiled in groups and having the ends of each group brought out to a switch on the machine, we may connect the windings in a variety of ways so as to get different voltages and amperages from the machine. When the wire is all in one piece the machine generates the highest voltage. The magnet may be either series, shunt or compound wound. The connection of the exciting wire on the field magnet may be made with the coils wound in the pole-pieces.

Multipolar dynamos or motors may be wound with wires in their polar faces in a manner similar to that proposed for bipolar machines. The windings would be strung from a north to a south pole-piece in all cases. The cylinder would be of bare laminated iron. Each winding in the pole-pieces could be grouped. The magnets may be either series, shunt or compound wound, and the coils in the pole-pieces may be properly connected with the field-magnet windings or exciting coils.

The reason why our machine will operate may be given here. On sending a steady current through field windings and through the polar windings we thereby cause a shifting of the direction of the poles in the revolving cylinder. The north pole of the magnet attracts the south pole of the cylinder. The south pole of the magnet attracts the north pole of the cylinder. Each pole of the cylinder is not so near the middle of the pole-piece as it was when the cylinder was not running. Hence there is perpetual attraction between the north pole of the magnet and the south pole of the cylinder, and between the south pole of the magnet and the north pole of the cylinder. The magnetism dies out on one side of the armature at the same rate as it is restored on the opposite side. While the poles of the cylinder remain stationary in relation to the magnet, they are in motion in relation to any point in the cylinder. Each pole may be likened unto a dog on an endless-tread power for churning. The north pole of the cylinder only need be considered in this comparison. The pole is the dog, the cylinder the inclined endless belt of slats on which he walks, and that part of the frame before him is the south pole of the field magnet. The dog ever moves but never advances, for his forward motion is balanced by an equal motion of the belt of slats in the opposite direction.

When used as a dynamo the magnetism in the cylinder laps, so that its poles are not exactly opposite the poles of the field magnet. The rotation of the armature, in connection with the action of the field magnet and the polar windings, causes a displacement of the poles of the armature. This displacement is perpetual, so far as any point in the cylinder is concerned, but the poles of the cylinder are stationary in relation to the pole-pieces while the machine is running. The north pole of the cylinder is, however, not at every instant the same north pole; this is to say, it does not consist of identically the same molecules. Neither does the flame of a lamp consist even for two seconds of the same molecules. In the case of our cylinder, however, each molecule may become part of the north pole for an instant during each revolution. There is then a motion of the north pole of the cylinder in front of the wires stretched across the pole-pieces. Now, when there is motion of a magnetic pole before a conductor placed near it, electric currents can be generated.

It might be thought that it would be impossible to generate a perfectly steady current in our machine because the number of coils in the pole-pieces is not infinitely great. On giving the proper attention to this case, it will be seen that the increments and decrements occur in this displaced magnet, which is made up of perpetually recurring molecules of the iron cylinder. Of course, some parts of the coils wound in the polar faces are more efficient than others, but the small, medium and great effects are totalized in the same conductor.

Instead of winding the polar coils through slots or holes in the poles, they may be wound upon a thin iron cylinder, which is fastened to the polar faces. Within this rotates the active cylinder with little clearance.

The machine described in the preceding paragraphs would have the advantages of simplicity, durability and low cost. There would be neither moving wire, commutator brushes nor slip rings. The current would be as steady as that from a unipolar dynamo. Indeed, it is a question whether this should not be considered a unipolar dynamo.

The coils may be connected in various ways to change the voltage and the amperage, even when the machine is in motion. Having no moving wire, there is little danger of chafing the insulation, and there is no binder wire to break and cause costly accidents. A clean, smooth, easily balanced, laminated-iron cylinder is the only revolving part. A somewhat higher efficiency than usual may be expected, because the current is perfectly uniform and because there is no wire wound where the action is nil. On cylinder and ring armatures the whole surface is covered, because its place changes. Wire in a neutral area one moment will be in an active area in the next.

Morse Lamp Adjuster.

The accompanying pictures illustrate the method of using the Morse adjuster for suspended incandescent lamps, which has just been put upon the market. The device is said to be the only absolutely insulated adjuster sold and it has received the written approval of every board of fire underwriters, wire and building inspector, factory, insurance and electrical expert to whom it has been shown. The adjuster is neat and compact and can be attached to the cord of any suspended lamp in a short space of time. With its assistance the lamp can be raised or lowered quickly, thus throwing the light where it is most needed. The adjuster is adapted for use in oces, mills, factories and shops, where it may easily save time and breakage of bulbs. It is manufactured and sold by the Incandescent Lamp Manipulator company, 116 Bedford street, Boston, Mass. This company also makes lamp manipulators and cleaners and is continually developing new devices for improving and simplifying the handling of incandescent lamps. The company was awarded a bronze medal at the Paris Exposition.

Lamp Raised. Lamp Lowered.

MORSE LAMP ADJUSTER.

Swedish-American Multiple Switchboard.

The full-multiple, central-battery switchboards manufactured by the Swedish-American Telephone company of Chicago possess many interesting features. All signals, including both line and keyboard signals on the switchboards, are of the luminous type, consisting of miniature incandescent lamps placed behind three-eighths-inch opal-glass bull's-eyes. They are, of course, self-restoring in action. This form of signal permits the most advantageous arrangement of drops and line jacks, namely, the placing of the answering jack directly underneath its line signals. Thus, the operator in answering a call is not obliged to find the jack corresponding to the signal shown, but she has simply to plug into the jack directly under the lighted signal. It is thus said to be practically impossible to make a mistake in answering a call. This arrangement, of course, allows any amount of cross-connecting or distributing of the subscribers' lines into any operator's position without any renumbering of drops or answering jacks.

The cord-circuit signals are of the same luminous type, and each pair of cords is equipped with two. the full supervisory system of signals. One of these signals works only in connection with the answering plug and the other works only in connection with the calling plug, thus enabling the operator at any instant to tell at a glance the exact state of connection at that moment. This entirely does away with the necessity of the operator ever breaking into the circuit after the connection has once been made.

The keyboards are equipped with ringing key and operator's cam, or with combination key which performs both operations. In this board the strips of drops and jacks are placed in the lower panels and above them are placed the multiple jacks. The multiple jacks are made in strips of 20 each, each jack being placed on seven-sixteenths-inch centers. Each jack consists only of sleeve and tip springs and is therefore entirely free from inside contacts, which are used in other systems, and which are apt to be the source of endless trouble. In fact, on this system there are no contacts anywhere in the subscriber's circuit, it being an absolutely continuous circuit from the subscriber's instrument to the jacks in the switchboard. The only contact in the entire circuit is that of the switch hook at the instrument and the contacts made between the plugs and the jack springs in the switchboard, but over the latter contacts no current is broken, as none of the common-battery current ever flows over the jacks or through the cord circuit.

These switchboards, even in their smallest units, are true universal boards, that is, any board, no matter how small, can, if desired, be increased to a full-multiple switchboard of any capacity simply by adding additional sections and without any change in those installed other than the addition of the multiple jacks and the necessary wiring.

The operation of this system is as follows: To signal the exchange, the receiver is taken from the hook, by which the line signal is at once lighted. When the operator answers by inserting the answering plug in the jack, this light at once goes out. On ascertaining the party required, the operator makes a busy test on the multiple jacks, and not finding the line busy, inserts the plug and rings the subscriber. At once the supervisory lamp of that cord circuit lights and remains lighted until the party called answers. When conversation is finished and both receivers are restored to their hooks, both lamps in the cord circuit are lighted, this condition being the only positive signal to the operator to disconnect. Should one or both of the parties desire other connections when they have finished their conversation, the slow movement of the switch hook up and down will flash either one or both of the signals in the cord circuit, which will be a positive signal to the operator to connect herself at once

with that circuit to find out what is wanted. In other words, through the use of this double supervisory system, there can never be, as far as the operator is concerned, what might be termed a "position of doubt." Although this switchboard and system are said to accomplish every action which is included in the most modern Bell switchboard, their chief advantage lies in the extreme simplicity of method and apparatus employed to effect it. Each line is equipped with a small relay, and this relay controls all of the signals used in handling connections, whether those of the cord circuit or the line signal. Other than this relay there is no relay or coil of any sort used anywhere in the system, and the cord circuit is entirely free from them.

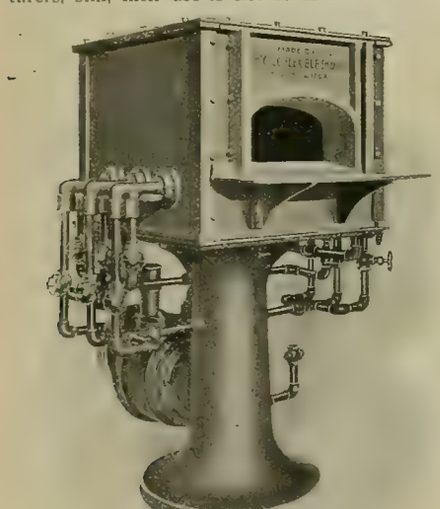
An important feature of the system is the entire absence of the objectionable click in the receiver. The system is a true common-battery system, requiring but one set of storage batteries (of 11 cells). It is, in addition, a true two-wire system and requires no third wire, or, what is its equivalent, a ground connection at each instrument.

The most important part of a common-battery system is, after all, its talking circuit. The Swedish-American company guarantees its system to give perfect results with the instruments located as far as 30 miles from the exchange, and at this distance it says that the telephones will work perfectly when connected at the switchboard through toll lines or to instruments working on the local-battery system or any type of common-battery system.

The Swedish-American Telephone company has recently secured additional manufacturing facilities and also doubled its floor space and is now prepared to furnish full exchange equipment, either of the magneto ring-down type or full-multiple and common-battery switchboards from a 10-line to a 10,000-line exchange.

Stewart Gas Blast Furnace for Treating Magnets.

Although much has been written and said about the great advantages of gas furnaces in the treatment of fine steel, and although these advantages are usually conceded by all up-to-date manufacturers, still, their use is not as universal as would



STEWART GAS BLAST FURNACE FOR TREATING MAGNETS.

be supposed from the many points in their favor. There are many gas furnaces on the market and new patterns are being constantly introduced. The one illustrated herewith is the No. 3 oven and muffle furnace, manufactured by the Chicago Flexible Shaft company, 158-160 Huron street, Chicago. It will burn illuminating gas, water gas, natural gas and gasoline gas, and it is said that with none of these will it make any smoke, soot or odor.

This particular oven furnace is equipped with independent burners, making it possible to regulate the heat so that an absolutely uniform temperature can be maintained on all parts of the muffle, even though the doors be left open. The furnace is especially adapted for heating magnets, and for large pieces of steel to be annealed or hardened, such as large dies, punches, knives, tools, etc. By its use it is said that more magnets can be heated, and heated properly, in one day, than can be heated in the old way in three days and at considerably less cost.

The furnace combines, on one base, a combustion chamber, an air reservoir and a rotary pressure blower. No piping of air is necessary. The air reservoir is sufficiently large so that an ample supply is always on hand, which is a very important feature. The blower when belted to power will deliver air to the furnace at a constant pressure of one pound to the square inch, at which pressure the heat is soft and uniform, as is required for magnets, fine tools, dies, etc.

This furnace can be set up in any convenient place, as it requires no chimney. The flame is projected from the burners into the chamber encircling the muffle. The lining is of such shape that a rotary motion is imparted to the flame, causing it to distribute itself evenly over all the enclosed space, the products of combustion being drawn off by the two small openings at the top of the chamber. The degree of heat is under perfect control. Makers of magnets are invited to investigate the possibilities of this furnace.

International Storage Battery.

A new type of storage battery, the construction of which is said to involve no new chemical or electrical principles, the invention being of a purely mechanical nature and relating to the construction of the element, is being placed upon the market by the International Storage Battery company, 45 Milk

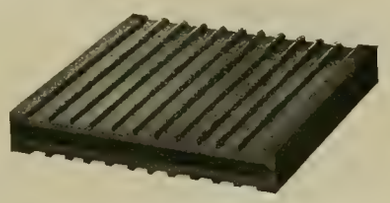


FIG. 1. INTERNATIONAL STORAGE BATTERY.—FILLED SECTION ASSEMBLED.

street, Boston, Mass. The structural part of an element of the battery consists of two halves or sections made of porous non-conducting earthenware, which form a chamber that contains the active material. The inner surfaces of the sections are cellular in construction, the exterior surface being ribbed. The halves or sections which form the sides and bottom of the chamber are united by means of suitable cement so that the chamber is practically fluid tight. The walls forming the extensions are made relatively wide so as to form substantial cementing and abutting surfaces, and also to serve to strengthen the structure and halves or sections. In the chamber of the closed vessel thus formed of two halves or sections is first placed the lead oxide or material to become active, and into this material is then inserted a lead conducting sheet, which latter performs the office of a conducting electrode.

The enclosed oxides are claimed to be freely accessible throughout to the electrolyte of the cell, being exposed thereto on all sides. As this end is attained without undue compression, a maximum porosity always exists throughout the active mass. Maintenance of this porosity during the charging and discharging processes, which is so essential during any heavy work, is also provided by the elasticity of the element. Fig. 1 shows the filled halves of a pottery-frame element assembled and cemented, while in Fig. 2 is illustrated a series of elements assembled and cemented in a glass jar.

The manufacturer claims for this type of battery that it is lighter than any other and highly efficient,

FIG. 2. INTERNATIONAL STORAGE BATTERY.

has a lower first cost, costs less to maintain, and is more durable, variable and abnormal draughts of current not affecting its life. It is said to be adapted to central-station work, as the confinement of the active material avoids deterioration of the element. The elements being practically solid, they can be used for traction or carriage service without danger of disintegration by jolting or concussion. The International company guarantees the maintenance of its batteries for 10 per cent. per annum of the original cost, when used for installations of large capacities, as in central-station work or railway and carriage service.

Auxiliary Telephones in Chicago.

The daily number of telephone calls in the exchanges of the Chicago Telephone company has increased so largely that many lines are overloaded. A large number of subscribers now have for the accommodation of their business two, three or more telephones, and some of the largest firms have more than 100 telephones each. Many have private branch exchanges, with trunk lines and private operators to handle their calls. There are at present several thousand subscribers who provide themselves with two or more telephones.

To accommodate this increased service the Chicago Telephone company is now offering an auxiliary long-distance telephone on a special circuit operated on the measured-service plan at a cost of $75 a year, including the privilege of sending 600 calls, or $90 a year for 900 outgoing calls, excess calls being charged for at graded rates. All ingoing calls are free. This telephone may be listed with the subscriber's present number and used entirely on ingoing business, the present telephone being used for outgoing calls or for ingoing calls when it is not busy. To a subscriber who has but one line, this arrangement gives two telephones, and is said to double the present facilities at a moderate cost.

A. S. Hibbard, general manager of the Chicago Telephone company, says: "We regard this plan somewhat as an educational one. If the telephone is really a door to trade, men will learn that a telephone that is blocked by too much use is like an overcrowded door. The instruments put in will all be long-distance telephones of the latest pattern, such as are now used in talking from Omaha to Boston. The general enlargement of the company's business made this new plan possible, just as it made it necessary. There are now some 28,000 telephones in Chicago, and each succeeding month of 1900 has had a greater amount of business than the one before it. The new plan is one we have been thinking of for some time."

The net gain in telephones operated by the Chicago Telephone company during the last year has been nearly 9,000, against 6,475 for the previous year. There are now 180 cities and towns immediately around Chicago in which the Chicago company is operating offices and exchanges. These are reached by 8,680 miles of toll lines. Five new exchange buildings have been built in Chicago by the company, and its large main office and office building at the corner of Washington and Franklin streets has been doubled in extent. In all of these new buildings new switchboards have been installed of the latest type, operated with automatic signals, so that out of the 12 exchange offices all but one are now operated in that manner. In October the company inaugurated in its North Office the experiment of nickel-in-the-slot lines for small users. The service has been very popular, and if it is found that it does not interfere with the other service of the exchange it will be extended to other offices. The total number of telephones operated in the Chicago exchanges at the end of the year was about 28,000 and in the suburban exchanges 8,500. The company is now operating in the city 92,354 miles of wire.

Escaping Street-railway Current in Indianapolis.

In an action to recover $50,000 damages brought by the natural-gas and water companies of Indianapolis against the Indianapolis Street Railway company for deterioration in pipes and mains caused by electrolysis, Judge Carter of the Indianapolis Superior Court holds the complaint good and quotes the ancient maxim of law, "So use your own as not to injure others," and says: "Here are three corporations, each occupying the streets by legal authority, each performing a service to the public, and each being compelled under the law to serve the public. The method in use by the defendant company in operating its cars results in serious injury and in some cases to the destruction of the plaintiffs' pipes. The defendant can, by the use of an approved appliance at reasonable expense, make adequate preparation for the return of the current to the power house and so operate its cars as to avoid injuring the plaintiffs' pipes. The plaintiffs cannot by any known method, protect their pipes from injury. The number and size of the cars propelled by electricity is rapidly on the increase. Suburban lines are coming from every direction, and the current of electricity now discharged into the earth is very large, and if it be true, as claimed, that these currents not only attack gas and water mains, but the steel frames of tall buildings, deteriorating and weakening such buildings, is there no remedy in the law to prevent it, or to compel the defendant company to control its return current when it is conceded that it is reasonably in its power to do so? When these perils or injuries can be avoided by the adoption of well-known and approved appliances, I think it must be held to be actionable negligence in the use of its franchise on the part of such corporation not to adopt such appliances."

The defendant company did not contend that the facts alleged in the complaint were not true; it simply maintained that the damage resulting from the escape of the electricity was incidental to the enjoyment of the franchise granted to the company. The ruling is regarded as important and much interest was manifested in the outcome.

Observations on Crookes Tubes.[1]

By H. Westbury.

Cathode rays are supposed to be produced at a pressure of about a millionth of an atmosphere. They are generated from any source of electricity with voltage high enough to force a discharge through a Crookes tube. They proceed perpendicularly from the surface of the cathode in straight lines and fall upon the opposite wall of the tube, producing fluorescence. If any object be placed between the cathode and the opposite wall of the tube, a black shadow of the object is cast upon the wall of the tube. The path of the rays is entirely independent of the position of the anode. They can be deflected from their straight path by either pole of a magnet. Two parallel streams of cathode rays repel each other. If the rays fall upon a balanced object in the tube it will rotate. Making the cathode concave and so bringing the rays to a focus heats the anode rapidly. The glass walls of the tube are opaque to the cathode rays. The X-rays are supposed to be produced at the same time as the cathode rays, originating at the end of the latter and passing out of the tube into the air. They produce fluorescence in certain chemical compounds, such as tungstate of calcium, platino-cyanide of barium, etc. Wood, paper, cloth, metals, flesh, etc., are transparent to the rays, although not to the same degree. The rays affect photographic plates, and thus give shadow photographs of objects otherwise concealed. They are not believed to be light rays, as they cannot be reflected, refracted or polarized. Two views are held as to the nature of the cathode ray; one, that these rays are a radiation in the ether, probably transverse waves like light, hence they are sometimes called ether waves; the other, that they are streams of particles of the gas still left in the tube projected from the cathode. If, however, rays can be produced in a tube entirely free from air, it is evident that the second theory is incorrect. If there is left a small hole in a tube, and a thin plate of aluminum sealed in, the cathode rays pass out and can be deflected with a magnet. This first theory is well supported, but does not explain why a magnet deflects these rays or why two cathode streams repel each other, as nothing similar is known in light radiation.

It was early appreciated that the three things in which great improvements were necessary were the exciting apparatus, the fluorescing screen and the Crookes tube. With the first I have nothing to do in this paper. The screen has unfortunately stood practically where it started until now, in spite of numerous experiments with all kinds of salts, of which the following have been found to fluoresce in varying degrees, viz., platino-cyanide of barium, tungstate of calcium (these fluoresce better than any other salts at present known), tungstate of strontium, subchloride of mercury, mercury diphenyl, cadmium iodide, sulphide of calcium, potassium bromide, potassium iodide, tetrametaphosphate of lead, mercurous chloride, bromide and sulphate of lead, fluorite, powdered lead glass, pectolite, sodium cressotinate, ammonia salicylate, calcium salicylate and salicylic acid.

Neither tungstate of barium nor lead fluoresces appreciably. There are a large number of other chemical and mineral salts which also fluoresce, but not to so great a degree as those above mentioned. Among these may be mentioned powdered German glass, barium fluoride, calcium fluoride, sodium fluoride, sodium chloride, mercuric chloride, cadmium chloride, silver chloride, lead chloride, lead iodide, sodium bromide, cadmium, lithia bromide, mercury, cadmium sulphate, uranium phosphate, nitrate of uranium (which fluoresces almost as well as tungstate of calcium), acetate of uranium, molybdic acid, silicate of potash, sodium bromide, wulfenite, orthoclase andalucite, herdinite, apatite, calcite and many others.

Sulphide of zinc and sulphide of calcium can both be used for strengthening screens in contact with X-ray plates. Tungstate of calcium, at first generally used for this purpose, has been universally superseded by platino-cyanide of barium, which, however, is extremely troublesome to handle, owing to its unstable nature, the least friction or dirt spoiling it. In my opinion, therefore, a cheaper and more durable fluorescing substance is much to be desired.

The Crookes tube is important in the production of X-rays, as at the present time it is the only practical way of producing the rays for medical use. Such tubes are, generally speaking, made of flint glass, although lead glass can be used, but is more opaque. Originally it was laid down as a fact that lead glass would not produce X-rays at all. Ordinary ruby glass is also opaque to the rays, and it appears that the rays will not pierce certain colors. The red-tinted glass used in some English tubes is not ruby glass, but simply due to minerals in the glass not necessarily opaque to the rays.

It is extremely interesting to watch closely the vagaries of various tubes after re-exhaustion on the pumps. Some will fluctuate in vacuum, one minute going very high and the next so low that no rays are generated. This can sometimes be driven out of the tube by heating the anode to a white heat and then allowing it to cool off before again repeating the process which we call "curing" a tube. All the best vacuum tubes are treated in this way, as it has been found by experience that tubes exhausted too high on the pumps never give the results obtained from tubes taken off at a lower vacuum and then electrically cured. If I remember correctly, our friend, Dr. Rollins, has demonstrated this fact in his interesting notes on X-light. Other tubes behave very curiously. Some will throw a peculiar patch of fluorescence in certain parts of the tube; others will be of high vacuum and give a reversed current, and the other week I even obtained a German tube with an aluminum ring in the center, which, after re-exhaustion, gave a reversed current at a very low vacuum—a phenomena I have never observed before. It is no exaggeration to say that no two tubes behave exactly alike, although, of course, tubes can now be made so uniform as to lead any outsider to believe there is no distinction in them at all.

There is quite a difference of opinion as to the correct situation for the cathode, whether just inside the bulb or inside the terminal, and this difference seems to have been in existence for several years, as I remember reading an article two or three years ago, claiming that the cathode inside the bulb was of no use for coil tubes, but immaterial for static current. Personally, I have failed to find much variation, and am inclined to think that, within reasonable limits, any size cathode and any position gives about the same results, but at the same time, I believe that a good deal depends upon the concavity of the cathode, and, of course, liability to puncture has to be considered in placing the cathode, more especially on a static tube. Theoretically speaking, however, the quantity of current should govern the size of the cathode. While it is probably true that a focus right on the center of the anode is best, yet the benefit obtained is so small that so long as the cathode stream impinges on some part of the anode disk, X-rays are present in abundance. Sometimes one gets an old tube with the anode twisted and bent out of all shape, and even with a hole right through it, which yet gives magnificent results.

Another curious phenomenon is the peculiar blackening of the glass bulb after continual use. Many explanations have been brought forward to account for this discoloration, but so far none of them seems plausible, and probably until we solve the exact nature of the rays themselves, we cannot tell what causes this deposit on the bulb. One thing I can say, however, that tubes giving fine phosphorescence blacken less than others. It used to be considered that the more phosphorescent a tube was, the better X-rays it would generate, but this cannot be proved, as I have many tubes with little or no phosphorescence giving as good results as those made out of the most luminous glass. This luminosity is also a very curious phenomenon. Sometimes it appears evenly all over the bulb, the glow lasting for a considerable time after the current is turned off. Sometimes it is only present in small portions of the bulb, and occasionally I have seen it represented by simply a luminous shadow of the anode thrown on the otherwise black wall of the tube.

To the outsider, the evolution of the present perfected form of Crookes tubes from the types originally used shortly after the X-rays were discovered does not present very many features striking to the eye, but to those who have been closely following these changes they have improved very steadily every year. The original types of tubes were of the kind in which the cathodic stream of rays was thrown on the glass of the tube itself. While this type of tube was at first successfully used, the necessity for a tube which would focus the rays soon became apparent. After numerous experiments with various contrivances for attaining this result, tubes were produced with aluminum cathodes and platinum anodes, and these have held their ascendancy up to the present time. Since that date constant experimenting has led to something approaching a standard shape for Crookes tubes. The bulb was gradually changed from the oval and tubular shape to globular, although some of the very earliest types were made spherical. The distance between the anode and cathode with which the best results could be obtained was gradually determined. The terminals were extended to meet the increasing efficiency of the apparatus used for the excitation of the tubes, which caused the current to spark across, and many minor details in connection with the sealing in of the terminals and proper supporting of them, to enable a tube to be transported without danger of breakage were made. Of recent date, we have the reinforcement of the anode with other metals to enable it to stand up against the heavy currents now used, and the endeavors to focus all the rays in a circle on the front wall of the tube, so that none of them may be useless by passing out where they are not required.

One of the earliest troubles met with in tubes was their tendency to increase gradually in vacuum, until at length they became so high that the current would not pass through them, and even if an enormous spark were used, the resulting rays were so highly penetrating as to be of no practical use. This led to the devising of the adjustable vacuum feature which is now so prominent in most tubes sold in this country. Originally, ordinary potash was used, enclosed in a small auxiliary tube and liberated by means of applying a match or Bunsen burner. This lowered the vacuum, certainly, but only for a few minutes, when it jumped up again as high as before. Many operators also cracked their tubes, owing to heating the auxiliary tube too much, and many present will remember the burned fingers which sometimes resulted. To meet this difficulty, the present types of adjusters were designed with a wire terminal, so that an electric spark can be discharged directly through the auxiliary tube, and better salts and combinations were obtained, which regulate the vacuum a great deal better than formerly, but, of course, this is not yet by any means perfect.

Both osmium and iridium have been used for the anode, but both of these metals generate so much gas that it is very difficult to exhaust a tube containing them, and even then, after use, such a tube will continually run too low for the production of rays, in addition to which the cost is prohibitive for a commercial tube. I am inclined to believe that for some of the finer forms of X-ray work the tubes with water-cooled targets may prove useful, but unless such a tube can be designed much cheaper than at present, their cost is also prohibitive.

I particularly wish to bring before this meeting one point which I very much desire to impress upon tube purchasers generally, and that is the advisability of our trying to standardize American glass for Crookes-tube use. There is, unfortunately, at the present time a color fancy among many Crookes-tube operators, who insist upon having tubes which give an apple-green effect. Now it is a fact that this has nothing whatever to do with the strength of the rays given out by such tube, and tubes made of American glass giving a whitish or yellowish color illuminate a screen just as brightly as one made from the best green German glass. My reasons for raising this point, apart from the patriotic one of using home-made materials, which, however, ought to have a little weight, are that the domestic glass is, as a rule, stronger and freer from blisters, cords, air bubbles, etc., which tend to make a tube liable to puncture, and also, what I think is the most important reason for purchasers of tubes to consider, that the domestic tubes are much more easily repaired.

I am not in favor of using a larger bulb for a Crookes tube than about five inches, as I do not think that there is any better definition or even field obtained by using larger bulbs. Of course, for very heavy sparks, an eight or 10-inch bulb is probably an advantage.

An interesting experiment with the double-focus tubes on alternating current is to run them in multiple series, which can easily be done by wiring each of the two cathodes together. Of course, the field is somewhat enlarged, but as I have never taken a large radiograph this way, I cannot say whether this arrangement is of much practical use. In multiple they do not run so well, and with single-focus tubes, as a rule, there is no benefit obtained by using more than one tube at a time.

The use of a very high vacuum or "hard" tube is of very little practical utility, as, while the rays are enormously penetrative, the definition obtained is not distinct or clear, and for very delicate work, such as observing the lungs, etc., the definition has to be as clear as it is possible to obtain.

Dr. Lenard, of Philadelphia has recently done some excellent work in the line of penetrating the inmost recesses of the organs, and I have several times verified his published statements. The following is, therefore, interesting:

In cases of calculus, a soft tube is required, as the rays must differentiate between the shadows of tissues less dense than the least dense calculus, and all calculi can be found. A soft tube is one having a low vacuum, and best results are obtained from such a tube with a large volume of Roentgen discharge. For lumbar and pelvic pictures the vacuum requisite is equivalent in resistance to from one to two inches of spark in air, as measured by a parallel spark gap. High wattage and not high voltage seems to be the necessary element in the current employed to energize a tube on such cases. Great difficulty is met with in obtaining such volume to penetrate these thicker portions of the bodies, unless a regulating tube is used, which permits the required volume of electrical energy to be forced through a tube without altering its resistance, eliminating the effect of heat, which, in a soft tube, either lowers the vacuum until it loses all penetration or raises it rapidly until the penetration is too great. It is this inherent tendency of a regulating tube that has been highly exhausted to regain its high vacuum after it has been lowered that makes it superior to an already soft tube that has never been high or hard. The vacuum of an initially soft tube will not remain steady while energy sufficient to develop the required volume of Roentgen discharge for soft-tissue work is forced through it.

While the cause of X-ray burns is still in dispute, I would like to state that I believe, in common with several other observers of tube phenomena, that they are only caused by certain tubes, and that the trouble is in the tube itself, at what point I cannot, of course, say, but I firmly believe that there is some little difference which causes the rays to burn, or, more properly speaking, causes dermatitis. However, militating against my theory, to some extent, is the fact that Dr. Scott and other operators have found that the funnel-focus type of tube, which probably focuses more of the rays on one spot than any other type of tube, causes dermatitis after very short exposure, which would tend to show that the old theory of the more powerful the rays, the more the tendency to burn, is correct.

1. Paper read before the Roentgen Society of the United States at New York city on December 14, 1900.

Progress at the Pan-American Exposition.

By Frank C Perkins.

The outlook is bright that the Pan-American Exposition will be opened on time in four months. A new power-transmission line is being built from Niagara Falls to the Pan-American grounds, which will be somewhat different from the old line from the power house at the Falls to Buffalo and Tonawanda. The new conductors over which the polyphase, high-tension alternating current will be delivered to the exposition will be of aluminum instead of copper. Aluminum conductors have now been used with such success on other transmission lines that there is little doubt but that they will give satisfaction.

PROGRESS AT THE PAN-AMERICAN EXPOSITION.—NORTH TOWERS OF THE MACHINERY BUILDING FROM THE ROOF.

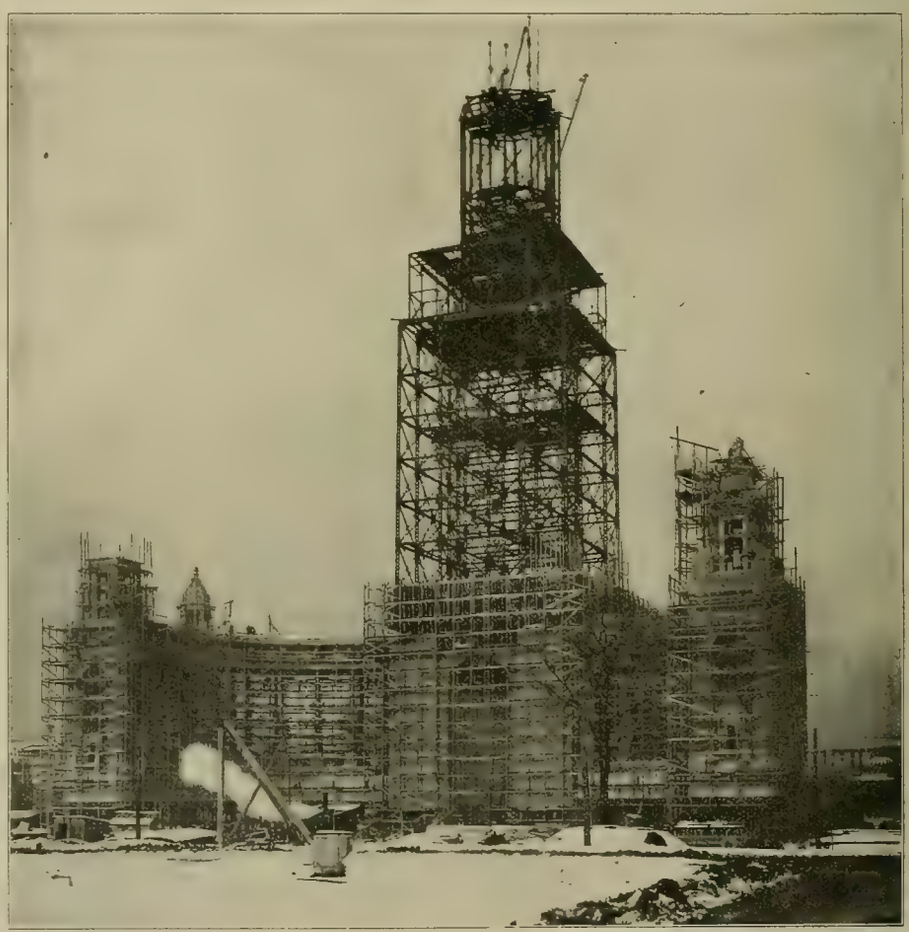
It is stated that the Pan-American will surpass all former enterprises in six important and interesting features. The first of these is in the court settings. The Pan-American buildings have been placed symmetrically with reference to one another, so as to form a system of connecting courts, each with its special features, yet each a part of one great picture. The principal courts which will be beautifully supplied with electrical effects are the Court of Fountains and Plaza, which form a north and south perpendicular area and connect with a transverse court called the Esplanade. Two minor courts open into the Esplanade. They are called the Court of Cypresses and the Court of Lilies and will also be decorated by unique electrical effects. The courts have not been stinted as to space, as they are 33 acres in area. There will be plenty of room and a fine opportunity for observing the electrical and artistic features to the best advantage. A second surpassing feature is the hydraulic and fountain effects, embracing electrically illuminated lakes and ponds, lagoons and canals from which many jets of water will spout. The third feature is that of the horticultural and floral embellishments, while the fourth will be the sculptural and plastic decorations. The fifth will be the color effects, which will be strongly contrasted with the World's Fair White City. The last and sixth feature is the electrical illuminating and decorative effects, which, in reality, will be the means of beautifying and bringing out all the special features above mentioned. Some 200,000 104-volt lamps of eight, 10 and 16 candlepower will be utilized to aid in the illumination.

William B. Rankine, second vice-president of the Niagara Falls Power company, announces that the first installation of the plant in the new power house will consist of six 5,000-horsepower generators, which will supply the electrical energy not only for the Pan-American display, but also for several new concerns which are arranging for power and sites for their factories at Niagara.

The work on the Machinery and Transportation building, as well as the Electricity building, is rapidly nearing completion. The coloring of the Machinery building, which has been so successfully accomplished under the guidance of C. Y. Turner, is beautiful. An example of the artistic designs which are being wrought out on some of the buildings is given in the accompanying illustration which shows a view of the north towers of the Machinery building from the roof.

If the present plans are carried out, the Pan-American year will witness the electrical illumination of every road connecting Buffalo, Tonawanda and Niagara Falls. The Town Board of Tonawanda has become favorably impressed with the idea, and it is understood that it will do all in its power to promote this matter and to bring about the realization of the same before the gates of the exposition are thrown open to the public. The idea is to use Niagara power to light the country highways and all roads from Buffalo to the Falls. The Tonawanda Power company, which distributes Niagara current, has already begun the construction of the Delaware avenue system from the exposition grounds and will construct a line along the Military road and the River road if no objections are made by the property owners. There is little doubt that the plan to illuminate Delaware avenue from the Twin Cities to the city line of Buffalo will be rapidly carried out.

Popular interest centers just now in the building of the great electric tower, progress on which is noted in the accompanying view and in the development of the color scheme under Mr. Turner's direction. The construction of the tower is certainly an important undertaking in engineering. All wait impatiently to see how the tower will appear when it has received the elaborate decorations which have been designed for its embellishment and the ivory-like hues blended with the blues and greens and gold which the staff will take on before the tower is completed. At night myriads of electric lights will illuminate the tower, from the fountain and cascade at its base to the farthest point thrust against the sky.



PROGRESS AT THE PAN-AMERICAN EXPOSITION.—ELECTRIC TOWER.

To the electrical engineer who visits the exposition one of the most interesting exhibits will be the step-down transformers, rotary converters and other apparatus used in connection with the application of Niagara power to the machinery and illumination of the exposition grounds. To furnish power to the exposition, the Cataract Power and Conduit company, which distributes power from the Falls in Buffalo, will have ready a second transmission line. This will double the present capacity of 10,000 horsepower delivered to Buffalo from the Falls. Besides the 5,000 horsepower furnished from the power house of the Niagara Falls Power company, the exposition will use 5,000 horsepower more which will be generated on the grounds, so that if for any reason there should be an accident, interrupting the flow of electricity from the Falls plant, the exposition may not be without power and light.

Space Telegraphy in Germany.

The Postal and Telegraph departments of the German government have already formally adopted the Braun system of wireless telegraphy in preference to that of Marconi. Professor Braun, who is the head of the Physical Laboratory at Strassburg University, is said to have proved that Marconi's theory that distance could be overcome by the employment of more powerful induction coils is an error, and that there is a definite limit to the length of currents favorable for the transmission of messages, beyond which any further strength of current is of no avail. The German savant has overcome the difficulty by making the transmitter oscillate, not as before by static charges, but by induction. His transmitter is a single wire, its lower part being in spiral form. By its side, though completely separate, there is another spiral wire, generally consisting of a single coil of thick wire. Through the latter Leyden jars are discharged, creating electric waves in the primary wire and causing others in the transmission wire. The transmitted energy can here be increased, theoretically, without limit, and is at the same time easily isolated.

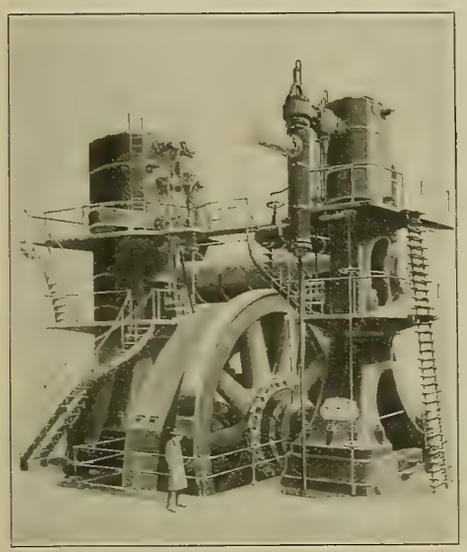
Professor Slaby of the Technische Hochschule in Berlin has announced that he and Count Arco, by minutely studying the properties of the electric waves from the transmitter, have discovered means for removing a great defect in the system, namely, the impossibility of telegraphing simultaneously from several stations to a common one by the use of a single wire at the receiving station. He contends that Marconi's method utilizes the very part of the transmitting wire which is the least fitted for the purpose, the upper end of the same wire producing the greatest effect.

Professor Slaby exhibited his instruments, by which, by the use of a spiral coil which he calls a multiplicatory, he greatly increases the effectiveness of the system. Demonstrations were made with two stations, respectively, 14 and four kilometers distant, which were connected with the lecture hall. Messages were received from these stations simultaneously and much quicker than by the present system.

The Norwalk, Ashland and Southern Railway company of Norwalk, Ohio, has been incorporated by C. P. Wickham, G. T. Thomas, C. T. Jackson and others. The capital stock is $10,000, and the company will construct and operate an electric line from Norwalk to Ashland by direct route.

Generating Set of 5,000 Horsepower for Brooklyn.

The accompanying illustration shows an electrical generating set of 5,000 horsepower built for the Kings County Electric Light and Power company of Brooklyn. It is one of two such sets turned out at the Westinghouse works near Pittsburg. The engines, made by the Westinghouse Machine company, are of the vertical, cross-compound, Corliss type. They are over 35 feet high, measuring from the floor level. Each engine comprises two vertical cylinders erected side by side on massive frames, bolted to ponderous bed plates. In each engine there is room left between the two cylinders for a Westinghouse generator, which will furnish current for light and power. The revolving part of this generator is mounted directly upon the steel shaft of the engine, and is firmly bolted to a flywheel with



GENERATING SET OF 5,000 HORSEPOWER FOR BROOKLYN.

a 100-ton rim and 28 feet in diameter. The shaft is 39 inches in diameter and 38 feet six inches long. The bearings are 60 inches in length. The shaft is hollow, hydraulically forged of open-hearth steel, the hole through the center being 16 inches in diameter, and it weighs about 75,000 pounds complete. The flywheel is built in segments, keyed to each other, and all bolted to the hub. The engines have intermediate reheating receivers. The high and low-pressure cylinders are of 46 and 86 inches' diameter, respectively, and both are equipped with a new form of Corliss valve gear. The stroke is 60 inches and the speed is 75 revolutions per minute. Steam is supplied at a pressure of 170 pounds and the normal horsepower of the engines is from 4,500 to 5,000. The bearing shells and caps are water-jacketed, as are also the crosshead slides.

The generators are of the Westinghouse engine type and give a three-phase output of 250 amperes in each phase at 6,600 volts, with 3,000 alternations per minute.

Building engines of such great size calls for unusual shop and foundry facilities, and even the shipment is by no means an insignificant problem. Thus, for instance, the two great bed-plates of one of these engines weigh over 43 tons each, and as they are cast complete in one piece, they are very difficult to handle. For transporting these enormous castings to Brooklyn the Pennsylvania Railroad company has constructed special steel cars. Each of the segments of the flywheel is a carload. Cyrus Robinson, one of the prominent engineers of the Westinghouse Machine company, was the designer of the engines.

Besides the two engines described above the Westinghouse Machine company is building a number of similar engines, notably 16 engines of 5,000 horsepower each, for the Third avenue railway of New York, two engines of the same capacity for the Boston elevated railway, two engines of 1,500 horsepower for Manchester, England, and eight engines of 6,500 horsepower for the new Waterside power plant of the New York Gas, Electric Light and Power company.

Death of Lord Armstrong.

Lord William George Armstrong, known as a scientist, and inventor of the Armstrong gun, died on December 27th at his home at Cragside, in England. He was noted as an authority on electrical mechanics and was a distinguished contributor to the scientific periodicals. He was born in 1810, and was a solicitor until 1847, when he became an engineer and founded the Elswick Manufacturing company of Newcastle-on-Tyne. His first invention was the hydro-electric machine for generating static electricity by means of steam jets, said to be the most powerful means of developing frictional electricity yet devised. He afterward invented the hydraulic crane and extended the application of hydraulic power to machinery of every kind. In December, 1854, he constructed the first piece of rifled artillery now used in the armies of the world. Since that date he made many improvements in the gun bearing his name. His works at Elswick were gradually extended until to-day they form one of the largest and most important manufacturing establishments in Europe.

A Few Remarks on X-rays and Other Rays.[1]

By Arthur W. Goodspeed.

I would like to speak of a probable improvement in the inductorium as an X-ray generator, suggested by my own experience and subsequent measurements. This matter was referred to more at length in an article by myself, "On the Technic of X-ray Work," in the Philadelphia Medical Journal, January 6, 1900. A quotation from the article makes clear my point:

"Difficulty is often met in adjusting the interrupter for different rates on account of the sparking which results. In this case the capacity of the condenser is probably not suited to the set of conditions that must be met. In other words, the time of a complete cycle of operations and the ratio in which this period is divided between closed and opened circuit in the primary is of considerable importance and is clearly related to the self-induction of the coil and the capacity of the condenser intended to take up this extra current. If the capacity be too small the condenser will be only partially effective, and sparking will result at the break.

"Adjustments should be made so that the actual interruption of the primary current shall be as sudden as possible. This results in a rapid variation in the magnetic flux through the iron core, which induces in the secondary a rapidly increasing electromotive force. This act of breaking the primary, however, produces a self-induction in the coil, which in itself tends to retard the suddenness of the break by causing an arc across between the points as they recede from each other. It seems as if the current possesses a sort of momentum, on account of which it becomes most difficult to stop the flow instantly. If, however, a condenser of large capacity be connected around the break, the extra current will flow into that. The condenser evidently must be of capacity sufficient effectively to absorb all the charge that would otherwise tend to jump between the contact points. But a very important part of the phenomenon is yet to follow. The best iron core will not alone lose its magnetism, except after a time which is considerable when compared with intervals of the minute order of magnitude we are contemplating. To effect this necessary result the condenser at once discharges back through the circuit, the effect being to demagnetize the core very rapidly, thereby inducing an enormous electromotive force in the secondary.

"I am told by the makers that on the largest commercial X-ray coils the condenser capacities vary from five to 15 microfarads. A hasty measurement of the one I am using shows its capacity to be about 35 microfarads. To me this comparison suggests that the ordinary commercial coil would be much more efficient if its condenser were several times larger than usually made. If a coil with an insufficient condenser be operated slowly, it sparks badly at the break, for reasons already given. If the speed be increased until the sparking is a minimum, it is so because the time of 'make' has been too short to allow the direct current to attain a maximum; the extra current due to self-induction is therefore less, and the small condenser can take care of it. Obviously, though, under these conditions the coil is not operating with maximum output. The time of 'make,' i. e., the interval during which the primary is closed, ought to be just long enough to enable the current to reach its maximum value: this time, of course, depends on the self-induction of the coil as well as on its resistance. The time of 'break,' i. e., the interval during which the circuit is open, must be long enough to enable the condenser to be charged and discharged. If the make follow the break too soon, clearly the direct current will interfere with the discharge of the condenser."

Another matter that it seems appropriate to bring before you this evening concerns the claims of priority in making the first electrographs by exposing a photographic plate directly between the poles of an electric machine and allowing the spark to produce its autograph. I noticed recently (see the American X-ray Journal, December, 1899, p. 675) "that Dr. Wagner was the first person to get the impression by placing the sensitized plate between the sliding electrodes of a static machine." The short article from which I quote called forth in the next issue of the same journal (January, 1900, p. 693) a letter to the editor from Elmer Gates, claiming to have preceded Dr. Wagner by several weeks or more.

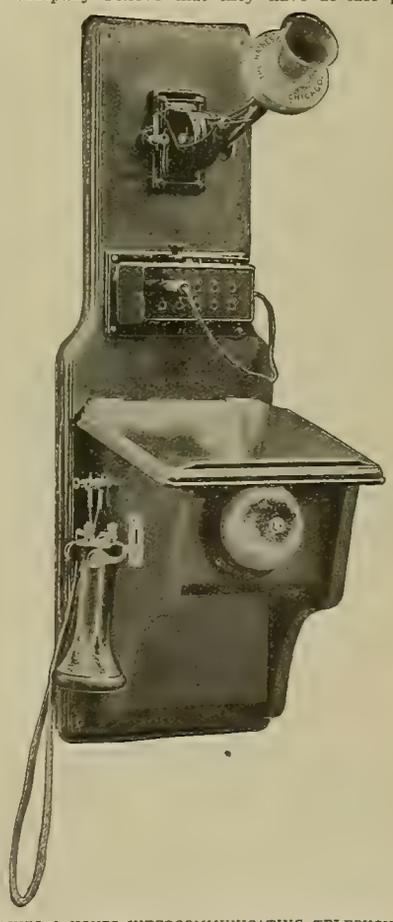
It really seems hardly worth while for these two gentlemen to dispute priority in taking electrographs, since your speaker, in connection with W. N. Jennings of Philadelphia, made electrographs as early as November 20, 1889, in precisely the method described by Gates. Experiments along this line were conducted at intervals from 1889 till 1893. Electrographs of coins similar to those described in Thompson's book on X-rays, p. 19, were made by Jennings and myself on February 20, 1890. I am told that Kinraide of Boston several years ago showed some beautiful electrographs at the Franklin Institute, and I have not the least doubt that a dozen other experimenters performed the same experiments anywhere from five to 10 years ago. Whether this be true or not, of the cases cited I have personal knowledge.

Upon one other point will I say a few words—one which is exciting considerable interest at this time among both chemists and physicists. I refer to the radiation emitted by the recently discovered radioactive substances obtained from uraninite. Early in 1898 Mme. Curie called attention to the fact that certain uranium minerals, as pitchblende, emitted Becquerel rays even more actively than uranium itself, and suggested the presence of a new substance to which this action is due. Later she and her husband isolated a new material much resembling bismuth and 400 times more active than uranium. To this substance they gave the name polonium, from Poland, their native country. Continued research upon pitchblende brought to light another substance very like barium, which at last proved to be 900 times more active than uranium. To this they gave the name radium. I have a developed photographic plate here which was exposed for several hours to the action of six little piles of uraninite, under each of which was a small piece of sheet-metal, about 0.005 centimeter thick. The metals were aluminum, lead, silver, gold, zinc, copper, and the plate shows roughly a difference in translucency—the aluminum seeming the least resistive, while, perhaps, the lead is most so. This suggests a close relation, perhaps identity, with the X-rays. Recently the Curies are said to have separated still a third radioactive substance from pitchblende.

1. Abstract of paper presented before the electrical section of the Franklin Institute at Philadelphia.

Haines & Noyes Intercommunicating Telephone.

A new type of telephone has recently been put on the market by the Haines & Noyes company of Chicago, which, judging from workmanship and design, promises to make a place for itself. After a careful study of the various kinds of systems and instruments now on the market, the engineers of this company believe that they have at last perfected an instrument which will answer every requirement.



HAINES & NOYES INTERCOMMUNICATING TELEPHONE.

The telephones are graceful in outline and design and have an excellent finish. Fine workmanship and the best material throughout are expected to commend these telephones to all who may be looking for the best apparatus.

It is claimed for the transmitter that it will not pack under any conditions. It is stated that water may be poured in the mouthpiece or suction applied without packing the granules or impairing in any way the speaking qualities of the instrument. The illustration shows one of the company's wall style of intercommunicating telephones. The plug boxes are so designed that the desired station may be called up, no matter in which jack the plug has

been left, which does away with the old excuse that the telephone cannot be used because one station cannot call up another.

In addition to this and local and long-distance telephones, the Haines & Noyes company has new and unique designs of apartment-entrance, hotel and private-residence telephones, besides switchboards and annunciators for hotels, sanitariums and hospitals.

Core-type Transformers for Three-wire Secondary Service.

In the design of transformers of the "shell" or "ironclad" type for three-wire, secondary service, the General Electric company states that it is not always necessary to take special precautions for maintaining equal voltages on the two halves of the secondary winding under conditions of either equal or unbalanced load. The winding space in this type of transformer may be made of such proportions

FIG 1. CORE TYPE TRANSFORMERS —EXTERIOR OF COILS.

that the secondary coils are close enough to the primary winding to prevent magnetic leakage sufficient to affect materially the regulation, even if the load is very unequally divided between the two halves of the secondary.

In a "core" type of construction, however, such as the General Electric company first introduced in its type H transformer, special precautions must be observed in order to obtain equal voltages in the two halves of the secondary, under all conditions. The simplest and most natural method of winding such a transformer with two secondary coils would be to place one of the coils on one side of the transformer core and the other on the remaining side. With this winding, equal voltages would be given by both secondaries, provided they were equally loaded. If, however, one side were to be loaded more than the other, its voltage would drop below the normal, while the voltage of the light-loaded half would rise above that value, the sum of the two voltages remaining practically constant. This result can be simply explained as follows:

Assuming that one secondary is carrying a load while the other is unloaded, as equal current flows in all parts of the primary, there will be, on the side of the transformer where the secondary is loaded, one-half the primary ampere-turns necessary to supply those existing in the secondary winding, the other half of the ampere-turns being in the primary

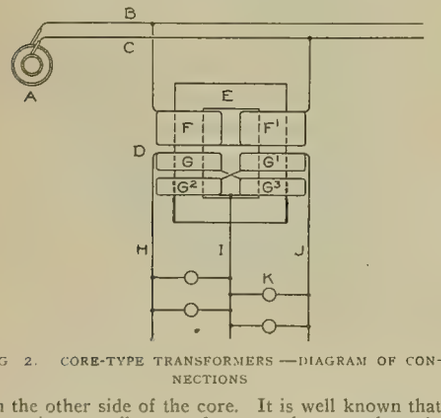


FIG 2. CORE-TYPE TRANSFORMERS —DIAGRAM OF CONNECTIONS

on the other side of the core. It is well known that the primary coils must be near the secondary, in order that practically all the ampere-turns flowing in the former shall appear in the latter also. The half of the primary situated in the side opposite the loaded secondary is evidently not near enough to deliver to it the full ampere-turns, and many of these will, therefore, be wasted in creating a leakage flux that will return to the unloaded side of the core without passing through the other side. As a result, there will be a density in the core of the unloaded side greater than normal, producing corresponding differences in the voltages generated in the two secondary coils.

The General Electric company was not only the first to make the "core" type of transformer, but was also the first to overcome the difficulty of maintaining equal voltages on the two halves of the three-wire secondary. The method adopted consists of distributing equally, over the two sides of the transformer core, both halves of the secondary winding, so that each secondary, throughout its length, is closely adjacent to the entire primary winding. In order to insure the exact equality of resistance and reactance in the two secondary windings necessary to obtain perfect regulation of the two halves, the inside portion of the secondary winding on one leg of the core is connected in series with the outside portion of that on the other leg. As a result, the drop in voltage of type H transformers under any ordinary conditions of unbalanced load is the same on each half of the secondary, and is, in amount, the same as if the load were equally distributed on the two halves. Fig. 1 shows the exterior of the coils of a core-type transformer.

The method of winding is covered by letters patent No. 595,403, issued to the General Electric company, December 14, 1897, on an invention by Walter S. Moody. The accompanying illustration (Fig. 2) is the first figure of the patent.

The following figures, taken from actual tests on a General Electric type H transformer of 7,500 watts' capacity, built as above described, plainly show the results obtained:

	Side A.	Side B.
Load	0	0
Volts	104	104
Load	18 amps.	18 amps.
Volts	103.5	103.5
Load	0	18 amps.
Volts	103.8	103.3
Load	18 amps.	0
Volts	103.2	103.8
Load	36 amps.	36 amps.
Volts	102.1	102
Load	0	36 amps.
Volts	103.4	102.6
Load	36 amps.	0
Volts	102.7	103.6

Train Lighting by Electricity.

One of the subjects discussed by the International Railway Congress at its recent session in Paris was that of electric lighting of railway trains. Strange as it may appear, electric lighting is more generally in use upon the European railways than in this country, but the system being largely that of storage batteries only, the results experienced have not been altogether satisfactory. The ideal system is described in the report of the congress in the following words: "Electric lighting is without contradiction that which presents itself under the most attractive form. Incandescent electric lamps have, in fact, an incontestable superiority over all other methods of lighting [railway trains]. The electric lighting of the carriages produced by means of a dynamo driven by the axle during the run of the train realizes in principle a complete and rational system of lighting." After commenting upon its advantages, especially in the immunity afforded from the dangers of fire and explosion, the report concludes as follows: "Everything invites to the belief that from the pecuniary point of view this method of lighting will permit more favorable results than have hitherto been attained, and any disadvantage of the present is largely offset by the superiority of safety conditions and by the other inherent advantages of the method." Had the International Railway Congress been informed of the "axle-light" system of the Consolidated Railway Electric Lighting and Equipment company of New York, it might have realized in it the ideal for which it seems to have longed.

Eureka Electric Company's New Building.

Owing to the rapid development of the business of the Eureka Electric company of Chicago, it has become necessary for the company to seek larger quarters, and about February 1st it will remove from its present location at 157 South Canal street to a six-story building at 143 and 145 South Clinton street. The entire building, which is to be known as the new Eureka Electric building, will be occupied by the company in the manufacture of its well-known switchboards, telephones and protector devices. The basement floor will be devoted to the making of magnets for the Eureka magneto generators and receivers, and to the manufacture of all the iron and steel work entering into the construction of the ringers. The company's own electric-light and power plant will also be located in the basement. On the ground floor will be the offices and general salesrooms, as well as the shipping department. The second floor will be used for storage purposes, while the third and fourth floors will be utilized for the manufacture of the company's telephone instruments and switchboards. Machine rooms will be located on the fifth and sixth floors The company will have a floor space of 50,000 square feet in its new quarters and the arrangement will doubtless facilitate the transaction of its business and insure prompt attention to the needs of the trade and prompt deliveries on orders. The company will be pleased to greet its old friends and any new ones who may be interested in telephone apparatus, in its new building, after February 1st.

Eastern capitalists are considering a system of electric feeder lines for the Northern Pacific railroad in the Yakima Valley, Wash. Cheap water-power is available for generating electricity. Better transportation facilities are especially necessary for fruit growers and dairy men.

CORRESPONDENCE.

New York Notes.

New York, December 29.—A certificate of the increase of stock of the Metropolitan Street Railway company from $45,000,000 to $52,000,000 has been filed at Albany. Of the additional stock $3,000,000 is for the expense of changing motive power from cable to underground trolley, and $4,000,000 for indebtedness contracted by the purchase of stocks in other New York city railways.

The Peckham Manufacturing company of Kingston, N. Y., manufacturer of motors, trucks and car wheels, has notified its 250 employes that hereafter they will participate in the company's profits, receiving the same dividend on their wages as is paid on common stock. The coöperative plan originated with President Edgar Peckham.

The annual meeting of the stockholders of the Brooklyn Rapid Transit company will be held on January 25th. There is a report in Wall street that President Baldwin of the Long Island railroad is to enter the board of directors.

The wires of the Postal Telegraph company in Union, N. J., were sold at a tax sale recently. The company had two miles of wire strung on poles of the New York and New Jersey Telephone company, and the wire was sold for $1. The claim against the property was about $150. The wires of the Hudson Telephone company and the Western Union Telegraph company were also advertised for sale, but the former company paid the tax under protest and the Western Union stayed action by an appeal to the courts for a decision as to whether the property was real or personal.

Work on the subway progresses smoothly. There are 2,000 men at work now and 2,000 more will be employed in the spring. About 14,000 tons of the structural steel have been prepared and tested, and more than half of it delivered along the line of work. For about a quarter of a mile north from Broadway and One-hundred-and-thirty-third street the structure is practically completed, and about a block and a half near Fourth avenue and Tenth street are also completed, the steel, waterproofing and concrete being in place in each case. Other sections are progressing satisfactorily and there seems to be no doubt that the work will be finished on time. A committee of members of the Central Federated Union has held a friendly conference with John B. McDonald, the general contractor, with a view to an agreement which shall prevent all strikes among men employed in the tunnel. It is expected to result in the appointment of a joint arbitration board to settle all disputes which may arise. M. L. G.

Canadian Intelligence.

Ottawa, Ont., December 29.—J. W. Hill of Toronto, Ont., has been for the last eight months engaged in the construction of the works for the reduction plant of the Pittsburg Reduction company at Shawinigan Falls, Que. Mr. Hill says that the company intends to go into the manufacture of aluminum. This is the first establishment of the kind in Canada, and the Pittsburg company came to this side because of the Canadian corundum deposits. The reduction works, which were built at a cost of $250,000, will be operated by electricity generated at Shawinigan Falls, which are three miles north of the city of Three Rivers, Que.

Some time ago the city of Brockville, Ont., purchased the plant of the Brockville Gas and Electric Light company for $85,000, on a valuation by a Toronto civil engineer. The Brockville light commissioners, however, recently engaged a New York expert, named Mr. Blossom, to make an inspection of the plant. Mr. Blossom's report has come to hand, and it practically condemns the whole plant, which is not only stated to be out of date, but also in a very bad condition. The value of what material might be utilized would be about $30,000, but the wiring, etc., is of little account. To repair the systems as they now stand, would cost about $63,000. Mr. Blossom favors concentration of the two plants and building an entirely new system at an estimated cost of $125,000.

The negotiations for the purchase of the Metropolitan electric railway by the Toronto Railway company are not yet concluded, and the consummation of the scheme depends upon the action of the city of Toronto. The purchasing company desires that the municipality shall guarantee a perpetual entrance to the city for cars of the various radial lines. The Toronto Railway company already owns the lines radiating east and west, and if it acquires the Metropolitan and the Toronto suburban railways, it will have a considerable start toward the realization of the big radial-railway system now being promoted. It is the intention of the Toronto Railway company to improve largely and extend the present service, and also add to the number of radial lines.

The Great Dog Falls, over which the drainage of 1,200 square miles of territory passes, are to be developed into electrical power and the power transmitted to Port Arthur, Ont., by wire. The company which will develop the power has been quietly investigating the possibilities of these immense falls. The Ontario government will be interviewed, with the object of securing control of the falls at once. The Great Dog Falls are in an air line about 25 miles from Port Arthur, and, according to estimates,

are capable of giving 5,000 horsepower the year round. A. V. W.

From the Buckeye State.

Columbus, December 29.—Last Thursday a deal was completed by which the Sandusky, Norwalk and Southern Electric Railway company becomes the owner of the Sandusky, Milan and Norwalk and the White Line or People's Railway company's properties, the first an interurban line and the latter a city line. The deal has been under way for some time. The price paid, it is understood, is 37½ for the Sandusky stock and 34 for the White Line stock on a basis of 50. Emil G. Schmidt is the general manager, Mr. Adams general superintendent and Mr. Thompson superintendent of the city lines. The offices will remain in Sandusky. The lines will be improved in the city and the interurban lines will be extended south to Mansfield, it is said, in the spring.

The board of public affairs of Springfield has awarded the contract for lighting the city with 260 incandescent lights to the Springfield Light and Power company at $73 per light.

United States Consul E. N. Gunsaulus, who is home from Pernambuco, Brazil, says that they have several lines of horse cars in that city, with a population of over 200,000, but no electric lines. There are electric lines in some other portions of that vast country, however, and he believes there will be developments in this line in Pernambuco within a few years. There are several telegraph-cable lines out of that city, three of them going to continental Europe and others to coast points. In all there are more than 60 persons employed there by the cable companies, which are mostly owned and operated by Europeans, as are also the banks and large commercial houses. The locomotives used on the railroads there are of American make and he believes that there is a great future there for American goods of all kinds.

The commissioners of Franklin county have granted the Columbus, Winchester and Lancaster Traction company a franchise to build a line through the county parallel to the Hocking Valley railway.

The Norwalk, Ashland and Southern Railroad company has decided upon its line between Norwalk and Ashland and an organization will be effected in a short time.

The commissioners of Adams county have granted the Ripley Northern Railway company a franchise to build an electric line through the county along the pikes.

The American District Telegraph company of Cleveland has had its charter amended to allow it to do a general electrical business and almost any other branch of business that it may desire to enter.

The Chagrin Falls and Eastern Electric Railroad company has increased its capital stock from $300,000 to $500.000.

The Sandusky and Interurban Electric Railway company has had its charter amended to allow it to build a line from the main line at Ceylon to Norwalk by way of Berlin Heights; also a line from the main line near Oak Harbor to South Amherst.

The United Power company, East Liverpool, has been incorporated, with a capital stock of $900,000, to build and operate power and other plants and to furnish steam and electric power to private individuals and corporations. Louis A. Healy, Jason H. Brooks, George C. Anderson, William F. Halstead and Louis A. Waters are the incorporators.

The Consolidated Ice and Electric company, Cambridge, has been incorporated, with a capital stock of $100,000, to operate an electric plant for furnishing light, heat and power and manufacturing ice. The incorporators are P. C. Patterson, Charles S. Turnbaugh, H. O. Barber, John L. Locke and Y. H. Barrington.

The Northern Ohio Traction company has declared a semi-annual dividend of 2½ per cent., payable January 2d. The net earnings of this company, exclusive of interest on bonds for the portion of the year up to November 30th, were $36,388.

The Elwell-Parker Electric company's loss by fire on the plant at Cleveland is estimated at about $36,000 by the insurance companies.

Plans are on foot to extend the Salem and Lisbon electric line to Columbiana. The right of way has been secured to Leetonia.

Thomas L. Childs has been granted a franchise by the Summit county commissioners to build his road between Canton and Akron.

Attorney T. Y. McCray, one of the incorporators of the Mansfield, Mount Gilead and Columbus Electric Railway, Light and Power company, with headquarters at Mansfield, is now in the east in the interests of the proposed line. The company was incorporated recently, with a capital stock of $20,000. It is proposed to build a line from Mansfield through Galion and Mount Gilead to Columbus, with a branch from Mount Gilead to Marion and another from the main line in Delaware county to the town of Delaware. The other incorporators are J. F. Boals, Thomas E. Barrow, Lewis J. McCray and T. Y. McCray, Jr. Attorney McCray says that some of the work on the road will be done this winter, a portion of the engineering having already been done. He also states that the Mansfield, Savannah and Wellington line will be built the coming year. At the latter point this road will connect with another line, making a through route from Mansfield to Cleveland, and with the other road, from Columbus to Cleveland.

A report has been current for several days that plans are being formulated for a third-rail electric line from Columbus to Toledo along the old Sandusky road.

Colonel V. A. Taylor of the Portage Lake Traction company has secured most of the franchises necessary for that line. They provide for two lines, one running east and west from Akron to Ravenna, a distance of 17 miles, the other north and south past Lake Brady, Pippin Lake, Twin Lakes and ending at Twinsburg. North of the latter place the route has not been decided upon. The lines will cross at Lake Brady, or at least connect there. These lines will open up the northern Ohio lake country, one of the most beautiful sections of the state. The company will likely be financed within a few weeks now.

The Scioto Valley Traction company of Columbus has indicated its intention of building a line from Washington Court House, by way of Chillicothe, to Lancaster, with strong probabilities of a line between Columbus and Lancaster. With the original line from Columbus to Washington Court House this will make one of the large systems of the state.

It is reported that the name of the Ohio Valley Electric Railway company will be changed to the Camden Interstate Railway company in honor of Senator Camden, who was largely instrumental in building it, and is heavily interested in it financially.

The board of directors of the Cincinnati Street Railway company has decided that employes of the road may buy stock in the company at par, $50 a share, and may pay for it in installments or in full, just as they please. If paid in installments it will be held by the company until fully paid for, interest being paid on the money paid in. The stock will then be held by the company for five years, in order to protect it against speculators, who might put up the money and have the employes purchase the stock and transfer it to them. If the employe remains that long with the company it will then be turned over to him; but if he does not, the money he paid will be returned to him with interest.

The Dayton, Springfield and Urbana Electric Railway company has inaugurated an express system on its lines. The officials will form a system of interchange with other electric roads, and they hope in time that the plan will result in the formation of a state express company.

The receivership of the Niles Electric company, Niles, has been terminated and the receiver dismissed. The funds remaining on hand will be used to pay debts pro rata.

The Ross county commissioners have granted a franchise to the Columbus and Southern Electric Railway company to build its line from Chillicothe along the Chillicothe pike to the Pickaway county line.

The Cleveland and Chagrin Falls Electric Railway company has ordered a 220-cell storage battery which will be put in place as soon as possible. It is likely that all the northern Ohio interurban roads will install batteries if this one proves successful. This road is building a new power house about three miles from Akron.

The trouble between the two roads that asked for a franchise at Medina has been settled by the City Council granting a franchise to both, with the understanding that they use the same track.

O. M. C.

Information from Indiana.

Indianapolis, December 29.—The City Council of Montpelier has voted to purchase the local light plant now owned by the Kerlin Bros. of Toledo. The price agreed on is $38,000.

S. V. Perrott and others of Indianapolis have secured an option on the Bloomington electric-light plant. They propose adding a hot-water-heating plant.

A. D. Ogburn and others have secured a 50-year franchise for an electric-railway line at Newcastle.

The Indianapolis Street Railway company will popularize the several parks under its control by erecting a number of electrical fountains therein.

The Indianapolis, Morristown and Rushville Electric Traction company has obtained a franchise from Shelbyville for a period of 30 years. A bond of $10,000 is required to secure the carrying out of the franchise conditions.

A. N. Dukes, who temporarily restrained the sale of the old Wabash and Erie Canal towpath to the Fort Wayne and Huntington Electric Railway company, now seeks to compel a transfer of the disputed property to himself, on the ground that he held an option.

The Cambridge City Electric Light and Power company has been incorporated, with a capital of $3,000. The directors are W. H. Doney, W. A. Freitz and A. R. Feemster.

The United States Court has appointed I. N. Hawkins receiver of the Bourbon (Ind.) electric-light plant. The application was made by E. J. Marckle of Chicago and others, who loaned the company a large sum with which to make improvements. The Bourbon plant was built by the authorities of the town and there has been a dispute over rates and the estabiishment of too many lights. The plant cost about $18,000 and is bonded to that amount.

The Union Traction company's connection between this city and Anderson was successfully completed this week. The completion of the line puts Indianapolis in direct electric-transit connection with Anderson, Elwood, Muncie, Alexandria, Marion and many other towns of the gas belt along the 200 miles of electric road over which the Union Traction company operates.

Judge MacMaster of the Indianapolis Superior Court has held the Indiana interlocking-switch law unconstitutional. The law in question prescribed that all interurban electric-railway companies should construct and maintain an interlocking device at the junction of any steam road the line crosses. The judge says: "It is not just to require an electric road which crosses a steam road to put in such interlocking device and to exempt the steam road from doing the same thing when it crosses an electric road. The circumstances and conditions in the two cases are identical and the dangers to be guarded against are precisely the same, whichever road may cross the other. Such discrimination conflicts with the constitution, and is for that reason void."

A Noblesville jury returned a verdict for $7,000 in favor of J. S. Jolly and against the Indianapolis Street Railway company, on change of venue. Mr. Jolly was run over and had one foot cut off above the ankle. He asked for $20,000. F.

Memphis, Tenn.

Memphis, December 29.—F. G. Jones, general manager of the Memphis Street Railroad company, recently filed applications for permits in the sum of $239,000. The permits issued to Mr. Jones included provisions for an extension of the street-railway company's power house, corner of Broadway and Davie avenue, to cost $175,000, and for an extension of the new barn, corner of DuBose avenue and Walnut street, to cost $50,000.

The Cumberland Telegraph and Telephone company is putting in a telephone exchange at Collierville, Shelby county, Tennessee, about 18 miles from Memphis. The same company has its conduits completed and is drawing cables into them. The new central-energy switchboard is in position, and the new telephones will soon be put in.

Barton & Couch are now figuring on a telephone line from Marion, Ark., to Memphis, a distance of about seven miles.

The Memphis Light and Power company has increased its capital stock to $2,000,000. With this additional capital it will finish its underground system and add new machinery, to cost about $200,000.

The Cirizens' Street Car company of Memphis is now moving to its new building on Walnut and Spring streets. Its buildings occupy a full square and are an ornament to that part of the city. Provisions are made for the offices, shops and storage of idle cars of the company. R.

PERSONAL.

W. F. Richardson, secretary and manager of the National Telephone Equipment company of Detroit, was in Chicago last week. Mr. Richardson is spending considerable time in the South just at present, as his company is making a large telephone installation in that section.

Adolph A. Chaillet, lately technical manager of the Shelby Electric company of Shelby, Ohio, has resigned, and opened an office as consulting and contracting engineer at 476 Ellicott square, Buffalo. He will continue his connection with the Shelby Electric company as director and technical adviser and will handle the Shelby lamps.

William H. Moore, an electrical expert who was for a long time associated with Thomas A. Edison, died at his home in New York recently. He made several trips abroad for Mr. Edison, one of them being to Japan to secure pith from a jointless reed for incandescent-lamp filaments. He was 46 years old at the time of his death.

F. F. Sapp, manager of sales for the North Electric company of Cleveland, is an old Chicagoan and is pretty sure to make an annual holiday visit in northern Illinois. The season of 1900-1901 was no exception to his rule, and he pleased many of his friends in Chicago by calling upon them. Mr. Sapp regards the outlook for the new year in the telephone business as excellent.

Robert Emmett Kelley, president of the Texas Arm and Pin company of Beaumont, Texas, died recently in New York city, at the age of 47 years. Mr. Kelley started life as a printer and later became a journalist. He was for some time on the editorial staff of the Houston Post and was also connected with the Houston Chronicle. In 1899 he disposed of his newspaper interests and thereafter devoted his entire attention to the lumber business, in which he had been interested for some time previously. Mr. Kelley was highly esteemed by a large circle of friends in Texas.

W. R. Mason, formerly a well-known Chicago electrical man and more recently in charge of the Siemens & Halske interests in St. Louis, has formed a connection with the Northern Electrical Manufacturing company of Madison, Wis., and the Stanley Electric Manufacturing company of Pittsfield, Mass., and will hereafter act as district manager for those companies, with office at 110 Laclede building, St. Louis. W. H. Abbott, formerly of the engineering staff of the Siemens & Halske com-

pany, will be associated with Mr. Mason in his new connection. Both gentlemen have many friends, who will wish them every success in their new departure.

Andrew Rosewater, city engineer at Omaha, Neb., has been in New York investigating underground-conduit systems with a view to determining the most advisable course for the city of Omaha to pursue in placing its wires underground.

Señor Leandro Fernandez has been appointed minister of colonization in the cabinet of President Diaz of Mexico. He is an engineer and received his technical education in the United States, and it is related of him that about 20 years ago he delighted the people of the city of Durango by illuminating its plaza with the electric light, the first time such a thing had been attempted in Mexico.

On New Year's day Hiram S. Maxim, the machine-gun inventor and shipbuilder, was knighted by Queen Victoria. Mr. Maxim, although a naturalized British citizen, is a native of Tangersville, Me., and lived in this country until 1883. He was prominent in the early development of electricity from 1870 to 1883, when he went abroad as the representative of an electrical company. For his achievements in electrical experiment he was decorated in 1881 with the cross of the Legion of Honor by President Grevy of France. In recent years he has devoted himself chiefly to the making of automatic guns and to experiments in flying machines.

Moses Harris, a pioneer of Chicago and the original house-wrecker, died at his residence, 4804 Champlain avenue, on December 31st, after a short illness. Mr. Harris was born in Russia 62 years ago and came to Chicago at the age of 22. At the close of the World's Fair he organized the Chicago House Wrecking company with his four sons, and purchased the fair buildings for $80,000. It is said that he cleared a large sum of money on the salvage of these buildings. Other large wrecking jobs which his company has handled are the Mackay Spectatorium, Bay View plant of the Illinois Steel company at Milwaukee and the Omaha Exposition. Three years ago Mr. Harris retired from the company and his son Abraham was made president. A widow, four sons and two daughters survive him.

ELECTRIC LIGHTING.

M. Roth is interested in the establishment of a new electric-light plant in Livingston, Mont.

A bill has been passed authorizing an issue of $10,000 electric-light bonds for Petoskey, Mich.

The city of Stillwater, Okla., has voted to issue $7,000 bonds for erecting an electric-light plant.

During 1900 there were 900 arc lights added to the Chicago municipal service, making a total of 4,300.

Hayden, Wheeler & Schwend, Charlotte, N. C., want bids on a gas and electric-lighting plant for an office building.

At a special election at Tampa, Fla., an issue of $250,000 waterworks and electric-light bonds was favorably voted upon.

It is proposed to spend $10,000 for the illumination of the dome of the capitol at Washington at the time of the inauguration.

Capitalists contemplate building a large power house on the Muskegon River, near Croton, Mich. Thomas W. Orbison of Appleton. Wis., is interested in the project.

W. V. Lockwood, representing San Francisco capitalists, is making arrangements to establish an electric-light plant at Scotia, Cal., for supplying the neighboring towns with light and power.

City Electrician Ellicott of Chicago recommends a reduction of the electric-light inspection rates. The present price is $1 for arc lights and seven cents for incandescent lights, and a reduction of 15 per cent. is recommended.

It is said that the Electric company of America received about $750,000 from the South Jersey Gas, Electric and Traction company for the Camden Lighting and Heating company, and that the profit for the Electric company of America was about $200,000.

The New Martinsville Ice and Electric company has been incorporated, to establish an electric-light plant and ice factory at New Martinsville, W. Va. The capital stock is $15,000 and the incorporators are J. Scally, G. B. Woodcock, M. V. Obers, C. Beck and others.

The International Light and Power company, El Paso, Texas, will place orders within 60 days for a 200-horsepower, tandem-compound engine, 125-kilowatt, direct-connected, two-phase generator, transformers, meters, arc lamps, poles and line material; probable cost, $25,000.

A new 60-kilowatt alternator has been installed at the Chicago municipal lighting plant at Halsted street and Blue Island avenue for the purpose of supplying the incandescent-lighting system of the City Hall during the hours after 6 p. m., when the City Hall plant is not running. The transformers are in the basement of the City Hall, and the new 1,100-volt line to the power house is ready for use. Up to this time the lights during the evening have been supplied from the Edison mains, costing the city $210 a month. City officials expect to reduce the cost 50 per cent. by the new arrangement.

The Memphis Electric Light and Power company of Memphis, Tenn., will issue $2,000,000 of bonds for improvements, including its system of conduits, which will cost $500,000. General S. T. Carnes, late president of the National Electric Light association, is president of the company.

The Hinton Light, Ice and Fuel company of Hinton, W. Va., has been incorporated, for the purpose of constructing an electric-light plant for furnishing light and power in the city of Hinton. The capital stock is $10,000 and the incorporators are J. Leslie, F. W. Gilbert and J. H. Miller.

The Muskegon Electric Light company of Muskegon, Mich., has been sold to Liddon Flick and Theodore S. Barber of Wilkesbarre, Pa., the same men who recently purchased the Muskegon Street Railway and Muskegon Gas Light companies. The new owners propose to make extensive improvements in the electric-light plant and will probably consolidate the railway power house with the lighting station.

ELECTRIC RAILWAYS.

The trolley system is rapidly displacing the storage-battery cars on the streets of Berlin.

The Union Traction company of Indianapolis, Ind., has increased its capital stock from $4,000,000 to $5,000,000.

The Lake Street Elevated Railway company of Chicago has obtained its Cicero franchise and work has been resumed.

A charter has been granted at Harrisburg, Pa., for the Warren and Shefield Street Railroad company, with a capital stock of $66,000.

A trolley car at Peoria, Ill., recently jumped the track and struck a 125-foot electric-light tower. The tower fell on to a large church, badly wrecking the roof.

The Monticello, Fallsburg and White Railroad company, organized to operate a street surface road in Sullivan County, N. Y., has been incorporated, with a capital stock of $250,000.

J. H. Jeffries has been elected president, and S. W. Divine, vice-president, of the Chattanooga Rapid Transit company, which proposes making several extensions in the city and suburbs.

The Detroit, Mount Clemens, Romeo and Armada electric railway of Mount Clemens, Mich., has been incorporated for $25,000. Judge J. C. Tucker is president and F. E. Nellis, secretary of the company.

The ordinance for a 50-year franchise for the Chicago, Evanston and Northern railway has been placed on file by the Evanston (Ill.) council. It is said that it was presented merely as a "feeler" regarding the sentiment of the council.

A Christmas dinner was given by the Chicago Union Traction company and the Consolidated Traction company of Chicago to about 6,000 employes. The two companies are operated under one management, practically, and the dinner was served in the various car barns.

The Chester Traction company of Chester, Pa., has leased the Philadelphia and Chester Railway company and the Southwestern Railway company for 999 years. This gives the Chester Traction company a clear right-of-way from the heart of Chester to the southern boundary of Philadelphia, from which points the run will be made to Chester in 40 minutes.

Officers of the Metropolitan Street Railway company of Kansas City have arranged for a loan of $2,800,000 for purposes of improvement and extension. It is the purpose of the company to extend its lines with part of the proceeds of this loan and to convert some of its cable roads into electric lines. The company has outstanding $5,600,000 stock and about $4,000,000 bonds.

The Florida Peninsular Transportation company of Tampa, Fla., has been incorporated, with an authorized capital of $1,000,000. John P. Martin of Xenia, Ohio, is to be the president and general manager of the company. Charles Orr of Cleveland and William Martin and W. Reddell of Xenia are also interested. It is proposed to build an electric line from St. Petersburg to Tampa.

The Paris underground railway has drawn so much traffic from the surface roads that the latter have applied to the Municipal Council for permission to discontinue service on one tramway and two omnibus lines which are losing heavily. Answering the question of one of the councilors, the president of the underground averred his trains were faster than any rapid transit in London, New York or Chicago.

Articles of incorporation have been filed by the Detroit United Railway company, which now controls the street-railway lines of Detroit, Mich. The company has a capitalization of $12,500,000, and among the stockholders, besides the Wilson interests, are H. A. Everett and Ralph A. Harman of Cleveland. The company has elected a board of directors consisting of R. T. Wilson, M. Orme Wilson and Ralph M. Edwards of New York; Henry A. Everett and Ralph A. Harman of Cleveland, and J. C. Hutchins and A. E. Peters of Detroit. The board has elected Mr. Edwards president, he succeeding Tom L. Johnson in that office. It is said that Mr. Johnson has no interest in the Detroit lines at present. The other officers were elected as follows: Vice-president and treasurer, J. C. Hutchins; secretary, J. F. Van Name of New York; assistant secretary, E. A. Peters. A. B. Du Pont, late manager, now of St. Louis, will retain the position of consulting engineer.

AUTOMOBILES.

An automobile show is to be held at the Second Regiment Armory in Philadelphia on February 4th to 11th. It is stated that all the prominent manufacturers of automobiles, as well as automobile accessories, will be represented. The list of exhibitors two weeks ago numbered about 50.

It is possible that the Chicago Public Library may inaugurate an automobile service in place of the present delivery wagons, seven in number, which are in use for distributing books from the central library to the sub-stations. The proposition has met with support by reason of the fact that electric power for the vehicles could be furnished from the library plant.

SOCIETIES AND SCHOOLS.

The American Mathematical society held its annual meeting on December 28th at Columbia University in New York city and elected Professor Eliakim Hastings Moore of the University of Chicago president. The summer meeting will be held next August at Cornell University.

The one-hundred-and-forty-ninth meeting of the American Institute of Electrical Engineers will be held on January 9th in connection with an Institute dinner at Muschenheim's, 41 West Thirty-first street, at 7:00 p. m. The topic for discussion after dinner will be "Electricity in the Last Century and in This." The council will meet at the office of the Institute in the afternoon of the same day.

ELECTRICAL SECURITIES.

Directors of the General Electric company have declared the regular semi-annual dividend of $3.50 a share on the preferred stock, payable January 31st to stockholders of record at the close of business January 15th.

Directors of the Union Traction company of Chicago announce that they have decided to carry out a plan of refunding the outstanding six per cent. certificates of indebtedness of the North Chicago street railroad by issuing a new 4½ per cent. bond. There are in the neighborhood of $1,600,000 of these certificates of indebtedness outstanding, and consequently the refunding of them in a 4½ per cent. bond would result in a saving in interest charges of about $23,000 a year.

MANUFACTURERS AND DEALERS.

A company known as the National Measured Service company of Chicago has been incorporated, with $50,000 capital, to manufacture the telephone service meters which are the invention of H. D. Stroud and L. A. Schmidt. The officers of the company are: President, William T. Fenton; vice-president, C. H. Chadwick; secretary, P. J. O'Keeffe; treasurer, Robert M. McKinney; general manager, James E. Plew.

One of the most important points to be considered after securing a good telephone cable terminal is to obtain a good protection for it. Among other casings the metal one manufactured by the Moon Manufacturing company, 43-49 South Canal street, Chicago, is particularly noteworthy. It is made of the best galvanized iron, with a heavy coating of mineral paint, thus making it rustproof, and with a sliding door, making it dustproof. The casing is stormproof, well stayed and riveted, making it very strong and durable, while it is subject to practically no damage whatever from change of weather. The sliding door when opened exposes the entire sides of the terminal head without any obstruction whatever, making it very easy for the workman to operate.

The St. Louis Electrical Supply company, 911 Market street, St. Louis, Mo., has issued an interesting catalogue and price-list, describing its telephones and switchboards and illustrating its different lines of telephone supplies. The company's No. 909 long-distance telephone is a handsome instrument and is said to be made with the best material only and guaranteed to be equal, if not superior, to any telephone on the market. It is finished in either oak or walnut and has an adjustable arm, concealed cord, solid-back transmitter and double-pole receiver. In presenting its central full-metallic-circuit switchboards, the company has absolute confidence that there is nothing better on the market at any price. The company also believes it has succeeded in combining a perfect self-restoring drop with the most simple mechanism. It handles a full line of receivers, magneto bells, transmitter parts, induction coils and transmitters, as well as other telephone accessories.

PUBLICATIONS.

The 1901 edition of the Columbia desk calendar is distributed by the Columbia sales department of the American Bicycle company, Hartford, Conn. This useful compilation has been issued annually for the last 16 years and has come to be regarded as almost indispensable in many business offices.

A new booklet on electrical conductors has just been issued by the American Steel and Wire company and copies may be obtained by addressing the company at any of its sales offices. The booklet is a "pony" catalogue and price-list of electrical wires and cables for telegraph, telephone, light and power circuits and is to be followed later by a more elaborate production.

A catalogue describing the Model gas and gasoline engines has been issued by the manufacturer, the Model Gas Engine company of Auburn, Ind. These engines, which are described and illustrated quite fully, are designed to operate with any grade of gasoline, producer gas, coal gas or distillate, and can be used for driving any machinery or doing any work for which power is required.

TELEGRAPH.

The old home of Professor Samuel F. B. Morse, the inventor of the telegraph, situated on the old Post road, near Poughkeepsie, N. Y., has been sold by William Morse, one of Professor Morse's sons, to F. J. Hulst.

It is reported that the strike of the Santa Fe operators has been declared off. General Manager Mudge of the Santa Fe system stated that the Order of Railway Telegraphers would not be recognized under the present management.

A Manila report states that during the last month the cable ship Burnside was to have begun the laying of 600 miles of cable connecting Negros, Mindanao and Jolo. Much annoyance has been caused among the Philippine Islands by cutting of cables and telegraph lines.

The work of placing underground the wires of the Allegheny (Pa.) fire-alarm and police telegraph is almost finished. The work is being done under the supervision of Superintendent Elmer Loomis of the bureau of electricity. A feature of the new system will be the placing of the terminal boxes within easy reach of the sidewalk, instead of being on top of the poles, as formerly.

MISCELLANEOUS.

Electric haulage on the canals of Belgium is on the increase, according to a recent consular report. A Brussels company has a system in operation between Virginal and Ruysbroeck, about 14 miles, using 30 tractors and four electric tugs. It is equipped to supply electricity for towing by day and night, for small and medium industries, and eventually for neighboring rail and tramway lines and night public lighting.

The General Electric company has closed a contract with the Bethlehem Steel company for six more of the weldless field rings of Bethlehem nickel steel for the extension to the big power plant at Niagara Falls. These rings measure 142½ inches outside diameter and 130¾ inches inside, leaving the walls 5⅞ inches thick. The width of face is 50¼ inches, and the estimated weight of each ring is about 35,000 pounds. They will be worked up on a mandrel, under the hydraulic press, and are said to be among the largest forgings of this sort which have yet been produced.

N. Shellinger, an electrician in St. Joseph, Mo., made an interesting experiment recently, according to an Associated Press dispatch. In the presence of several physicians a cat was killed by electricity, the current being maintained until the animal was pronounced dead by the physicians present. After several minutes, during which the action of the heart had entirely ceased, the current was reversed, and the heart began to beat slowly. A low-potential alternating current was then turned on, and after a few minutes the action became regular and the cat showed signs of life. The animal was said to have entirely recovered within two hours.

W. P. Beardsley, general manager of the Altoona Phœnix Telephone company of Altoona, Pa., has patented a new glass insulator which is said to possess many desirable features. The device is made in two parts which screw together. In the lower and inner part is a pawl, worked by a steel spring that catches and holds the wire tightly and prevents it from slipping, just as the present tie wire does. The new insulator thus does away with the tie wire entirely, thereby reducing the expenses of maintenance considerably. In addition, the new insulator allows of the slack in any wire being taken up without climbing more than one pole. The insulator is also double-grooved, thus allowing of its use in transposition work without a second insulator.

TRADE NEWS.

It is reported that the St. Louis Car company may remove its plant from St. Louis to Norfolk, Va.

Partrick, Carter & Wilkins of Philadelphia have removed to the new buildings at 1231-1239 Callowhill street, where the office is located, and to 407-409 North Thirteenth street, the company's new factory.

The Liberty Incandescent Light company of Chicago has been incorporated, with a capital stock of $2,500, to manufacture lighting and heating apparatus, by Jacob Zaun, W. H. Weisler and Matthew Stoker.

The Randall-Loudon Electrical company of Memphis, Tenn., has gone out of business. James D. Randall, the president and manager of the company, will have an office at 40 Monroe street and will act as manufacturers' agent.

The Badt-Goltz Engineering company of Chicago remembered its friends with this novel New Years greeting: "Happy New Century.—May your capacity be always larger than your load, and may you never be troubled with high peaks."

The Joseph Dixon Crucible company, Jersey City, N. J., according to its annual custom, has again presented to its journalistic friends, with the compliments of the season, a very useful assortment of its well-known pencils, crayons and erasers. The gift is one that is appreciated by all recipients.

N. S. Amstutz and H. C. Osborn announce that they are associated under the name of the Amstutz-Osborn company, located in the Caxton building, Cleveland, Ohio, where they will be pleased to see their friends. The gentlemen are designers, supervisors and constructors of special mechanical and electrical devices and also solicitors of United States and foreign patents.

Charles A. Olson of the Crane company, Chicago, formerly superintendent for the Westinghouse company at St. Petersburg, Russia, was a recent visitor at the International Correspondence Schools, Scranton, Pa. Mr. Olson stated that a number of men in his employment in Russia were students of the schools. As instruction is carried on by mail, no difficulty is experienced in teaching students at a distance, and, in fact, the schools have students in over 100 foreign countries.

The friends of James E. Duff will be interested in the knowledge that he has been appointed Chicago representative of the Economy Electric company, manufacturer of incandescent lamps, at Warren, Ohio. Mr. Duff is widely and favorably known to the electric-lighting fraternity of the West and Northwest, having been associated for a long time with the Chicago Edison company and later with the Renew Lamp company. In addition to manufacturing new incandescent lamps, the Economy company makes a specialty of renewing burned-out lamps, and as Mr. Duff has had a wide experience in this line, it is predicted that he will be successful in his new relation.

The exhibits at the recent annual meeting of the Roentgen Society of the United States, held in New York city, included all kinds of apparatus for generating X-rays, such as static machines, direct-current coils, high-frequency sets, etc. The exhibitors of static machines included the Waite & Bartlett Manufacturing company, Van Houten & Ten Broeck, the Electric Therapeutic Manufacturing company of Indianapolis and Swett & Lewis of Boston, Mass. Direct-current and high-frequency coils were exhibited by the Edison decorative and miniature-lamp department of the General Electric company, Harrison, N. J. Direct-current coils were also shown by Oelling & Hinz of Boston, Mass., and a special high-frequency set by Dr. Kinraid of Boston, Mass. A large number of all kinds of Crookes tubes were shown by the General Electric company. Barium fluoroscopes were exhibited by Mr. Jackson of Orange, N. J., and the General Electric company.

The rapid increase in the business of the Keystone Electrical Instrument company of Philadelphia has rendered it advisable for the company to carry a complete stock of its indicating instruments in New York city, in order to meet demands for prompt deliveries in cases of emergency. The stock will comprise combination portable voltmeters, ammeters and wattmeters, direct-current, portable voltmeters and ammeters, switchboard voltmeters and ammeters in illuminated type K and type R cases, switchboard potential indicators, arc-light voltmeters and ground detectors, constant-potential ground detectors, polarity indicators and vehicle voltameters. The stock will be very complete, and in the various types enumerated will cover all ordinary ranges in voltmeters, from 10 volts up to 700, and in ammeters, from 15 to 500 amperes. A portion of this stock will be on exhibition at the company's office, 15 Cortlandt street, the remainder being held in its storeroom, boxed and packed, ready for delivery.

BUSINESS.

The Electric Appliance company, Chicago, is sending out literature describing its Packard transformer of the "Mark VI" type.

The Texas Arm and Pin company of Beaumont, Texas, manufacturer of long-leaf, yellow-pine cross-arms, space blocks, oak and hardwood-lumber pins and brackets, asserts that it has the largest stock of short arms ready for shipment in the United States.

The American Bridge company has lately taken a contract for three large viaducts on the Chicago, Burlington and Quincy railroad and also is building a 300-foot draw span for the same company. The Rock Island railroad has placed a contract for 3,500 tons of material, to be delivered during 1901.

The constantly increasing trade of F. N. Manross, Forestville, Conn., manufacturer of hair springs for all kinds of marine clocks, steam and electric gauges, etc., and also non-magnetic hair springs, has compelled him to enlarge his factory, and he is now in a better position than ever to accommodate his customers.

In a recent issue of the London Engineer an Englishman tells his countrymen why he buys American tools, and emphasizes the selling power of good catalogues by this statement: "I am using a Sturtevant fan, which happened to be the first selected, and that on account of the excellent catalogue issued."

Charles B. Besly & Co., 10 and 12 North Canal street, Chicago, report recent shipments of small tools and supplies to Ohio, Indiana, Iowa, Texas, Kansas, Nebraska, Montana and Utah. Many letters are being received from foreign countries asking for circular matter and full particulars regarding the Besly specialties, and recent shipments have been made to Buenos Ayres, Montevideo, Brazil and England. Numerous orders are being received for the Gardner grinders.

The American Electric Fuse company of Chicago has secured from the C. McIntire company of Newark, N. J., a general western agency for the sale of the well-known McIntire specialties. The company also sells the American connectors, as well as a full line of fuses, fuse blocks, lightning arresters, paper insulators, magnet wire, etc., and it has recently secured a general agency for the sale of the American battery compound. The company guarantees this compound to be the most economical, the cleanest and longest-lived battery salt ever put on the market.

W. N. Matthews & Bro. of St. Louis, the enterprising manufacturers' agents and distributors of "used" material, report that they have been particularly successful with the Stombaugh guy anchor, a device which greatly cheapens the cost of pole-line construction. They are now selling a lot of "used" outriggers, windlasses and arc-lamp hoods discarded by the Missouri-Edison Electric company of St. Louis in consequence of losing contract for city lighting. These gentlemen have adopted the use of the term "used" because they say their material is not second-hand in the ordinary sense of the word. Matthews & Bro. are agents for Packard products, Paiste specialties, Akron Insulator and Marble company's goods, Cling-surface and several other good lines.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued December 25, 1900.

664,369. Telegraphy. William E. Athearn, New York, N. Y. Application filed April 5, 1900.

The telegraph line contains a pair of condensers and Morse signal transmitters alternately discharge the condensers into the main line. The condensers and transmitters are included in a shunt from the main line, choke coils being installed in the main line between the shunt connections. A diaphragm receiver is in circuit with a transformer or induction coil, the primary of the transformer or induction coil forming a part of the line in which it may be inserted.

664,371. Electric Heater and Circuit Controller Therefor. James I. Ayer, Malden, Mass., assignor to the Simplex Electrical company, Boston, Mass. Application filed May 20, 1899.

The heating chamber has an opening and heating resistances disposed about its sides, a switch-controlling circuit-closure of the resistances and a switch lever pivoted to the chamber support, carrying a circuit-closing blade. A spring attached to the switch lever normally urges it to a position of open circuit. Slots in the chamber walls are provided for a gate passing through them and attached to the lever. There is an opening in the gate so located that the opening in the gate and the opening in the chamber coincide when the gate and lever attached are moved to a position of circuit-closure.

664,396. Dynamo-electric Machine. Israel Fisher, Boston, Mass., assignor to Reuel W. Waters, Newton, Mass. Application filed April 3, 1899.

This machine has a multipolar field in which adjacent poles alternate. The armature has two pole pieces for each field pole piece, the armature pole pieces being slightly out of line with each other. There are coils for the adjacent pole pieces of each set, adjacent coils being wound in opposite directions. A commutator is provided for each set, having adjacent segments connected respectively with the coils, the segments connected with each set of coils being also connected with each other. The brushes are so arranged that the segments shift the current through them at the time when the pole pieces are substantially in line with the field pole pieces.

664,430. Telautograph or Facsimile Telegraph. Anton Pollak, Budapest, Austria-Hungary. Original application filed February 17, 1899. Divided and this application filed December 21, 1899.

The receiving instrument has a swinging mirror, a lever connected to the mirror for operating it, and a disk formed with a cam surface for moving the lever. A shaft is adapted to move synchronously with the shaft of the conf

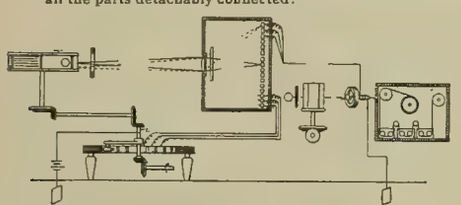
mutator of the transmitting station, and a spring is adapted to hold the shaft in contact with the cam surface of the disk, whereby upon rotation of the shaft the lever will act to swing the mirror, until the lever reaches the end of the cam surface upon the disk, whereupon it is suddenly retracted under the operation of its spring, and again commences its swinging movement. (See cut.)

664,432. Insulator. Edward Renault, Waldo, Fla. Application filed May 8, 1900.

This insulator consists of a body having a restricted top or neck, thereby forming a shoulder on the body, the neck being externally threaded and provided with a groove or opening therein, the bottom of which is curved and merges into the shoulder. The shoulder is beveled and curved as described, and a cap is threaded on the restricted neck and has its lower edge beveled and curved, the extreme edges of the shoulder and edge being rounded or curved in opposite directions.

664,442. Coil for Electromagnets. Severn D. Sprong, Long Branch, N. J., assignor of two-thirds to Charles Getter and William P. Adams, Long Branch, N. J. Application filed November 29, 1899.

This patent is on an electromagnetic coil, comprising a central tubular cylinder, of insulating material, coils of wire of differing thickness surrounding the cylinder, rings of insulating material surrounding the cylinder and separating and insulating the coils, and pierced with apertures through which pass the inner ends of the wires, and all the parts detachably connected.



NO. 664,430.

664,459. Overhead Electric Trolley. James H. Brown and William H. Tobin, Jr., Pittsfield, Mass. Application filed July 10, 1900.

The trolley harp has one of its side members jointed to the fixed part and adapted to be moved in either direction in relation to the trolley wheel and a device adapted to operate to hold the jointed side member of the trolley harp rigidly fixed in place adjacent to the trolley wheel and to be moved at will away from the same. Two sets of ball-bearing adjuncts are arranged, one set in each side member of the trolley harp, and comprise in each set two ball cups, a double ball cone between the two ball cups, two series of balls and a coupling device between each double ball cone and the axis of the trolley wheel.

664,470. Construction for Third-rail Electric Railways. William Courtenay, New York, N. Y. Application filed September 29, 1900.

The insulator block consists of an integral generally rectangular piece of non-conducting material having a drip or overhang at the sides, and a perforation in the direction of the axis of the rail. The two anchors are at diagonally opposite corners of the block, each embracing a corner of the block, and each held to the tie or sleeper by a bolt or the like passing through the anchor and into the sleeper or tie.

664,503. Collector Ring. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 29, 1900.

This current collector comprises a split hub adapted to engage a shaft, a flange at one end of the same forming an end plate for the collector, a number of insulated contact rings, separating rings of insulating material between them, an end plate, an adjustable clamping ring concentrically supported in the plate, and adjusting screws mounted on the plate for shifting the clamping ring in its seat.

664,511. Electric Cut-out. John H. Trumbull and Henry Trumbull, Hartford, Conn., assignors to the Trumbull Electric company, Hartford, Conn. Application filed April 17, 1899.

This cut-out comprises a base piece, carrying contacts, each having a loop with a transverse opening and a clamp for a line wire, and a removable cap for the base piece. The contact pieces on the cap have spring arms that register with and engage respective loops, the arms being provided with a stop and on the outer end a latch located at an angle across the arm.

664,537. Process of Extracting Copper. James Douglas, New York, N. Y. Application filed September 22, 1900.

The claims cover the process of reducing copper ore and matte, which consists in electrolyzing solid cuprous chloride, employing the gases evolved in the treatment of copper ore and matte, employing the electrolyte resulting from the electrolyzing of the solid cuprous chloride as a solvent for the cuprous chloride so produced, and recovering the copper from the solution by electrolysis.

664,550. Electrolytic Treatment of Iron for Preservation Thereof. Henry L. Hollis, Chicago, Ill. Application filed February 20, 1899. Renewed May 16, 1900.

The subject of this patent is a method of electrolytically treating iron objects to change the surface portions of the iron to protective coatings of iron oxide, which consists in temporarily inserting the object to be treated in a suitable oxidizing and cleaning reagent as an electrolyte, temporarily connecting the object as a cathode with a source of electricity, passing an electric current through the electrolyte and iron object to remove foreign material from the object and thereafter connecting the object as an anode with a source of electricity and passing an electric current through the iron object and electrolyte, whereby oxidizing conditions are furnished at the surface of the iron object. This causes oxygen to unite with the iron to form the protective coating. The flow of current through the iron object is then stopped and the object removed from the bath.

664,554. Regulating Socket for Multifilament Incandescent Electric Lamps. Charles A. Hussey, New York, N. Y., assignor to William P. Pinckard, Birmingham, Ala. Application filed August 29, 1900.

This socket has contact pieces corresponding to the lamp contact pieces and also two line terminals, to one of which one of the single-filament contact pieces is connected through its corresponding socket contact piece. Two switch contact pieces in the socket are electrically connected each to one of the other socket contact pieces, and a revoluble four-sided commutator is provided, formed of insulating material, but having contact pieces suitably disposed upon its surface and adapted to make contact with such switch contact pieces, and having also suitable conductors connected to its contact pieces, whereby by the rotation of the commutator the filaments may be connected to the line in series singly or in multiple.

664,557. Telegraph Switchboard. Francis W. Jones, New York, N. Y., assignor to the Postal Telegraph-cable company, New York, N. Y. Application filed July 16, 1900.

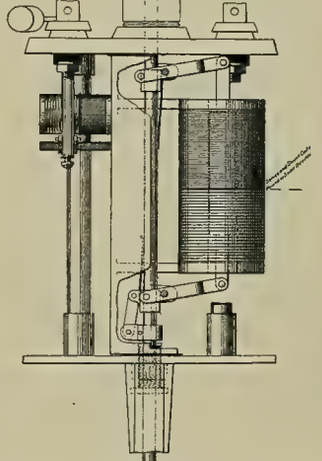
Two transverse series of conducting strips are fixed at opposite sides of an insulating frame, each strip having holes or perforations, the holes in the upper or exterior strips being larger than those in the lower or interior strips. A double contact plug consists of a split metal pin engaging the smaller of the holes and a tapered metal sleeve or section located on the pin but insulated therefrom closely engaging the larger of the holes.

664,594. Means for Transmitting Motion to Distant Points. David P. Thomson, Lynn, Mass., assignor to the General Electric company of New York. Application filed September 29, 1900.

This invention is applicable especially to a system of train control for direct-current motors, comprising a motor controller, and an actuating device therefor comprising relatively movable members, a rotary converter operated from the direct-current source and having its alternating-current side connected to the winding on one of the members, a system of train conductors to which the winding on the other member is connected, and a master controller connected to the train conductors, constructed and arranged to short-circuit successively the winding on this member along angularly displaced lines.

664,649. Brush Holder for Dynamo-electric Machines. Christian W. Kragh, Madison, Wis., assignor to the Northern Electrical Manufacturing company, Madison, Wis. Application filed September 11, 1899.

The holder comprises a holding piece provided with an opening in which the brush is movably mounted, a contact piece bent at one end so as to form a channel in which a portion of the brush is received so as to make stationary contact therewith, the other end of the contact piece securely connected with the holding piece and a spring connected with the holding piece and adapted to act upon the brush so as to force it toward the commutator.



NO. 664,713.

664,650. Electromagnetic Ore Separator. Emil Kreuser, Mechernich, Germany. Application filed September 2, 1898.

A pair of closely placed co-operating rotary electromagnets are each provided with pole surfaces and a cylindrical core having inducing coils and arranged so that the magnetic lines of force are produced directly in the co-operating magnets, whereby the path of magnetic flux forms the shortest possible closed circuit, and the lines of force pass through a single air space constituting the magnetic field. Connections between the coils and the source of energy are such as to permit the rotation of the cylinders and the coils therewith.

664,667. Electric Push-button. Thomas A. Nathans, New York, N. Y. Application filed June 1, 1900.

A bottom plate holds a removable casing, and a push-button slides through the top of the casing. A double contact device is adapted to close independently a normally open circuit when the push button is depressed, and also when the casing is partially removed from the bottom plate.

664,679. Accumulator. Louis Renaud, Paris, France. Application filed May 24, 1900.

A perforated metallic vessel contains a mixture of 70 per cent. litharge and 30 per cent. minium, and forms one electrode. The other electrodes consist of perforated metallic tubes filled with a mixture of five parts of minium, 25 parts of litharge and a modicum of sulphate of sodium located in each of the perforations and out of contact with the metallic vessel and its active material. An electrolyte fills the space between the two electrodes.

664,681. Electric Call Box. Edgar E. Salisbury, Chicago, Ill., assignor to the National Autophone company, Chicago, Ill. Application filed July 24, 1900.

The call box contains a spring motor, radial arms arranged in the electric circuit and adapted to be rotated by the motor, a circuit-breaker coacting with the arms, a receiver lever, and a disk on the shaft supporting the arms. The disk is provided with notches, a pin on the receiver lever engaging in either one of the notches. A contact spring is adapted to be moved into circuit-closing position by the upward movement of the receiver lever, and a lever is provided for winding the motor.

664,691. Telephone Exchange System. Charles Timberlake, Indianapolis, Ind. Application filed October 23, 1899.

In a telephone exchange system a cut-off relay and a line relay are connected with the calling line of each subscriber. There is a spring contact plate near each line relay with a line to the electromagnet of each cut-off. Each of the electromagnets is connected to a battery. There is a contact point near each of the contact plates, and a common wire from the battery to each of the contact points, and means are provided for forcing the spring contact plate into engagement with the contact point near each line relay by the action of the armature of the relay.

664,713. Electric Arc Lamp. Royal E. Ball, New York, N. Y., assignor to the Ball Electric company, Yonkers, N. Y. Application filed September 21, 1899.

The lamp described comprises two carbon rods and feeding mechanism for the carbon rods provided with two separate levers, one of which has a greater leverage than the other. The lever having the lesser leverage normally sustains the weight of the carbon rods during the burning of the first carbon, and means are provided for transferring to the lever having the greater leverage, when the first carbon has been consumed, part of the weight sustained normally by the other lever, whereby the loss of weight due to the consumption of the first carbon is compensated for by the increased leverage thrown upon the feeding mechanism. (See cut.)

664,733. Method of Converting the Energy of Alternating Electric Currents into Effective Mechanical Energy. Rudolf Eickemeyer, Yonkers, N. Y. Application filed November 21, 1892.

This patent covers a method of converting the energy of alternating electric currents into effective mechanical energy, which consists in eliminating counter electromotive force of self-induction from alternating-current machines, by reducing the self-induction of the field windings with respect to that of the armature windings, establishing bifilar or inductionless circuits at appropriate portions of the armature circuits, and opposing a high magnetic resistance to the fluxes in the local magnetic circuits surrounding the armature conductors. (See cut.)

664,757. Telephone Service Apparatus. Uriah S. Jackson, Ossipee, N. H. Application filed June 15, 1900.

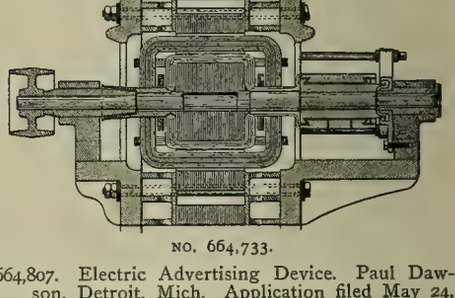
A series of boxes each has a clock train-operated disk and contact pins in the disks, also contact plates adapted to complete a telephone circuit through the contact pins and a magnetic device for controlling the clock train. Each of the boxes has a door the opening of which operates a switch whereby its connected telephone is put into the line circuit, and the direct circuit to the disk is cut out.

664,761. Printing Telegraph. Edgar Kinsman, Malaga, N. J., assignor of one-half to Alfred B. Richman, Malaga, N. J. Application filed December 21, 1899.

The type plate carrying a set of types is mounted in connection with a wheel having a groove therein which extends four times around its circumference and consists of alternate parallel and diagonal portions, constructed to reciprocate the type plate longitudinally by turning on its axis in one direction. A synchronizing system comprises an electric circuit, and circuit-breakers, one on the transmitter and one on the receiver. The circuit-breakers are connected to their respective instruments in such a way that the circuit is completed and broken simultaneously at both stations. A switch cuts out one of the circuit-breakers, and sounders are included in the circuit and adjacent to the circuit-breakers.

664,802. Fire-alarm Telegraph. Leonidas G. Woolley, Kenton, Ohio, assignor to the National Magneto Electric Telegraph company, Springfield, Ohio. Application filed July 20, 1900.

A time wheel is operated by any convenient motive power. A lever is operated by the time wheel, and a magneto-electric generator by the lever. A weighted lever has its free end raised between the times at which impulses are sent out over the line, and by its falling movement operates the electric generator.



NO. 664,733.

664,807. Electric Advertising Device. Paul Dawson, Detroit, Mich. Application filed May 24, 1899.

A revolving drum is composed of two heads or disks, formed with perforations near their peripheries and fastened upon a shaft, and flexible tablets are pivotallies secured in the perforations in the heads of the drum. The tablets are struck up from a blank of thin sheet metal having one of its edges reinforced by doubling the metal back upon itself, the reinforced portion projecting beyond the opposite ends of the blank and forming flattened pivots therefor, whereby any one of the tablets may be mounted or dismounted from the drum by slightly flexing it.

664,819. Electric Safety Appliance for Railroads. Edward L. Orcutt, Somerville, Mass., assignor to the International Railroad Safety Appliance company, Kittery, Me. Application filed January 3, 1898.

The track circuit is composed in part of the rails of the track, and includes a contact plate. A brush is placed on the train, and a supply of electricity on the train is connected with the brush to charge the track circuit when the brush engages the contact plate. A parallel or line circuit on the track includes a second contact plate, and a signal on the train is connected with a second brush. A mechanism on the track is included within the track and line circuits at the opposite end of the circuits to where their respective contact plates are connected, operated by the current of electricity in the track circuit to generate a current of electricity in the line circuit and thereby operate the signal on the train.

DESIGN.

33,780. Supporting Bracket for Telephone Receivers. Edgar C. Peixotto, Augusta, Ga. Application filed November 23, 1900. Term of patent, seven years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, JANUARY 12, 1901. No. 2

New Polyphase Plant of the Commonwealth Electric Company.

The growing tendency of central-station companies to supersede systems consisting of a number of scattered and comparatively small operating stations for others based on single large alternating-current plants distributing to sub-stations is well illustrated in the new station on the South Side of Chicago, recently constructed by the Commonwealth Electric company. When the Commonwealth company was organized nearly three years ago to consolidate all the central-station systems of Chicago outside of the territory occupied by the Chicago Edison company, it secured control of nine stations. According to an agreement entered into at that time, the Commonwealth company has occupied that portion of the city extending north of North avenue, west of Ashland boulevard and south of Thirty-ninth street. The six stations that were located in the southern portion of this district were soon afterward consolidiated into three plants, located at Fifty-sixth and Wallace streets in Englewood, Fifty-third street and the Illinois Central railroad tracks in Hyde Park, and Ninety-sixth street and Erie avenue in South Chicago. The territory that has been supplied by these three stations up to quite recently, and which will soon be handled solely by the new station, lies between Thirty-ninth street and the southern limits of the city at the Indiana state line and extends from the lake to the western limits of the city, embracing a section over 60 square miles in area. The new polyphase generating plant adjoins the old Commonwealth station (formerly a station of the People's Light and Power company), located at Fifty-sixth and Wallace streets, and supplies the Hyde Park district through a new sub-station erected to take the place of the old station at Fifty-third street and the Illinois Central tracks, which has been recently abandoned.

The map of Chicago, given in Fig. 2 on the next page, shows the territory covered by the Edison and Commonwealth companies. The heavily shaded portion indicates the districts supplied by the Chicago Edison company, while the light shading shows that part of the outside district that is now being covered by the Commonwealth Electric company. The stations of the Commonwealth company indicated are the Lake View station, with its Edgewater sub-station, and on the South Side the Fifty-sixth street station (station A), with its Hyde Park sub-station, and the South Chicago station. The transmission lines connecting generating plants with sub-stations are indicated by heavy lines. An idea of the large area south of Thirty-ninth street that is eventually to be covered entirely by this new Fifty-sixth street plant can be readily obtained from this map.

The old station adjoining the new main plant, which contains several series arc machines, will be continued in operation for the present. South Chicago and the territory now supplied from the station at Ninety-sixth street and Erie avenue will soon be taken care of by a new sub-station modeled after the Hyde Park sub-station and receiving its power from the main power plant.

Station Building.

At Fifty-sixth and Wallace streets the Commonwealth Electric company owns a large piece of ground west of the tracks of the Monon, Chicago and Eastern Illinois and other railroads. On the north end of this site is the old station, while adjoining it closely on the south is the new plant, with its two large cooling towers at the extreme southern end of the property. A good idea of the appearance and arrangement of the building may be obtained from the picture shown in Fig. 3 and from the plan (Fig. 4).

The station building is constructed almost entirely of brick, no steel being used in the walls. The outside walls are finished with sand-molded, red pressed brick. The building is 112½ feet wide and 120 feet long and is divided longitudinally by a brick wall into an engine room 55 feet in width and a boiler room 46 feet wide. The engine room has a clear height of 57 feet from the floor to the bottom of the roof trusses. It is well lighted by long windows on the side and north end and by two monitors in the roof. The boiler room is also well lighted. A special wire glass is used in all the windows. The interiors of both rooms are faced for a distance of six feet from the floor with white enameled brick, the remainder of the walls being painted with a specially prepared interior paint. The engine-room floor, as seen in Fig. 1, has been made to look very neat and attractive by the use of small hexagonal imported tiles, one-half inch thick, laid on concrete.

Boilers and Coal-handling Apparatus.

In the boiler room (Fig. 5) are installed four Babcock & Wilcox boilers in batteries of two each. These boilers are rated at about 500 horsepower each and are equipped with chain-grate stokers of the Babcock & Wilcox type. Superheating coils installed under the steam drums of the boilers are designed to be heated by the hot gases after they have crossed the water tubes for the first time and before they make their second crossing. In the cross-sectional elevation of the station, shown in Fig. 6, space is shown above the west ends of the boilers for the future installation of a fuel economizer. The coal-handling apparatus consists of a longitudinal conveyor and a cross conveyor equipped with McCaslin buckets and installed by the John A. Mead Manufacturing company. Coal is unloaded from the railroad track on the east side of the building into a coal crusher, whence it is carried by the cross conveyor to the main conveyor. This latter conveys the coal to the steel coal bins above the east ends of the boilers. These bins, which have a total capacity of 1,000 tons of coal, feed by means of hoppers and pendulum chutes to the grates of the boilers below. The cross conveyor and crusher are driven by a 30-horsepower, three-phase, 220-volt, General Electric induction motor, while a 20-horsepower motor of the same type drives the main conveyor. The conveyor system has a capacity sufficient to handle 50 tons of coal an hour. To provide for the removal of ashes from the boilers an ash bin has been provided. It receives ashes that are carried up from the basement by the main conveyor. The ashes are delivered by means of a chute running outside the building to cars on the railroad track, or wagons.

The breeching from the boilers leads into a stack, which is built of brick from the foundation to the roof. Above the building the stack is made of steel, the top being 200 feet above the ground. The chimney room below the stack proper is 19 feet in diameter, while the stack itself is 12 feet in diameter. The basement level of this room is used for storing and filtering oil, while the floor above is utilized

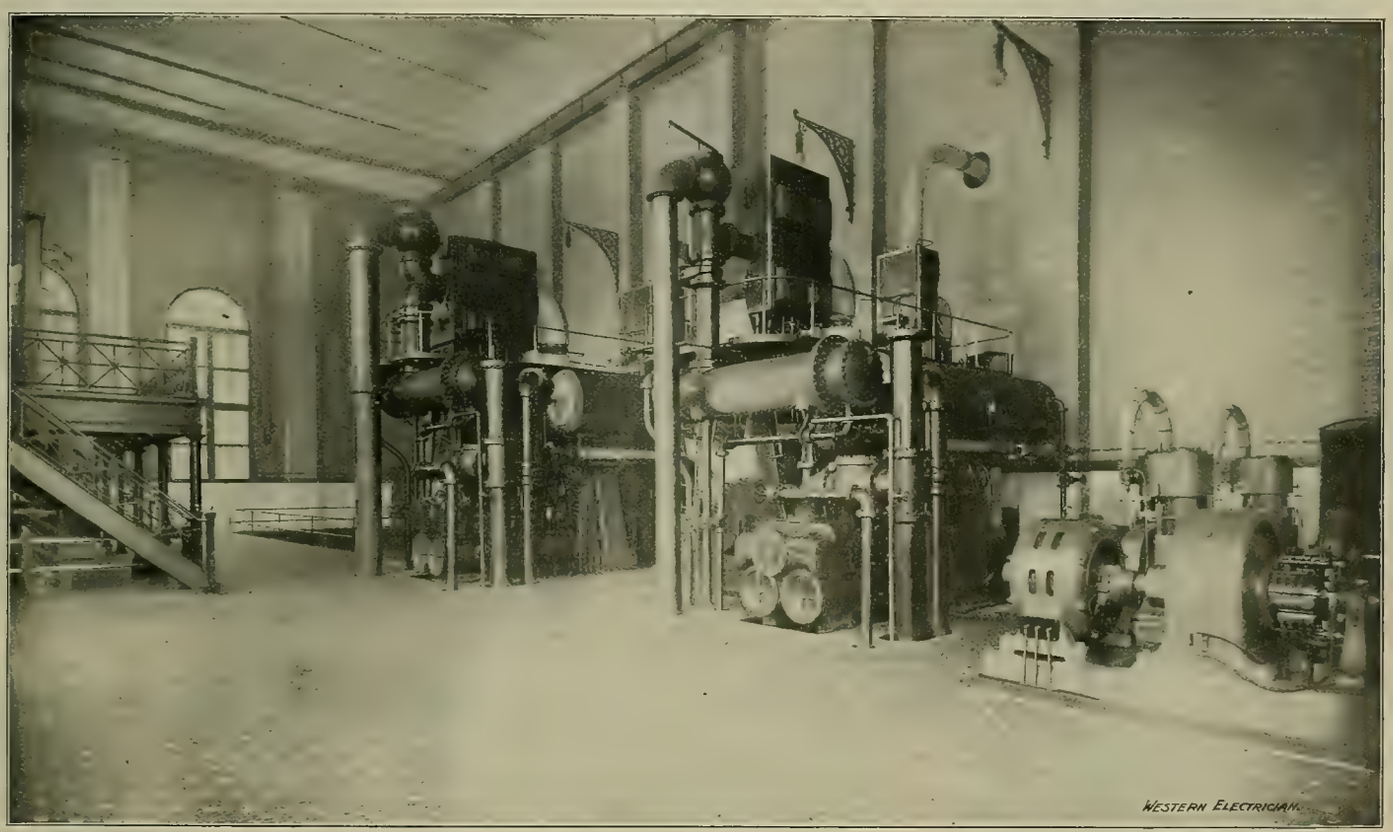


FIG. 1. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—VIEW IN ENGINE ROOM OF STATION A

as an entrance room to the boiler and engine rooms from the south entrance.

Engines and Generators.

The present engine-room installation consists of two three-phase, alternating-current, direct-connected units of 400 and 1,000 kilowatts' capacity, respectively. The alternators are of the revolving-field, General Electric type, with 48 poles, and deliver a 4,150-volt, three-phase current, with a frequency of 60 cycles a second. They are mounted between the cranks of vertical cross-compound engines, built by the Southwark Foundry and Machine company. The smaller engine has cylinder dimensions of 15 and 32 by 36 inches, while the dimensions of the larger engine are 23 and 52 by 36 inches. Both engines run at 150 revolutions a minute, which is an unusually high speed for engines of this size. The requirements for regulation are

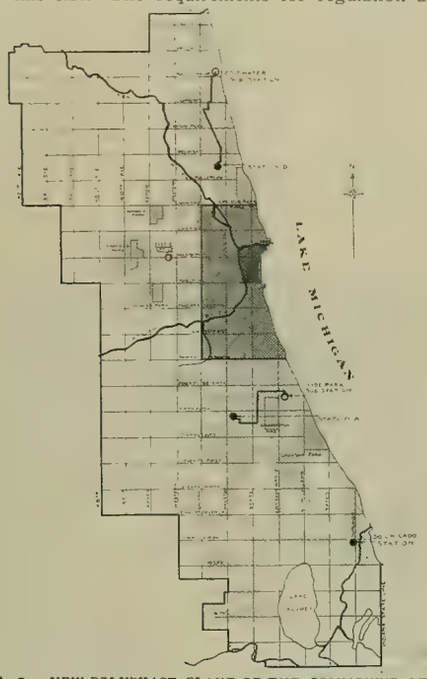


FIG. 2. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—MAP OF CHICAGO SHOWING COMMONWEALTH DISTRICT IN LIGHT SHADING.

extremely rigid, as the generators are intended to be operated in multiple.

In order to facilitate the adjusting of an engine, either for synchronizing purposes or for distributing load between the two engines after they have been in operation for some time, a special electrical governor control has been designed by C. G. Y. King, mechanical engineer of the Commonwealth company. This apparatus, which is installed on each engine, consists of a one-fourth-horsepower, three-phase, 220-volt induction motor, mounted on a carriage which replaces the adjustable weight on the blade of an ordinary Porter-Allen governor. It is controlled entirely by the switchboard attendant. The motor when running moves this carriage along the blade of the governor by means of a worm and gear. In Fig. 7, which shows the 1,000-kilowatt unit, a portion of the governor is seen at the left, while the device is shown in detail in Fig. 8.

Cooling Towers and Auxiliary Apparatus.

The engines are run condensing, the exhaust steam passing through jet condensers. In the absence of a natural source of water, cooling towers have been provided to cool the condensing water. Two of these have been erected, as seen in Fig. 2. They are of the Worthington, natural-draft type, and are the first cooling towers of this design to be erected in the country. In construction each tower consists of a cylindrical boiler-iron shell, 80 feet in height, erected on brick piers over concrete water basins, which are sunk below the ground level. The air pumps force the hot water from the condenser-discharge main to a height of about 30 feet above the ground within the cooling towers, at which level the water is scattered by means of revolving distributors, working similarly to ordinary lawn sprinklers. These distributors are located in the conical-shaped sections of the towers. The section of each tower below the distributors is made up of tiers, each formed of about 950 hollow cylinders of tile, each tile having an average length of 24½ inches with an inside diameter of six inches and an outside diameter of 7½ inches. Each tower contains a little over 10,000 of these tiles, which gives a very large cooling surface. The portions of the towers above the distributors are open, to provide draft and to carry the water vapor to a height where it will not be objectionable.

Water for the station is obtained from the city mains and also from an artesian well, which empties into a large reservoir. This artesian water, when mixed with the city water, in the right proportion, has been found to give excellent results as feed water for the boilers. The boilers are supplied with water from this reservoir by means of two vertical marine-type Worthington pumps, each 10 by seven by 12 inches in size. Installed near the base of the stack in the boiler room is an auxiliary Cochrane feed-water heater. A Goubert primary heater receives the exhaust of the main engines. Under normal operation the air pumps exhaust into the intermediate reheating receivers between the high and low-pressure cylinders of the main engines, while the exhaust from the exciter engines can be turned either into these receivers or into the open feed-water heater, depending on whether the exhaust of the feed pumps is or is not sufficient to heat the feed water up to 212 degrees.

Just south of the 400-kilowatt unit, as shown in Fig. 1, are installed three 30-kilowatt, direct-current exciters. Two of these are driven by simple, vertical engines and one is direct-connected to a 50-horsepower, 220-volt induction motor. A 20-ton electric traveling crane spans the engine room and is operated by three 125-volt, direct-current motors. The crane was built by Pawling & Harnischfeger of Milwaukee. Current for its operation can be supplied by any of the exciter units, when operated on a direct-current power bus. Arrangements have been made for charging automobiles from these exciter units. A complete gravity oiling system is installed in the station.

Electrical Design.

This station has been designed so as to transmit power to sub-stations economically and also to utilize the existing overhead single-phase feeders which distributed current from the old station and which represented quite a large part of the total investment in this territory. Therefore it was decided to install high-potential, three-phase generating units, from which the current for transmission to the sub-stations could be taken direct and which, by splitting up the three-phase current into single-phase circuits, could also be used for the distribution in the vicinity of the station. The method of breaking up the three-phase into single-phase current is unique and interesting.

The Y or star method of connecting the windings of the generators has been adopted, which gives a potential of 2,400 volts as a maximum between the common junction of the Y, or neutral point, and any of the three outer terminals, while the voltage be-

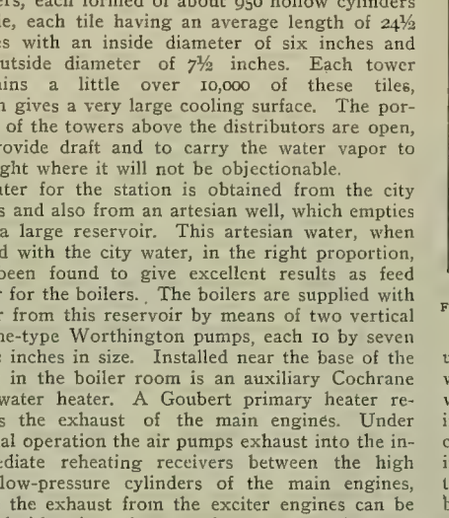


FIG. 3. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—STATION A.

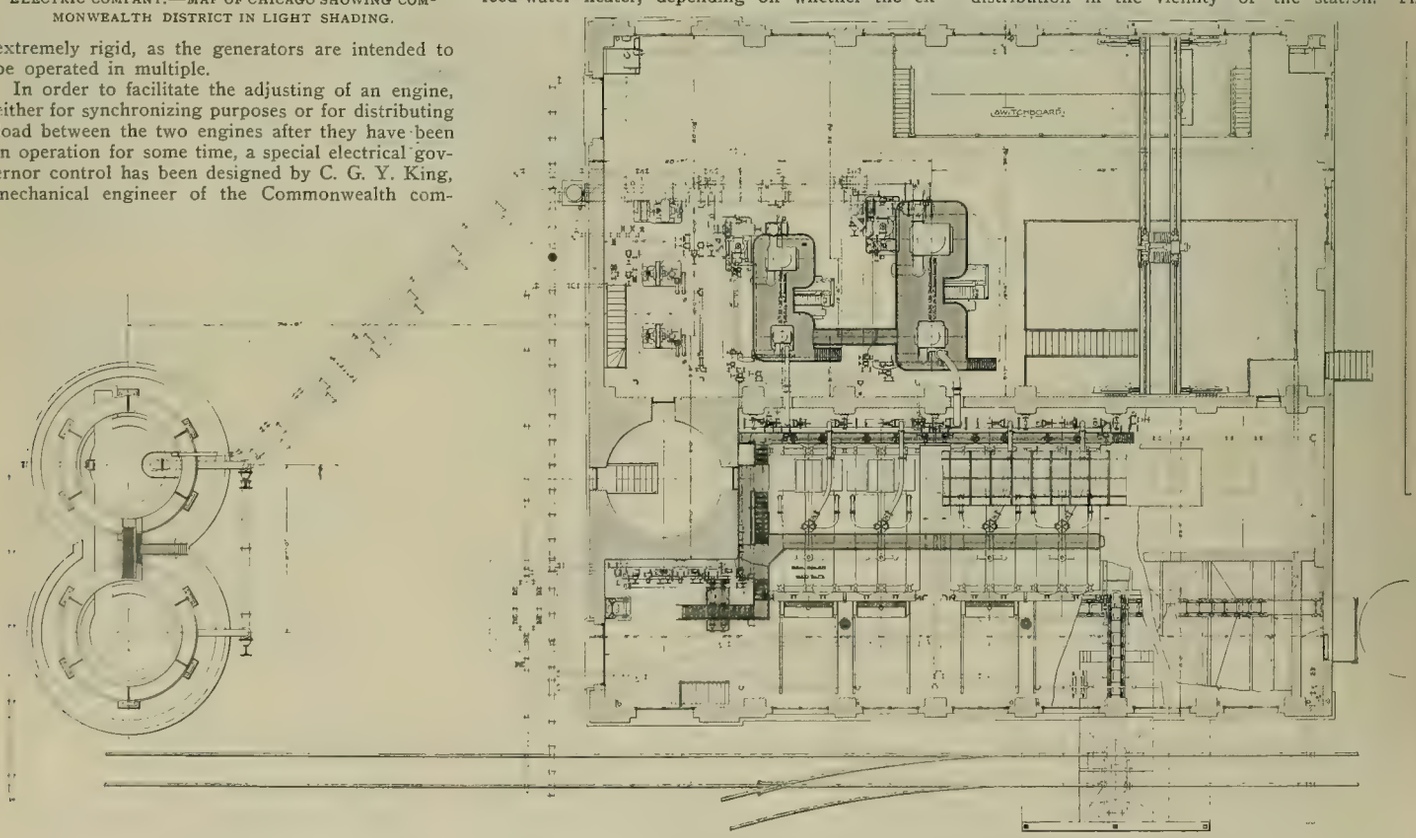


FIG. 4. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—PLAN OF STATION A AND COOLING TOWERS.

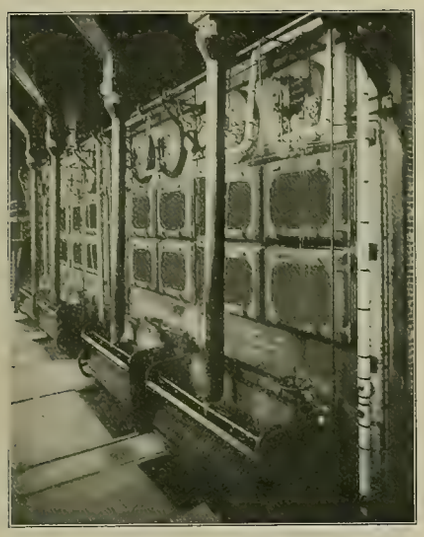


FIG. 5. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—BOILERS AT STATION A.

tween any two of the outer terminals is $2{,}400\sqrt{3}$ volts, or about 4,150 volts. There are two sets of buses, consisting of four bars each, on the switchboard connecting with the three machine terminals and the common junction point. The connection of the 2,400-volt, single-phase, feeder circuits to the 4,150-volt bus-bars is made by connecting each circuit between the neutral and one of the outer wires of the Y, care being taken that the feeders are divided in such a way as to balance the load. A single-pole, triple-throw, balancing oil switch, which is connected in on one side of each single-phase feeder circuit is so arranged that each side of the circuit can be thrown on to any one of the three bus-bars of the three-phase circuit. In the other leg of each feeder circuit is a knife switch to the neutral bus, an ammeter and a potential regulator. From each center of distribution a pair of pressure wires is brought back to the switchboard with the full primary voltage, so that the voltage at the distant ends of the feeders can be readily and accurately observed by the switchboard attendant, thus enabling him to maintain a very close regulation on the entire distribution system.

In order to provide for a load of induction motors, which is being developed in the territory, four-wire, three-phase feeders for both lights and motors have been arranged for. The motors will be operated on the 4,150-volt, three-phase circuits, while the lighting load will be connected between the neutral and one of the three main outside conductors, giving the ordinary primary voltage for lighting of 2,400 volts. In the neutral wire of these combined lighting and power circuits is connected a potential regulator, no regulation being necessary on the motor voltage. Pressure wires are brought back to the switchboard to indicate the distant voltage on the lighting branches of the circuits. An ammeter connected in the neutral lead of these circuits indicates the lighting load, while an ammeter in one of the outside wires gives the three-phase current in one leg going solely to the motors. The transformers for the motors will have 4,150-volt primary windings, Y-connected, while the secondaries will be delta-connected to the motors. The arrangement is such, however, that standard transformers are used for both lighting and power service. In connecting these combination lighting and power circuits to the bus-bars a triple-pole, single-throw oil switch is used.

Switchboard.

In the design of the switchboard special care was taken in order to get a board which embraced the latest knowledge of polyphase equipment, which would be fireproof in every particular, and which also could be extended and enlarged to meet the requirements that might be necessitated by the future growth of the station. Regard as to the appearance of the board was also taken into account, which has resulted in a very pleasing and attractive design. The switchboard is double-decked, the fronts of both sections being set off with ornamental railings, while substantial stairways lead to the gallery at either end. In Fig. 9 is given a general view of the switchboard. The upper portion of the board consists of operating panels, no high-potential circuits being connected to it, while on the lower section below the gallery are what are known as

FIG. 7. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—1,000-KILOWATT UNIT.

bus-bar panels, carrying switches and apparatus which need to be handled but seldom. There are 15 panels in each section, each 36 inches in width, making the board 45 feet long. Each operating panel corresponds exactly to the bus-bar panel immediately beneath it. White Italian marble has been used for the panels of the board, while a Tennessee marble is used for the floor of the operating gallery. The switches and fuses for the different phases on the bus-bar panels are separated by slate barriers. The trimmings of the board and gallery are in black ironwork, while instruments having a black oxidized finish are used on the board. The panels are interchangeable from end to end. Those at the south end (the left-hand side in the illustration) each accommodate two single-phase, two-wire, lighting feeders. At present there are seven two-wire and one four-wire combined lighting and power feeders connected to the board. Any one of the panels which now accommodates two two-wire feeders can, by the addition of two extra ammeters and four extra fuse blocks, be made to take care of two four-wire feeders instead. This can be done without any changes being made on the front of the panel, excepting the addition of the ammeters.

Beginning at the left end of the board the first six panels are designed for feeder circuits, each feeder having on its bus-bar panel, besides the fuses, four double-throw switches, which are used to throw over the connections from the main to the auxiliary bus-bars. These switches are formed of two independent blades of different lengths, so that the two cannot be thrown over by one movement of the switching pole. This prevents leaving the feeder circuit open when the change is made from one set of buses to the other. In normal operation the two sets of three-phase bus-bars are tied together in parallel by an electropneumatic tie switch, while the neutral buses are connected by a hand-operated oil switch. The seventh and eighth panels are station-power and ground-detector panels, and on the latter are mounted two visual lamp signals marked "open" and "closed," respectively, which indicate whether the bus-bars are electrically tied together or not. The instruments on each feeder on the operating panels consist of a voltmeter, an ammeter, a hand wheel, geared on the back of the board by means of bevel gearing to the balancing oil switch situated just below the gallery floor and back of the board, and the handle for controlling the potential regulator situated just in the rear of the panel.

On each of the generator operating panels are mounted three ammeters, three indicating wattmeters, one voltmeter and multiple-point voltmeter switch, one double-pole double-throw switch designed to connect the synchronizing apparatus in such a way that a generator can be synchronized with either bus, one three-pole double-throw switch for reversing the motor on the electrical governor control, one single-pole single-throw switch for controlling the pneumatically operated generator switch, one field rheostat and one specially designed field switch with discharge resistances.

At the extreme right of the board are four three-phase, four-wire panels for the long-distance transmission lines leading to the sub-stations. At present only two of these panels are in use, namely,

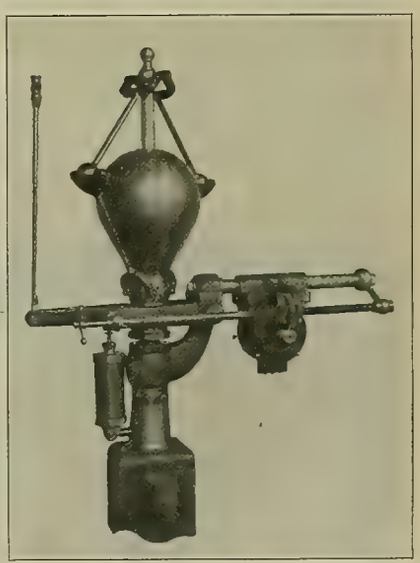


FIG 8. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—ELECTRIC GOVERNOR CONTROL.

those controlling the two transmission lines which supply the Hyde Park sub-station. Besides the indicating instruments for the two circuits, each panel has four wheel handles, each one of which operates an oil switch, placed below the gallery floor, by means of bevel gearing. These switches are to be used in case of emergency to switch any one phase wire of one transmission line to the corresponding phase wire or neutral wire of the other line.

The only integrating instrument on the board is a wattmeter on one of the bus-bar panels, which registers the current going to the exciter and coal-

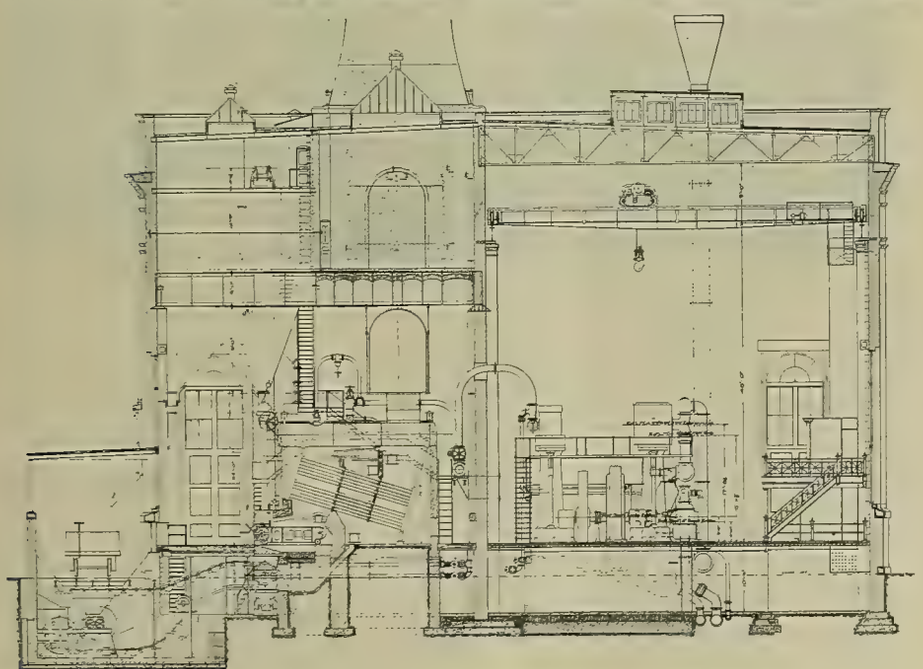


FIG 6. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—CROSS-SECTION THROUGH STATION A.

handling motors. A record sheet is kept by the switchboard attendants, upon which readings of the indicating instruments are recorded at regular intervals. A recording wattmeter is provided on an insulated stool, so that it can be connected at any time into any of the circuits to obtain the power factor or any desired data.

In Fig. 10 is given a view of the rear of the bus-bar section of the switchboard looking north. The two sets of bus-bars are located at about the center

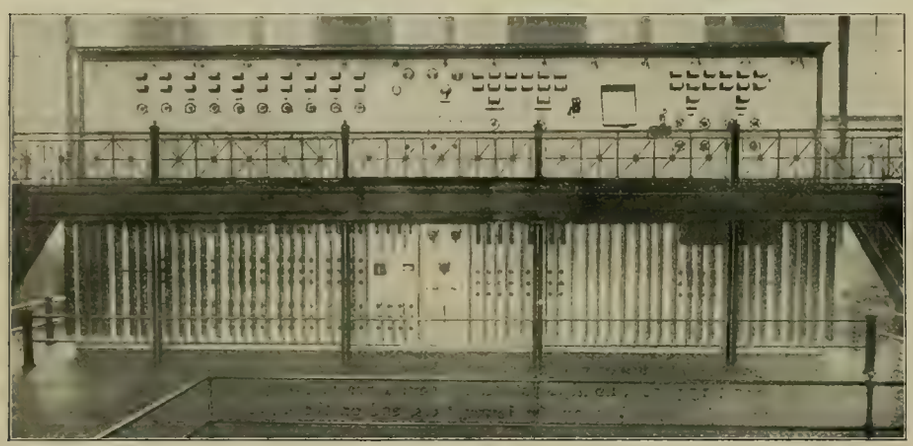


FIG. 9. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—MAIN BUS BAR AND OPERATING SWITCHBOARD IN STATION A.

of the panels, while suspended from the gallery floor above are the balancing oil switches for the feeder circuits controlled from the operating board above. In the center of the space are shown the electro-pneumatic oil switches for the generators, mounted in brick, fireproof compartments, while at the extreme left are seen a portion of the current transformers used in connection with the ammeters on the switchboard. Fig. 11 is a view of the rear of the operating section of the board from the north end. The bevel gearing connecting the oil switches below with the handles on the front of the board is shown, while at the further end, on the floor, are placed the potential regulators for the single-phase lighting circuits. The field rheostats are seen in the middle of the board. Mounted on frames along the wall in this section of the switchboard are potential transformers and the necessary fuse blocks for the voltmeters.

Several special details that have been brought out in the construction of the board are of interest. In order to prevent any high-potential currents from reaching the operating board, current and potential transformers, with grounded secondaries, have been provided for the indicating instruments, and insulating joints have been placed between the potential regulators and the balancing oil switches and their handles on the front of the board. The current or ammeter transformers of one rating are all interchangeable. The instruments are of the horizontal, edgewise type, and were supplied by the General Electric company, which also furnished the oil switches and the potential regu-

FIG. 11. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—REAR OF OPERATING SWITCHBOARD.

lators. The General Incandescent Arc Light company supplied the special high-tension knife switches, all low-tension switches and all other fittings used on the board. The bus-bars are supported on glass insulators of a special design and are wound with a varnished-cambric insulation, which is treated with fireproof paint.

Leading from the switchboard the outgoing cables are carried to the basement and on frames under the floor along the west side of the building to the southwest corner of the engine room. Here they are carried up vertically inside of a sheet-iron shaft to a point near the roof, where they pass through the wall in iron pipes. Outside the building the cables are connected to weatherproof wire on a fixture fastened to the building. Before leaving the building, however, all the circuits are provided with lightning arresters, which are mounted on marble slabs fastened to the wall. This lightning-arrester board (Fig. 12) is provided with a special gallery and is reached by a ladder. All the cables inside the building are lead-covered. Those leading from the switchboard to the outside distribution consist of No. 2 copper wire, covered with a paper wall six thirty-seconds inch thick, and encased in a lead sheath three thirty-seconds inch in thickness. In all wiring inside of the station where lead-covered cable is used, the lead has been carefully grounded in several different places to minimize the danger to attendants.

For the general artificial illumination of the engine room 12 constant-potential, alternating-current G. I. arc lamps are installed. They are supported from ornamental iron brackets, six on each side of the room. The incandescent lighting of the engine and boiler rooms is controlled from three cut-out cabinets, each of which is equipped with a double-throw switch, so that in event of trouble on the distributing circuits or in the station, these can be thrown over to one of the steam-driven exciters, thus insuring light in the station for every emergency beyond that of shutting off the supply of steam from the boilers.

Hyde Park Sub-station.

The transmission line between the main generating station and the Hyde Park sub-station is about 16,000 feet long and consists of eight No. 2 main conductors and four No. 10 pressure wires. The main conductors virtually comprise two transmission lines, each having what might be called a quadrilateral arrangement of conductors. When standing under the transmission line and looking from generating station to the sub-station No. 1 transmission line would appear on the left and No. 2 on the right, the two neutral wires being always carried on the two pins nearest the pole on the second cross-arm. The other three main conductors, being transposed at each of two underground crossings, divide the line into three overhead sections. One of these underground crossings is at Garfield boulevard and the alley east of Michigan avenue, and the other is at Fiftieth street and Grand boulevard. Unusual care has been taken in the construction of this transmission line. Specially selected poles, varying from 45 to 55 feet in length, are used, these being of cedar and shipped in from the state of Washington. Locke's No. 15, triple-petticoat, glass insulators are used, the wires being spaced 18 inches center to center.

This new Hyde Park sub-station, which has been erected for distributing purposes, is located at Fiftieth place and Cottage Grove avenue. The building (Fig. 13) is a brick structure, with two stories and basement. The first floor is used as a distributing room and office for trouble men and as a small storeroom for lamps and ordinary supplies. The basement is utilized as a general storeroom, while the second floor has been handsomely fitted up as living apartments for the men in charge of the sub-station.

The sub-station equipment proper consists of a trunk-line switchboard of two panels and a main switchboard of 10 panels taking care of eight two-wire, single-phase and two four-wire, three-phase feeders, each feeder panel having a full complement of indicating instruments, fuses, balancing oil switch, potential regulator and knife switches, similar to the equipment at the generating station. The pressure

FIG. 10. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—REAR OF BUS BAR SWITCHBOARD.

wires leading back to the main station give the attendant there the sub-station voltage. No step-down transformers are used in this station, the distribution being the same as from the generating plant. An auxiliary board, equipped with fuses, switches and instrument transformers, is placed back to back with the main board. In Fig. 14 is shown a view of the main switchboard, a portion of the rear of the auxiliary board, and at the right, near the floor, a section of the fuse cut-outs for all the circuits mounted on marble slabs.

The overhead transmission line to this sub-station is taken underground at a distance of about 400 feet from the building, the underground portion consisting of two No. 0 three-conductor cables for the main conductors and one No. 0 for the neutral. The distributing feeders leave the sub-station underground. each feeder line consisting of one No. 2 duplex lead-covered cable for the feeder and one

FIG. 13. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—HYDE PARK SUB-STATION.

No. 14 duplex, lead-covered cable for the pressure circuit. In addition to this, the four-wire feeder lines have one No. 6 duplex cable for the two power wires. Underground primary taps from the feeder ends are made with No. 6 single-conductor cable. The idea in laying out the underground system in this way was not only to reduce the cost by using duplex cable, but also to have a uniform arrangement, under which all the duplex cable would be known either as feeder wires or as pressure wires, while single-conductor cable could be recognized as being distributing wires from distributing centers.

In the territory which is supplied directly from the generating station, no rearrangement of feeder wires was necessary, as it is located very near to the old station. In the territory now supplied from the Hyde Park sub-station, however, considerable rearrangement of circuits was needed, as the old generating station supplying that section was located at Fifty-third street and the Illinois Central railroad tracks, over a mile distant. It is interesting to know that from this old station considerable two-phase power had been supplied. Such customers' motors were all changed, three-phase motors being installed and three-phase current supplied with very little loss of time. This, of course, necessitated that the work of rearranging the circuits and installing the new motors had to be carried on simultaneously, in order to avoid interruption of service to the customers.

Conclusion.

In the design of the main generating station the Commonwealth company has made provision for the installation of another battery of two 500-horsepower boilers and two 1,000-kilowatt generating units similar to the large unit already installed. Steps have already been taken toward the installation of a portion of this additional equipment, a contract for the new boilers having already been signed, while one of the new generating units has practically been contracted for. As an additional consideration for the future growth of the plant, the north wall of the building has been made of temporary construction, so that the station can be increased to twice its present size by extending it north on the site of the present old station. This will provide for six more boilers and four more 1,000-kilowatt units. In that case a new stack would be erected at the north end of the building and two additional cooling towers would be built on ground already available to the west of the present towers. In the event of the extension of the station building and the consequent removal of the old station, it is probable that the arc-light load will be taken care of by series alternating-current circuits supplied through suitable apparatus, which would deliver constant current when connected to three-phase, constant-potential bus-bars. It is thus seen that the Commonwealth company has provided an up-to-date and thoroughly equipped station, with an ultimate capacity of 10,000 horsepower, and it is not unlikely that within three or four years it will be necessary to utilize the entire capacity of the plant. The next step in the development of the company's plans, however, will probably be the abandonment of the South Chicago generating station and the equipment of a distributing sub-station, in its place, similar to the Hyde Park sub-station. The transmission to the South Chicago statoin will be about nine miles in length.

The design and successful completion of a large polyphase generating station, such as this company has just finished, calls for the best of engineering skill and experience. All the electrical features of this station and the sub-station, including the switchboards, rearrangement of circuits, etc., were designed by gentlemen connected with the engineering staff of the Commonwealth Electric and Chicago Edison companies, and the entire station was also erected under their supervision. The design of the station building was carried out by the architects, Shepley, Rutan & Coolidge, while the mechanical features, including the engines, boilers, coal-hanling apparatus, steam and water-piping systems, etc., were laid out by Sargent & Lundy, consulting engineers to the Chicago Edison company.

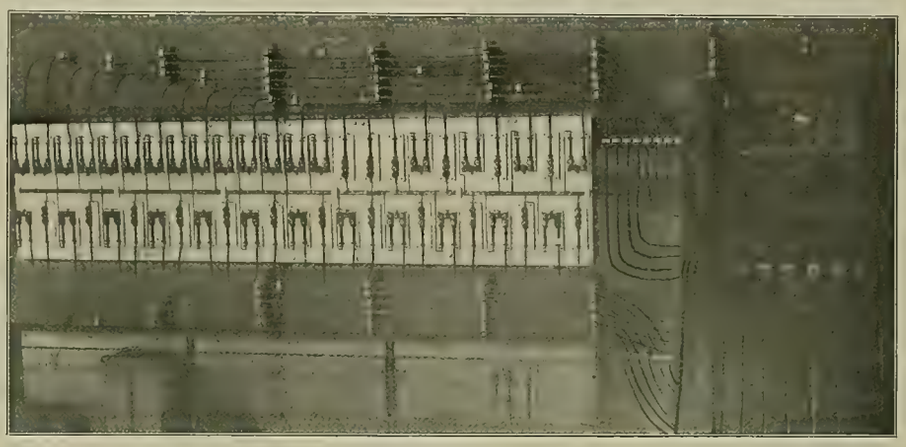


FIG. 12. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—LIGHTNING-ARRESTER BOARD IN STATION A.

FIG. 14. NEW POLYPHASE PLANT OF THE COMMONWEALTH ELECTRIC COMPANY.—VIEW IN HYDE PARK SUB-STATION.

Tesla Has a Message from the Stars.

Nikola Tesla gave to friends interested in the Red Cross movement this century greeting: "The retrospect is glorious, the prospect is inspiring. Much might be said of both. But one idea dominates my mind. This—my best, my dearest—is for your noble cause. I have observed electrical actions which have appeared inexplicable. Faint and uncertain though they were, they have given me a deep conviction and foreknowledge that ere long all human beings on this globe, as one, will turn their eyes to the firmament above with feelings of love and reverence, thrilled by the glad news: 'Brethren! We have a message from another world, unknown and remote. .It reads: One—two—three—' "

Mr. Tesla states that in some experiments which he has been conducting for some time he has been noticing disturbances that have had a peculiar effect on his oscillatory instruments. "What these disturbances are caused by," says Mr. Tesla, "I am unable to say at present, but I am firmly convinced that they are the results of an attempt by some human beings, not of our world, to speak to us by signals. I am certain of some points in connection with these things I have noticed. I am absolutely certain that they are not caused by anything terrestrial. I know, too, that they are not caused by the sun or moon, and hence I am forced to the belief that they come from some other planet. That we can send a message to a planet is certain. That we can get an answer is probable. Man on earth is not the only being in God's great system of worlds that is in possession of a mind."

The inventor sees no reason why communication cannot be opened in a comparatively short time with either Mars or Venus, or perhaps both, and suggests an electrical vibratory method of signal service.

Power Development on the Snake River.

The Trade Dollar Consolidated Mining company has in course of construction a power plant at Swan Falls on the Snake River, in Idaho, to operate its mines and mills at Silver City. The site selected is near an island, and a concrete dam has been built on one side of the island and a crib dam on the other side. All the material for the concrete, except the cement, was found on the spot, and it is stated that much of the gravel used ran $1 in gold a cubic yard. There are installed four 72-inch McCormick turbines, which will furnish 750 horsepower each, with a 17-foot head. They will be belted to Westinghouse two-phase generators of 300 kilowatts' capacity each, delivering power at 500 volts. The transmission voltage will be 20,000. T. T. Johnston of Chicago is consulting hydraulic engineer for the company and L. B. Stillwell of New York is the consulting electrical engineer. The company has been spending about $50,000 a year for steam power, and the new plant will undoubtedly effect a great saving.

Chicago Electrical Association.

The regular meeting of the Chicago Electrical association was held in its rooms in the Monadnock block on the evening of January 4th. The new officers were installed and, in the absence of the president, Vice-president Harold Almert presided at the meeting. The paper of the evening was presented by Albert Scheible, his subject being "Popular Notions as Hindrances to Electrical Progress." He spoke of many of the commonly accepted theories in regard to the nature and action of electricity and contradicted the popular idea that electricity is still in its infancy. His paper proved to be a very interesting one and was discussed briefly by the members present. Harold Almert, the retiring treasurer, reported 57 members in the association and that the finances were in good condition. The meeting closed with a short discussion on what should be done to increase the interest in the society and its meetings. At the meeting of the association on January 18th, Mr. Almert will present a paper on "Standardization of Arc Lamps."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The Fifty-sixth and Wallace street plant of the Commonwealth Electric company of Chicago, described at some length in this issue, is an excellent example of modern central-station practice. In the general design of this three-phase system the company has wisely looked ahead to the future needs of the large territory covered and has not only made provision for distribution by means of sub-stations to the thickly populated and distant sections of Hyde Park and South Chicago, but has also planned a station that can readily be increased to nearly twice its present capacity of 1,400 kilowatts, and which ultimately, by practically duplicating the station, may be made to provide a total of 10,000 horsepower. Of special interest in the equipment of the station are the use of 4,150-volt alternators, the splitting up of the three-phase current into single-phase components to utilize the single-phase feeders already erected, and the installation of a switchboard that is probably as near perfection in such features as interchangeability and extension of panels, convenience for operation, safety to attendants and avoidance of fire risk as could be built at the present day.

From a number of sources the Western Electrician has received flattering expressions of approval of its Twentieth Century Souvenir Number of last week. These complimentary references to the design and execution of this special issue are gratifying, and, without attempting to return a separate message of thanks to each one of the many friends who, by letter or personal assurance, have made pleasant reference to the New Years number, we can assure them that all their kind words are appreciated.

Whether municipal corporations have the right to enforce the removal of the poles and wires of electrical companies from the streets of cities is an old question, but one that is continually recurring. It has lately come up in Denver and in Indianapolis, and is always of interest and importance. A correspondent of the Western Electrician has lately had occasion to look up the law on the subject in the state of Indiana and he finds that the police power with which municipal corporations are invested clothes such corporations with authority to regulate the use of streets by electrical companies. The acts of Congress in relation to post roads do not impair the police power of the state or its municipalities, for all rights are acquired subject to that power. The police power of a state is very broad and comprehensive. However, it is by no means unlimited.

Where the consent of a municipality is made a condition precedent, the city may usually impose conditions which amount to more than mere police regulations. Thus, it may not only designate the route, the location of poles and wires, and the like, but it may also, in many instances, exact conditions as the price of its consent far more onerous than it would have any right to prescribe as mere police regulations where its consent was not required or after it had once been given.

A city invested with local control of the public ways may regulate the use of such ways by electric companies, and may, it seems, within limits, change the mode of use, although it may entail a large expense on the companies. It has been contended that a city cannot arbitrarily require a change in the location of poles, wires or other appliances, but it is difficult to say what can be considered an arbitrary exercise of power, for there can be no doubt that under the police power such a corporation may compel changes to be made whenever necessary to promote the public welfare, and to a very great extent the city authorities must be the judges of what is required by the public welfare. It has been held that although a city corporation may grant to an electric company the right to use the street, either by authorizing poles and wires to be placed upon or over the surface of the street, or by requiring wires to be carried underground, it cannot authorize such a use as will divert the streets from the use for which they were primarily intended. But the authority of a city, where not restricted by statute, to license the use of its streets by electrical companies or companies of a similar nature, is asserted by many cases; and the mode in which such companies may use the streets, provided their character as public ways is not destroyed, is, as a rule, a matter to be determined by the city authorities in the exercise of a sound discretion.

As an illustration, a city can require guard wires to be put up by an existing company at places where safety requires them. The Legislature may require existing companies to place their wires underground, and a city may do likewise, at least where they have not already been authorized to be strung overhead. It is said by a recent text-writer (Keasbey on "Electric Wires," second edition, section 66) that where wires have once been properly put up overhead with municipal consent, they cannot be disturbed by the municipality. But, according to the better reason and authority, a municipality having the usual police powers and authority over its streets may, in the absence of anything to the contrary, require existing companies to place wires underground whenever the public welfare and safety reasonably require that they should be so placed. Courts have held that a city may require a change in the location of poles, may prohibit the suspension of electric wires over buildings and close to the roof, may require splices on wires, may require a proper kind of pole, and, in general, may make such reasonable regulations for the use of electric wires and poles as the public welfare and safety may require.

But the police power of a city is not unlimited by any means, and while rights to use streets for electric wires and poles are taken subject to that power, neither the state nor its municipalities can destroy contract and vested rights by improper regulations and enactments under the guise of the exercise of such power. It is generally held that a right granted by a city, by ordinance, for a valuable consideration, constitutes an irrevocable contract, at least where it is accepted and acted upon by the grantee and money is expended upon the faith thereof. In such cases the vested right and obligation of the contract cannot be materially impaired by attempting to withdraw the consent of the city, or imposing other conditions not contemplated by the contract, or not properly police regulations.

The report that the Erie Telegraph and Telephone company has passed into the control of the Bell people is of great interest, although it is to be remembered that it is only a report as yet. The position of the Erie company in the telephone field is a peculiar one. It is and always has been a Bell company in the sense that it is compelled to use the Bell apparatus exclusively in the extensive exchange companies comprised within its system. But in another sense the Erie company has been an independent company for many years. Long before the Independent movement had reached important proportions the Erie company had cut loose from the American Bell company to the extent that the parent company was only a minority holder of its stock. This was true of only a few of the Bell licensee companies, and the fact, in conjunction with Mr. Glidden's energetic management, gave the Erie company great prestige. In February of last year the Independents rejoiced to learn that the important Erie company had passed under the control of the Telephone, Telegraph and Cable company—a corporation in which some large financiers were interested and which, while shrouded in considerable mystery, was believed to be non-Bell if not anti-Bell in its sympathies and affiliations. It must be confessed that the change of control brought no great change in the competitive conditions in the states of Michigan and Wisconsin, where the activity of comparatively small but simon-pure Independent companies has been particularly noticeable. Some of the Independents in those states asserted that competition became even more virulent after the T. T. C. company, as it may be called, for brevity, secured control of the Erie system. Nevertheless, the T. T. C. company was represented at the Cleveland convention of the Independent telephone men last June. The situation was thus a perplexing one. The Erie company was a Bell company and yet not a Bell company, while few pretended to know just what the T. T. C. company proposed to do. Now comes the report that, by skillful financial manipulation, the Bell people have secured control of a majority of the stock of the Erie company, and that nine of the old directors have resigned, while the T. T. C. interests have been compelled to relinquish a block of the Erie stock said to amount to $10,000,000. The exact proportion of truth in this report may not be stated at this writing; but the complications of the telephone business of the United States are so involved and far-reaching that one's capacity for surprise at anything that may happen has been considerably diminished. One thing is certain: The Independents have done and are doing a great and useful work in extending and popularizing the use of the telephone, and it is not likely that their activities will be seriously curtailed for some time to come.

Northwestern Electrical Association.

The ninth annual convention of the Northwestern Electrical association will be held in the Hotel Pfister, Milwaukee, next week (January 16th, 17th and 18th). Secretary T. R. Mercein has been indefatigable in preparing an attractive programme and announces several valuable papers and other interesting features. The events of each day have been arranged as follows:

WEDNESDAY MORNING, JANUARY 16TH.

Convene at 11:30 a. m. Roll-call. Reading of minutes of previous meeting. Annual address by President Norcross. Report of Mr. Mercein, the secretary and treasurer.

WEDNESDAY AFTERNOON.

Appointment of nominating and membership committees. Applications for membership. Reports of standing committees. Reports of special committees other than nominating committee. Miscellaneous business.

Paper—"The Rate Question," by Henry L. Doherty, Denver, Colo. Discussion.

Paper—"Practical Line Construction," by L. W. Burch, Madison, Wis. Discussion.

WEDNESDAY EVENING.

Theater party. Those desiring to attend are requested to assemble in Convention Hall at 7:30 p. m.

THURSDAY MORNING.

Questions and answers.

Paper—"Synchronous Converters," by Professor W. E. Goldsborough, Purdue University. Discussion.

Paper—"The Series Incandescent-lighting System of the Future," by P. D. Wagoner, Schenectady, N. Y. Discussion.

THURSDAY AFTERNOON.

Report of nominating committee. Election of officers.

Paper—"Education of Central-station Employes," by Professor D. C. Jackson, University of Wisconsin. Discussion.

THURSDAY EVENING.

Annual banquet. Those desiring to take part are requested to assemble in Convention Hall at 8:30 p. m.

FRIDAY MORNING.

Unfinished business. Adjournment.

The main party from Chicago will go on the Chicago, Milwaukee and St. Paul railroad, leaving this city on Wednesday next at 9 a. m. James Wolff of 320 Dearborn street is chairman of the committee having the local transportation arrangements in charge.

The members of the association, with many other friends, will deeply sympathize with Mr. Pliny Norcross, the president of the organization, whose wife died on December 28th at the family home in Janesville, Wis. Mrs. Norcross was 58 years of age, and was born in Johnstown, N. Y. She met her future husband at Milton Academy in Rock County, Wis., where both were students. After Mr. Norcross' service in the war, in 1865, the young people were married, and their home in Janesville was thereafter a haven of rest and domestic enjoyment for the busy man of affairs. Four children were born to this union, grew up to maturity and survive their mother. Frederic F. and John V. Norcross are practicing lawyers in Chicago. Edward P. is a student in the medical department of Northwestern University, and Mrs. George A. Mason, the only daughter, is also a resident of this city. Mrs. Norcross was a woman of lovely character, and her death, to the devoted husband especially, came as a great shock.

Lacombe Franchise Litigation.

In the suit brought by Mrs. Lillie C. Ames against the Lacombe Electric company of Denver, the company filed a demurrer, claiming that the plaintiff had not sufficient interest to bring suit and alleging that the bill did not state facts to justify a cause for action. The demurrer has been overruled, and Judge Allen of the District Court states that the state law provides that a taxpayer may bring suit against the usurper of a public privilege in case the district attorney refuses to do so. As the case comes under this provision, the first contention in the demurrer is invalid. The law also provides that when a bill is passed by any authorized board it must be advertised for at least five days before its passage, and, further, that if the bill is amended by some other board, it shall be returned to the board in which the bill originated, to be passed with that amendment. The complaint alleges that although the bill was advertised for five days, one of the days was a Sunday, so that only four days of publication could be legally counted. This, it is contended, made the passage of the bill illegal and consequently void. Further, it was charged that a resolution was passed by the Board of Supervisors, which constituted an amendment to the bill, and as this was not returned to the Board of Aldermen for reconsideration, this allegation, if proved, would invalidate the franchise.

It should be noted that Judge Allen's decision on the demurrer relates only to the right of the plaintiff to bring suit, and is in no sense decisive of the merits of the questions involved.

Something About the Illinois Telephone Company's Tunnel.

In the course of its investigations into the problem of quicker mail handling in Chicago a committee consisting of Postmaster Gordon and Captain West, superintendent of railway-mail service, elicited some interesting facts about the tunnel and plans of the Illinois Telephone and Telegraph company of Chicago. The committee's object was to consider the tunnel system in connection with the carriage of the mails; but as the Illinois company, after a great initial flourish of trumpets, had apparently fallen into a comatose state, something authoritative about its plans and prospects will be of interest to the readers of the Western Electrician. What follows is from the official report of the committee.

The possibility of securing underground electric-car connection between the depots having been suggested to the committee in connection with the tunnel now being constructed by the Illinois Telephone and Telegraph company, the postmaster and the secretary of the committee spent an evening inspecting the tunnel. They entered the shaft near Madison street and Fifth avenue, and, descending 35 feet, examined the tunnel, which runs from the alley south of Madison street to La Salle street, and north and south on La Salle street, between Madison and Monroe streets. The tunnel is shaped like a horseshoe, being eight feet at the highest point and five feet at the widest point.

Mr. A. G. Wheeler, president of the company, was asked on this occasion to attend a meeting of the committee and furnish whatever information he could as to the probability of the tunnel being available for the transportation of mails.

On the evening of October 23d [1900] Mr. Wheeler attended a meeting of the committee, and was accompanied by Mr. G. W. Jackson, engineer of the company. There were present, besides the chairman of the committee, Superintendent Cahill, Mr. George L. Lavery and Mr. W. R. Kerr of the Batcheller Pneumatic Tube company.

The following information was elicited:

Postmaster Gordon: In the first place, Mr. Wheeler, I understand the name of your company to be—

Mr. Wheeler: The Illinois Telephone and Telegraph company, incorporated under the laws of Illinois, and possessing franchises from the City Council for the construction of tunnels under the principal streets in the business center of the city. You have seen a portion of the tunnel.

Postmaster: Yes; Mr. Cahill and I have been in the tunnel.

Mr. Cahill: Does the ordinance permit anything besides telephones and telegraphs?

Mr. Wheeler: Yes; mails and newspapers, besides telephone and telegraph business.

Mr. Cahill: That clears up the matter. Will it admit pneumatic tubes?

Mr. Wheeler: The ordinance says by electricity or otherwise.

Postmaster: About how much of the tunnel is constructed?

Mr. Wheeler: Six shafts. We calculate to finish this district in four months, the tunnels and the laterals. We still have 11 miles of tunnel in the business district and branches under the main river and the North Branch.

Mr. Cahill: What are the prospects of completing the 11 miles?

Mr. Wheeler: About the first of July the work will be done.

Mr. Cahill: The 11 miles?

Mr. Wheeler: Yes, sir.

Postmaster: What will you cover in the business district, and how far south?

Mr. Wheeler: South to Twelfth street, west to Halsted street, and north to Chicago avenue.

Mr. Cahill: In other words, it will practically connect all the stations and railroad depots in the downtown district?

Mr. Wheeler: Yes, sir.

Postmaster: What is the size of the tunnel?

Mr. Wheeler: Eight feet high, six feet wide—horseshoe shape.

Postmaster: And is about the center of the principal streets?

Mr. Wheeler: Is in the center, running north and south and east and west.

Postmaster: You contemplate going under what streets in order to cross the river?

Mr. Wheeler: I would not care to say, but we will also go under the South Branch and the main river.

Postmaster: How many feet is the tunnel below the surface?

Mr. Wheeler: Thirty-five feet under the streets and about 60 feet below the river.

Mr. Cahill: That is a pretty steep grade, is it not?

Mr. Wheeler: No; we begin at Market street and come out at Clinton street.

Mr. Cahill: Have you any plan in mind for handling the mail in bulk—that is, in pouches?

Mr. Wheeler: We have avoided mentioning much about this, as we have thought best to first get our tunnel ready for business and then come in and bid for work. We thought we would handle the mail as now handled, in pouches. We expect to be ready for business about June or July, 1901.

Mr. Cahill: Will any portion of the tunnel be available before July 1st?

Mr. Wheeler: For messenger service about the first of May, I think.

Postmaster: Could you bid on this service?

Mr. Wheeler: We have taken a long time, as we think four months a long time, and have said July, but you understand, of course, that there is a lot of work in the tunnel after the tunnel itself is finished.

Postmaster: How would you connect with depots?

Mr. Wheeler: What do you mean?

Postmaster: How would you get the mail up from the tunnels?

Mr. Wheeler: It would come up through the laterals; that is the method of distribution from the tunnel. If we had tubes it would come up in the tubes. If we had cars it would come up in the elevators. We have detailed plans, but are not in a position to submit them now.

Mr. Cahill: Might you not make good time with the car in the tunnel and then lose it in getting the car up and down?

Mr. Wheeler: We are now running cars in our tunnels and handling 400 or 500 in eight hours. We handle all our dirt between eight o'clock at night and five in the morning, which is all handled in these cars. I would like to say, Mr. Gordon, that a talk at this time is not what would be desired, as it is not our time to do the talking. We are preparing to come in as a bidder. We are not looking for a subsidy, but to do the work. We expect to meet any requirements or not get the work. We will do it in schedule time anyway.

Postmaster: Now, Mr. Wheeler, you have had more or less experience in matters of this kind; what is your opinion of the size of pneumatic tube really practicable or available for transporting mail?

Mr. Wheeler: I do not think that is a fair question to ask me, as it is largely a matter of opinion. My own opinion is that a 36-inch tube is practicable and feasible, and can be operated successfully. But there may be better methods of doing this work than by tubes.

Postmaster: I suppose the largest tube now in operation is the eight-inch, or is there one larger?

Mr. Wheeler: The 12-inch is the largest in this country. I think there are larger on the other side, but I would not state for a positive fact. There is here in operation a 30-inch tube on private work about a mile and three-quarters long, in Burlington, N. J.

Postmaster: What kind of pipe is that?

Mr. Wheeler: Cast-iron pipe.

Postmaster: What is the size of the tube?

Mr. Wheeler: I should say 30 inches in diameter.

Postmaster: You say it is about a mile and a half long?

Mr. Wheeler: I understand it is between a mile and a half and three-quarters.

Mr. Kerr: This 30-inch tube you speak of has been in for several years, has it not?

Mr. Wheeler: Over four years.

Mr. Kerr: It is not a practical line?

Mr. Wheeler: No.

Mr. Kerr: Merely experimental?

Mr. Wheeler: Yes.

Postmaster: Mr. Wheeler, have you given any thought to the way in which mails could be handled?

Mr. Wheeler: Yes; we have detailed plans; but I would not care to submit them. We have nothing experimental. As a corporation we think it best to complete our tunnels and come in and bid. If we can get the work we will.

Mr. Cahill: This system might solve the inter-depot question, leaving the matter of inter-station exchange an open one.

Electric Railways in Mexico.

The electric railways in the city of Mexico are being rapidly extended. Three important suburban lines and one city circuit are already in operation and giving good service. Another extensive loop through the central and western part of the city, connecting the railway stations, will be opened early this year. All the suburban lines carry first and second-class cars, with an apartment for freight, which is a great convenience there, as suburban delivery is not generally practiced by mercantile houses. The suburban lines sell commutation tickets for passenger service.

A movement is on foot to build an electric road between Paris, Ill., and Clinton, Ind. Congressman Andrew J. Hunter of Paris is said to be behind the project.

DEVELOPMENT OF THE TELEPHONE FIELD.

The Telephone in Railroad Service.[1]

By E. A. Chenery.

Within the last 10 years the telephone situation, so far as it has had to do with the handling of the general business of a railroad, has undergone somewhat of a revolution, and while the limit of its usefulness has not by any means been reached, such a stride is being made as serves to startle those who are not directly in the van of progress.

Experiments have been made within the past few years in the direction of utilizing jointly telegraph wires for telephonic purposes, and this has reached such a stage as to warrant the statement that, within certain limits, this can and is being done. The writer, early in this year, carried on a conversation by telephone over an iron wire between Chicago and Aurora, a distance of 37 miles, which was being used at the time as a telegraph wire, and the slight noise due to induction was far from being annoying. Within the past few months several of the larger railroads have been considering the advisability of substituting the telephone for the transmission of orders in the movement of trains, and that an advance in this method will be made in the near future there is not the question of a doubt.

The old plan, and it is still in use by many roads, was to build and equip a private line running between the contracting agent and the local freight. Then other lines from the local freight to various yard offices, adding additional telephones to the most convenient line as new offices were opened, and the results inevitably were lines carrying from six to 10 busy stations, full of annoyances and lack of privacy such a system only affords. As the business grew it was impossible to conduct it with any degree of satisfaction, for the reason that where so many offices were on one line the service was of necessity subject to censure, because someone would often leave the receiver off in searching for information, and the other several offices would be tied up as completely as though the line had broken.

A telephone service, to give the best results possible, should be one connecting every office that may have business with another. It should not be the policy of the company to install only as few instruments as they actually can get along with, but rather to provide sufficient equipment of this character to take care of every possible condition arising in the daily routine of business. The freight office, as a starter, should not be so limited in its telephone facilities as to invite censure from the busy merchant, for this is surely the result when he, after repeated efforts to raise the office named, each time is given the busy signal. Possibly your competitor's telephone at the time happens to be resting, and the merchant, in his exasperation, cultivates a new friend.

The contracting agent, like the local freight, should also be able to render as satisfactory service by telephone as though a personal call was made at the office, for the busy man has no time to squander without reason, and here again should ample facilities be provided. The contracting agent and the local freight, in their dealing with the public, must now be equipped with information and data which, if not directly at hand, is obtainable on short notice. To insure this the telephone service must be extended to the various offices, junction points and yards where are located yard clerks, yardmasters and others interested in freight movements.

Other departments must not be forgotten in the provision for rapid communication. Telephones should be in the roundhouse, in the shops, office of the car inspector, the telegraph office, yardmaster's offices, and if the service to be covered includes passenger stations, the station master, ticket and baggage agent, information bureau and other such offices must be brought into close touch.

The new plan contemplates a separate exchange for the exclusive care of the class of business I have referred to, this exchange to be centrally located, with lines running to the various offices in the territory, enabling any one office to communicate with any other with scarcely an instant's loss of time. Such a plan is all right so far as it goes, but it is yet too narrow in its scope. At terminal points where the interchange of freight is heavy between any two or more roads there should be provided such facilities as will enable the representatives of one road to communicate with those of another, and the telephone offers a solution if its fullest use is obtained. Out of a number of instances, I might call attention to the following where such a system would be of value if it extended to all roads.

A delivery of 20 cars is made by a road we will call, for short, the B. N. railway, to the yards of the U. T. D. railway for movement on a fast freight due to leave shortly after the cars reach the latter road's yard. Two of these cars are found to be unaccompanied by waybills, and in the natural order of things they would be switched out for a later train, while the remaining number go on. If proper facilities obtained the yard clerk would be notified of the shortage, and the bills either hurried over by messenger or copies telephoned, in order that the cars might proceed without suffering a delay. Not only would unnecessary switching be prevented in such a case, but the claim department would be saved another bunch of correspondence.

Take another case, and one that has grown to be a daily occurrence. The elevator representatives about the closing hour place their orders for cars for to-morrow's loading and go home, expecting to find the order filled when they come around in the morning. In order that the empties may be gathered up, your car clerk, in direct touch with all yards, places his orders to cover such cars as are in his possession, and then makes his requests on connecting roads for such cars as are needed. These orders are now handled between one road and another usually by telegraph, and it often occurs that they are left hanging on the telegraph-table hook all night, because of lack of telegraph facilities, and reach their destination too late to accomplish the original purpose. It is obvious that if your car clerk was able to place his orders direct with the car clerk of your connection instead of through the hands of at least two operators and messengers between them and the operating desks, the results would be different, and your clerk would go home knowing that his wants, at least, were known by those concerned.

Waybill corrections—and this class of telegrams has grown with the increased business—might better be handled by telephone than by telegraph, with a positive understanding between the parties interested. We all know of cases of a message started to a connection directing the changing of waybill, either its destination, weight, rate or amount, and later on found the message had become lost, strayed or stolen, or, more likely, "bulled," through reading of bad copy, or because of being handled by "ham" operators, and found afterward the freight to which the message referred had been delivered, and the correction could not then be made.

The writer claims that the amount of telegraphing between agents of connecting lines in the same city is beyond all reason or warrant. It is not only extravagantly expensive, but often unsatisfactory, and burdens the telegraph wires to the detriment of other important work that the telegraph field is presumed to cover.

The ideal service, then, is the exchange. There is perhaps no large city in the United States so favorably situated as St. Louis for the carrying out of such a plan as I would suggest, from the fact that the roads all are located close together. We will take, for instance, East St. Louis, where the freight offices of 12 roads are located on the river front within a radius of one mile. Locate an exchange at the east pier of the Eads bridge, or some point in the immediate neighborhood which would be about midway between the roads named. Into this exchange run wires from telephones in each of these freight offices and such yard offices as are required. On the west side of the river possibly two exchanges may be needed, one in the northern part and another in the southern part of the city, each taking care of the district in its immediate neighborhood. Having these railroad exchanges and connecting them with each other by trunk lines, we have the ideal system, and once adopted, no one will ever recommend displacing it by the old system.

To illustrate the subject better, I may mention the telephone system of the New York, New Haven and Hartford railroad. This includes one exchange wherein something like 50 stations in the Boston building and quite as many more outside are cared for. Another exchange takes care of the station departments, ticket agent, baggage rooms, gates, etc., while other exchanges are located in the Boston and Albany offices, South Boston, and at certain towers, etc. Nor does the system stop with Boston. They have exchanges at Providence, New Haven and several in New York, and are connected by long-distance wires with all stations from Boston to New York, and with trunk lines between each exchange and the local city exchange of the city through which their road runs. The general manager or other officer in his office with this perfect system is enabled to transact business with any general or subordinate officer at any of the stations the entire length of the road.

The Pennsylvania system has also a system of telephone exchanges between New York and Pittsburg, all of which are connected with each other by trunk lines.

To be up to date a great deal of the work now done by telegraph must hereafter be done by telephone, and railroad companies at large points must have better facilities than they have heretofore had.

1. Abstract of paper read before the St Louis Railway Club on December 14, 1900.

Illinois Telephone Association.

An important meeting of the Illinois Telephone association is announced for February 6th at 2:30 p. m. at Champaign, Ill. An interesting programme is promised, including a number of papers, and it is stated that the meeting is for the purpose of considering business of importance to all Independent telephone interests for the benefit of the telephone companies in Illinois, and that little or no association business will be brought forward. All Independent concerns in the state are urged to send representatives.

Telephone News from the Northwest.

The contract departments of the Northwestern Telephone Exchange company in Minneapolis and St. Paul were abolished on January 1st, in common with those in all the offices of the Erie system.

The Wisconsin Telephone company has made overtures to the city of Marshfield, Wis., for admission to the city. The council refused admission unless the company would confine its business to toll business only. The local exchange at Marshfield is owned by the business men there, who felt that the entrance and competition of the Wisconsin company would mean the extinction of their business. The company sought to set its poles into the city without permission, but the poles were mysteriously chopped down in the night. Before the company could raise them the city had an injunction to prevent their being set. The Wisconsin company is now ready to enter Marshfield and confine itself to a toll business.

The new telephone system of the Northern Pacific railway, which is to supersede the telegraph, is not to be used for public service, except in cases of great emergency.

The Western Electric Telephone company has extended its wires to Bricelyn and Frost, Minn.

In order to adjust the estate of F. B. Fobes at Albert Lea, Minn., the local telephone system will be sold at public auction on January 17th.

The Zenith Telephone company of Duluth, Minn., an Independent company, has 1,330 instruments connected. Before the day of competition the local Bell company never exceeded 750.

A local company has been formed in Prescott, Wis., to establish a telephone exchange.

The Fox River Valley Telephone company has rushed work on its toll line between Appleton, Wis., and Kaukauna, the work being done within two weeks.

The gross-earnings tax paid the state of Minnesota by telephone companies for 1900 amounts to $25,450.73, which is something in excess of the previous year. Forty-five companies were included on the tax lists. The Northwestern Telephone Exchange company paid the bulk of the tax, $18,669.08. The Mississippi Valley Telephone company paid $512.30.

George McNaughton succeeds B. B. Mason as manager of the Northwestern Telephone Exchange company at St. Cloud, Minn.

The Wisconsin Telephone company will erect an exchange building in La Crosse, Wis., in the spring. It will be three stories high, and built of brick.

The Nevada Mutual Telephone company of Nevada, Iowa, has 204 subscribers. The concern began business in August, 1899, with 80 subscribers.

The Iowa Telephone company has amended its capital stock and doubled it, making it $4,000,000.

The British Columbia Telephone company will connect Vancouver and Victoria, B. C., by telephone cable. The cable will cost $100,000 and the company is now considering several routes.

The Iowa Telephone company, at Des Moines, has asked an injunction against the county treasurer to restrain him from selling its property for taxes. The company denies that the county has authority to levy any taxes against its property.

The Rocky Mountain Bell Telephone company plans to extend its toll lines to Billings, Mont., next season, from Big Timber.

Crow Bros. are arranging to extend their toll line into Iowa City, Iowa, paralleling the line of the Johnson County Telephone company. Crow Bros. operate about 50 miles of line in the southwestern part of the county and in Iowa and Washington counties. The Mutual Telephone company expects to retaliate by building to Oxford, to compete with Crow Bros.

The City Council of Waupaca, Wis., has repealed the franchise of the Badger Telephone company and ordered its poles and wires removed from the streets.

The exchange at Brighton, Iowa, has begun giving night service. It has 51 connections in Brighton and 11 in the country.

George Hudson, Jr., is building a line from Britton, S. D., to Burch.

Superintendent Skolsky of Eau Claire, Wis., for the Wisconsin Telephone company, has had his territory enlarged. The section, including Wausau, Stevens Point, Grand Rapids and Merrill, which has been hitherto under the charge of the Milwaukee office, is now under Mr. Skolsky.

The East Wisconsin Telephone company seeks to secure connection with the Sheboygan County Telephone company's lines at Sheboygan, Wis.

R.

Ohio Telephone Notes.

The Central Union Telephone company is arranging to enlarge its quarters at Mansfield and improve its facilities for handling business. A new switchboard was put in some time ago, and it is now about loaded up, there being something over 1,100 subscribers. An addition will probably be made to this board. The offices of the gas company in the Bird building have been leased and will be used for the offices of the manager, cashier and clerks. The long-distance toll station will also be in this department, and sound-proof booths will be put in.

The offices vacated by the business office will be used by the chief inspector and foreman. The other rooms will be arranged to accommodate the new apparatus that may be put in.

Sixty-five men are now quartered at Mansfield, working on the east and west line of the United States Telephone company. The greater part of the line between Ashland and Mansfield is completed. A Zanesville paper says that, in spite of the fight against the United States Telephone company by the city authorities, the line is now completed into the town and as soon as the switching apparatus is installed, the city will have long-distance service with all the Independent exchanges in Ohio. The company built around the corporation line for some distance and then entered the town over private property. The line crosses High street, but no poles have been erected. The office will be located at England Bros.' office.

E. M. Boynton will have charge of construction of the lines of the Central District and Printing company in Ohio, as well as in Pennsylvania. It is said that the Central Union Telephone company will build a line from Hudson to Twinsburg, to accommodate several persons there who wish to become subscribers. The line will extend from there to Macedonia and Northfield, and on into Cleveland.

George S. Walton of Salem has been made general manager of the new Stark County Telephone company at Canton. He said a few days ago that work on the plant would be begun within a short time. He wishes first to connect up Canton and Alliance and Canton and Massillon. He said, further, that it is the intention to connect every town in the county with this system as soon as possible.

The Warren-Niles Telephone company now has 1,400 subscribers. The last year has been a very prosperous year with the company.

The Columbiana County Telephone company, Salem, has issued a new and complete directory, which has been distributed among the subscribers.

At a meeting of the Cincinnati Telephone company's directors, held a few days ago, President G. N. Stone made a very gratifying report. Since July the increase in the number of subscribers has been 2,018, which is the greatest period of growth the company has ever shown.

A Logan paper says that J. F. Engle, superintendent of the eastern division of the Ohio Central telephone lines, has had his jurisdiction extended over the western division, as well. O. M. C.

Indiana Telephone Items.

Indianapolis, January 7.—The telephone service is rapidly increasing in Clay County. The plan is for each farmer subscriber to build one mile of line.

A train-dispatching system is to be put in operation on the Union Traction company's lines between Indianapolis, Anderson and Muncie by means of the telephone. The conductors will carry receivers that can be attached to wires suspended every half mile from the overhead telephone wires.

The Cherubusco Truth has entered upon the nineteenth year of its publication, in its own building, with a modern plant. The paper owns over 50 miles of telephone line, constructed at a cost of $4,500. The editor gathers news by telephone from all over the county.

Indianapolis has entered into contracts for the year with the Central Union and the New Telephone companies for telephone service to cost $1,800. Of this amount the Central Union gets $1,038 and the New company, $762. F.

Erie Company Said to be Controlled by Bell Interests.

The Erie Telegraph and Telephone company announces that it will issue $7,500,000 in one-year notes bearing five per cent. interest, to meet a floating indebtedness of $6,000,000 coming due within the next eight months. This issue is said to be necessitated at this time because last summer the Erie company increased its dividend rate from four to five per cent., instead of providing for the payment of its floating indebtedness. It is understood that the issue will be financed by the Old Colony Trust company of Boston on behalf of a bankers' syndicate, and that in order to accomplish this it was necessary for the Telephone, Telegraph and Cable Company of America to part with a large part of its holdings of Erie Telegraph and Telephone stock, which are said to have amounted to $10,000,000.

Advices from New York and Boston, dated January 10th, indicate that an important change has taken place in the affairs of the Erie company. For instance, the New York correspondent of the Chicago Tribune says: "The Bell Telephone company has secured control of the Erie Telegraph and Telephone company. The purchase has been made through the Old Colony Trust company of Boston, which will take the $7,500,000 five per cent. notes issued by the Erie Telegraph and Telephone company."

The Associated Press, in a dispatch from Boston, gives these details:

An upset in the diretcorate of the Erie Telegraph and Telephone company, as agreed upon when the Old Colony Trust company of this city undertook to finance the company's debt last week, occurred at to-day's meeting of directors. No less than nine of the old members of the board retired, and their places were filled by representatives of the Old Colony Trust company, Kidder, Peabody & Co. and others, who are interested in the financial plan that has been consummated.

No changes were made in the executive officers, Charles J. Glidden of Lowell continuing as president, with the likelihood of remaining as such for a time, although it has been asserted that he will retire at a future date. Nearly all of the stock called for under the trust agreement has been deposited, and the adjustment of the Erie company's financial difficulties is in a fair way to be completed.

Just what action the Old Colony Trust company will take toward the sub-companies is not yet known, suspension of construction work on the plant of the Michigan Telephone company having been ordered last Saturday. Orders to suspend work of the same character on the plants of the other sub-companies have also been issued.

The Erie stockholders met yesterday and ratified the plan which to-day was carried to its finality, such as mortgaging the property, providing for the existing debt and approving the agreement with the Postal Telegraph company of Texas for the joint use of the companies.

Competition in the Fox River Valley.

The Fox River Valley Telephone company (Independent) is promoting a telephone system which shall operate in opposition to the Wisconsin Telephone company in the Fox River Valley, including the cities of Appleton, Neenah, Menasha and Kaukauna. In answer to the argument set forth by the Independent promoters in this territory, the Wisconsin Telephone company has issued a remarkable circular letter to its patrons, setting forth reasons why they should stand by the old company and not sign contracts for telephones from the Fox River company. The letter in full is as follows:

Our attention is directed to a recent circular by the promoters of an opposition telephone system for the Fox River Valley, wherein stress is laid upon the beneficence of a "home institution" organized (ostensibly) for the purpose of relieving the industries of your several cities from the oppressions of the Wisconsin Telephone company.

Just what these oppressions are, and just what good purpose will be served by a competing system in the cities of Appleton, Neenah and Menasha and Kaukauna, is a matter of immediate concern to those by whom the burden of a second system of telephones must be borne. The circular recites, among other things, that "The time has come when the telephone in the residence is a necessity—not a luxury; and that prices will be fixed so low that you cannot afford to keep house without one."

Is the necessity for a second company, then, a question of rates, or that we lack enterprise, and have failed to serve you competently?

The answer to the first question is: We have been supplying to Appleton and Neenah a perfectly competent party-line service at the rate of $2 per month for business and $1 for residences, and in the smaller places, as low as $1 for business and 75 cents for residences.

As to the latter proposition, we beg to submit our large investments in keeping pace with both your local and outside requirements, and that we have enabled you, by reason of the one-minute basis, to do 90 per cent. of your toll business at one-third of the cost of former charges. Further, we have proposed to relieve the cities of Appleton and Neenah of our overhead plant in their main centers, and we stand ready to make this investment as soon as permission is granted.

Your prejudices against the "monopoly" are being appealed to in support of the movement, but, it strikes us, the old-time bugaboo loses its terrors under our present schedule of rates; and we venture to add, there are some monopolies not wholly prejudicial to the communities they serve. The telephone service, however, that best serves must in the very nature of things be a monopoly; and whether it be the Wisconsin company or another, it is merely a question, in the end, of the survival of the fittest.

We maintain that a dual system of telephones in cities dependent, from the nature of their industries, on the broadest facilities, cannot survive, except as a double tax and as an insufferable nuisance to its victims.

A second company, it is true, by its inferior service and facilities, would be enabled to serve many at a somewhat lower rate. On the other hand, we provide, for the advantage of the majority, a switching system that comprehends 25,000 stations within this state alone.

In connection with the exchanges between this city [Milwaukee] and Appleton, and vital to them, we operate as follows: Twelve pairs of copper wires to Oshkosh, 11 pairs between Oshkosh and Neenah and Menasha, and 13 pairs between Neenah and Menasha and Appleton. These lines are auxiliary to the exchange business—indispensable to it—and represent in this direction alone an investment of $125,000.

The value of a telephone service is in direct proportion to the number of connections, and it is out of the question that anything short of these facilities can permanently serve the needs of the Fox River Valley. Your neighboring city of Oshkosh, with like commercial requirements, wrestled with this beneficent problem for four years. We beg to refer you to our patrons in that city for the true inwardness of telephone competition, and refer the promoters of the Fox River Valley scheme to the original owners of that plant as to the profits in the enterprise. For a period of nearly five years the business men of that city were obliged to retain both telephones, and paid to each company $30 per year, or at the rate of $60 per year, as against our former rate of $36.

We beg to submit that a service adequate to your needs cannot be successfully conducted at lower rates than we now charge, and ask that you weigh these questions before signing their contracts.

In answer to this letter A. L. Hutchinson, secretary of the Fox River Valley Telephone company and also of the Little Wolf River Telephone company, addressed a letter to the public of the Fox River Valley, under date of January 8th, containing the following pertinent statements:

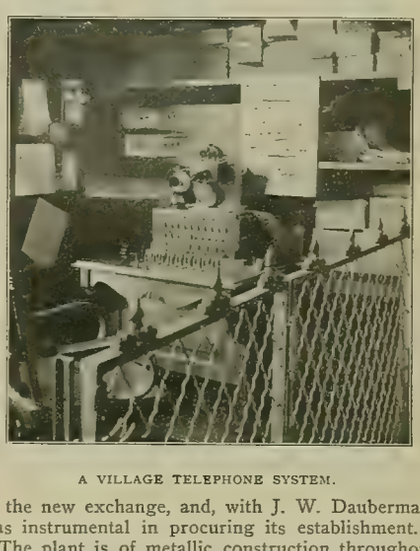
"We know what the profits of the owners of the Independent Telephone company in Oshkosh were for the five years that company was in operation These profits were over 100 per cent. on the original investment. We also know that after five years' experience with two telephone companies in the city of Oshkosh the vast majority of telephone patrons in that city were so disappointed when the local company sold out to the Wisconsin Telephone company last March that within 90 days thereafter the Little Wolf River Telephone company secured a franchise and had written contracts for over 450 telephones in that city.

"We also know that within the last two years the city of Fond du Lac has been invaded by the Little Wolf River Telephone company, and whereas the people of that city had telephone connection with less than 200 subscribers and mostly on party lines, to-day they are served by the Little Wolf River Telephone company with over 560 connections, on single metallic circuits except where otherwise ordered, and at one-third less the cost before the Independent company entered that city.

"The facts speak for themselves. And superior service, at fair rates, is the secret of the great success of the Independent telephone movement throughout the United States."

A Village Telephone System.

In connection with telephone work now under way in Will and Kane counties in this state a complete and convenient telephone system for a small village has recently been installed by the Northwestern Telephone company at Kaneville, Ill. The town, with a population of less than 100 inhabitants, is the center of one of the richest farming communities in the state, and the exchange opened with more than 50 subscribers within a radius of less than three miles. Ralph Dauberman is the manager



A VILLAGE TELEPHONE SYSTEM.

of the new exchange, and, with J. W. Dauberman, was instrumental in procuring its establishment.

The plant is of metallic construction throughout and is equipped with Stromberg-Carlson divided-circuit, central checking instruments. The central office of the exchange, which is placed in the general store, is provided with a cabinet telephone, divided-circuit switchboard; as shown in the illustration. A subscriber ringing the central office on any of the party lines throws the drop at the switchboard, but does not ring any of the bells on the line. When the attendant calls a subscriber, one-half of the telephones on that line will ring. Direct connection can be made from this exchange to any of the Independent exchanges in the state.

This company has also installed exchanges at Aurora, Joliet and Elgin.

Telephone Relay Story from Ohio.

James Houlehan, an inventor of some note at Toledo, has announced that he has discovered a plan of making a repeater that will carry telephonic messages any distance that may be desired. He says that he has also invented a duplexing machine that will answer the needs of all companies in that respect. Mr. Houlehan asserts that he has been made a good offer for his inventions by the Erie Telegraph and Telephone company, but that he has refused and will not take less than a million each for the inventions. It is said they will be tested by representatives of the Central Union company.

MANUFACTURERS AND DEALERS.

The Telephone Company of America of Washington, D. C., has been incorporated for $5,000,000, to manufacture telephones and telephone supplies and to operate machine shops and foundries.

The American Toll Telephone company of Cleveland, manufacturer of high-grade automatic pay stations, has just placed on the market an apparatus which possesses distinct points of merit. The pay-station device is entirely mechanical in its operation, thus doing away with the use of electrically operated mechanism. This company manufactures both local and long-distance pay stations, its No. 2 long-distance apparatus being made to take up little room by attaching to the wall. The No. 1 apparatus for local five-cent service is said to be especially noteworthy, as it is impossible to insert anything but the regular five-cent piece in the instrument. The American company's machines have been adopted by the United States Telephone company and are protected by patents in this and foreign countries.

Clinton E. Woods Automobiles.

The Clinton E. Woods automobiles, as manufactured by Woods, Waring & Co. of Chicago, are the latest production of Mr. Woods in the automobile world and have been designed mechanically and electrically and in their carriage construction so as to abandon many of the old ideas. These radical departures, however, have been made only after a most careful analysis of the conditions to be met, compared with means with which to meet them.

The motors have been greatly changed in their design and construction, to meet the fluctuating demands for power made by an automobile. The ball bearings have been greatly increased in size. The power requirements are provided with a battery that works on a five-hour discharge rate, instead of a three-hour, as heretofore, which greatly lengthens the life of the battery and increases its efficiency.

An entirely new form of rear-axle construction and gearing has been designed to give the necessary protection, to make the operation noiseless, and to simplify the construction of the supporting parts of the carriage.

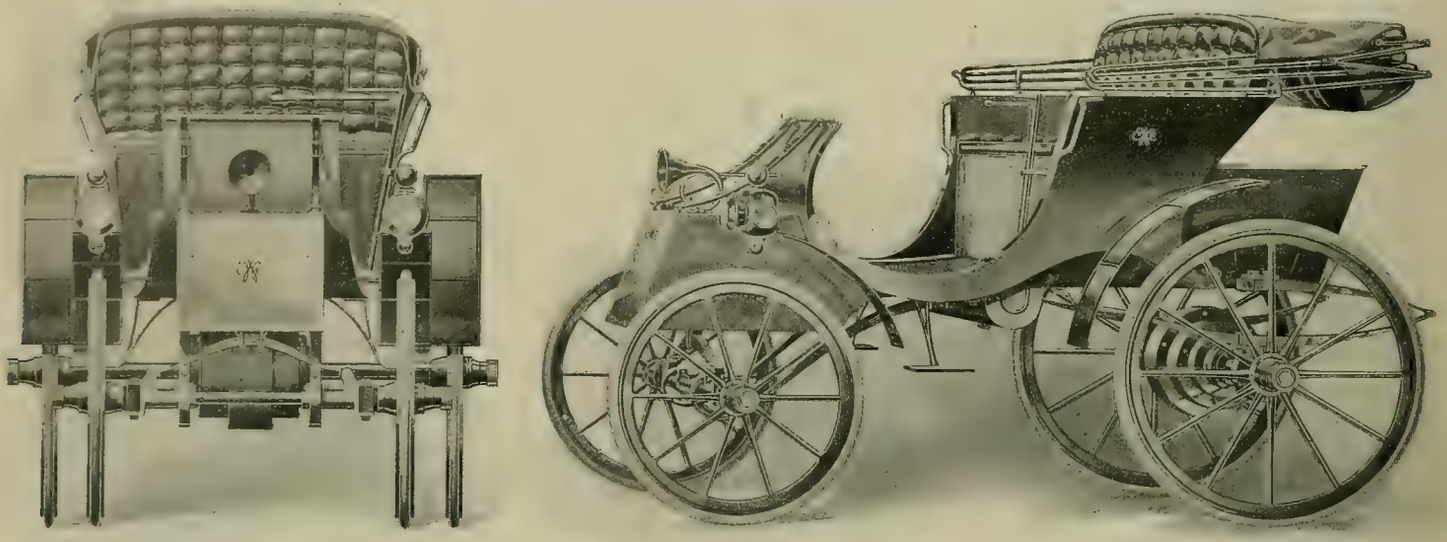
The construction of the carriage practically eliminates what is known as a running gear, inasmuch as no iron work or tubular construction of any nature is used between the axles or between them and the body except the flexible springs, and these are of a special design to meet the requirements put upon them. A new combination of brakes has been provided, which gives both a mechanical brake and an electric brake, and an entirely new system of control and wiring has been adopted that eliminates all complexity and very materially adds to the general efficiency of the vehicle, while the carriage part of the vehicle itself, it is believed, can truly be called an automobile without being a misnomer.

Four wheels, two axles, springs and a body constitute the carriage proper, as experience has shown that flexibility is required in these points; hence the entire absence of a mass of tubular or iron construction purposed for a useless rigidity. Simplicity in the motive power and protection in its transmission are necessary for permanency of adjustment and insurance of durability. These points are obtained in the Clinton E. Woods automobile by a solid rear axle and one motor, in which all gearing, of whatsoever nature, is encased, and by thus being made an integral part of the motor is given absolute protection from dust and water.

An automatic controller handle operates all the various speeds and also operates both the electrical and two mechanical brakes, the mechanical brakes being applied directly to the wheels by a very powerful friction device. The electrical brake is an electrical arrangement which operates without friction and by means of which the longest hills can be coasted at a moderate speed without the wear, tear and trouble incident to friction brakes. The two mechanical brakes are supplied, however, for emergencies.

The narrow front-wheel tread enables the steering to be accomplished by a new combination that makes the vehicle respond instantly to the slightest pressure of the steering lever and also gives a genuine automobile appearance. The automobiles have purposely been designed with a longer wheel base than anything heretofore built to make them ride easier and give more foot room in getting in and out. The mud guards afford full protection to the operator from muddy streets and the tops are provided with side curtains and rain aprons for inclement weather. The even distribution of weight on the wheels and the extremely low center of gravity permits quick manipulation with safety and comfortable riding, even on rough roads. In short, these automobiles have only been designed after a long experience that has pointed out every probable improvement in style, operation, convenience and comfort.

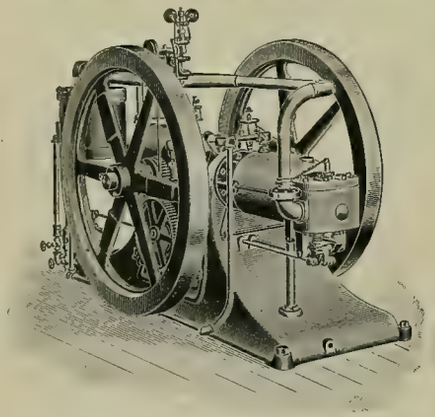
The road buggy illustrated in the accompanying side and front-end views is handsome and original and has been designed after a long series of studies to produce at a moderate price a carriage which should have the appearance of a vehicle twice its actual cost. It has every comfort of a full-size stanhope, inasmuch as it is provided with a 37-inch seat, which easily accommodates two people. Its racy, rakish appearance will appeal to all true lovers of automobile sports, business or pleasure. The total weight is 1,100 pounds. The manufacturers claim it will run 40 miles on one charge of the batteries on a hard, level road, and will climb anything up to a 20 per cent. grade.



CLINTON E. WOODS AUTOMOBILES.

McMullin Gasoline Engine.

The McMullin Motive-power and Construction company of Chicago believes it has reached a state of development worthy of notice in its isolated electric-lighting and vehicle-charging set. The motive power of this unit is supplied by a two-cylinder hydro-carbon or gasoline high-grade engine of the type illustrated in the accompanying cut. The two cylinders are in a horizontal position on either side of the crank shaft and perfectly balance the engine in weight and in power generation. They substantially do away with vibration, at least to such an extent that these engines, from two to 10 horsepower, can be safely set on a good floor without a specially prepared foundation. The fuel is fed to the carbureter by a pump, the carbureter being supplied with an overflow valve and conductor, thus regulating accurately the quantity of gasoline used. The fuel mixture, properly governed, passes from the carbureter to the explosion chamber, where it is fired by an electric jump spark. The make and break of the electric current is sure and is effected by means of an ingenious device operated by and on the outside of the engine. There are no moving parts inside the cylinder. The cylinder, explosion and compression chambers are cast in one piece and are entirely surrounded by a water jacket for cooling purposes, in which water is kept in constant circulation.



M'MULLIN GASOLINE ENGINE.

It is estimated that 200,000 incandescent lamps, requiring the erection of 400 miles of wire, will be used in illuminating the Court of Fountains, Electric Tower, Esplanade and Plaza at the Pan-American Exposition. Ninety-four large-sized searchlights will be placed under the water of the basin of the Court of Fountains to cast colored lights on the fountains and cascades.

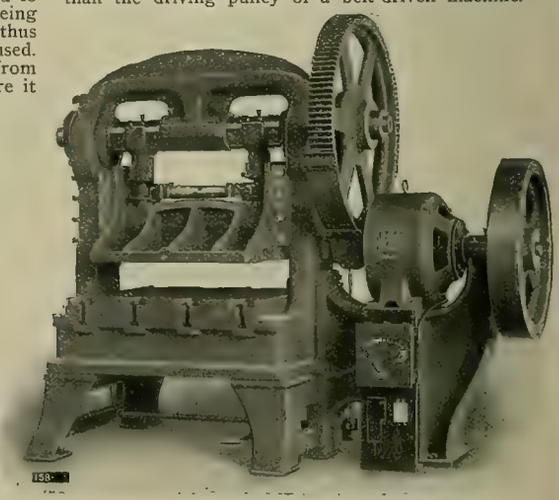
Rubber in Guatemala and Mexico.

A consular report from Guatemala treats of the cultivation of rubber in that region. Consul-general James J. McNally gives figures concerning the initial capital required to start such a plantation and the probable returns. He states that a plantation of about 115 acres planted with 100,000 trees will, when about seven years old, yield a product worth from $100,000 to $200,000 a year. He estimates the cost of the land at about $12,000, and says that labor is very cheap and that after the trees are planted they incur practically no expense. Sugar cane, coffee, cocoa and other products may be raised on the same land, and will, it is said, pay expenses while the rubber trees are maturing. If these figures are correct, the opportunities presented will attract investors, and a substantial production of rubber may be looked for from Guatemala within a few years.

Patents have been taken out in the United States and Mexico on a process of extracting rubber from the hule plant, a species of sage brush, which grows in the mountainous districts of Mexico and in parts of Texas, Wyoming and Nebraska. The cost of production is said to be slight.

Electrically Driven Blanking Press.

The accompanying illustration shows a No. 92 Toledo punch, direct driven by a Bullock No. N-136 electric motor. The motor occupies no more room than the driving pulley of a belt-driven machine.



ELECTRICALLY DRIVEN BLANKING PRESS.

It is series-wound, operates at 240 revolutions a minute, and at this speed develops four horsepower. The main switch, fuse box and rheostat, as shown in the picture, are mounted upon a board fastened to the motor support. The machine is compact and powerful, and, being electrically equipped, may be set upon the shop floor without regard to line shafting, a feature that makes it possible to economize greatly in floor space. The motor is described in bulletin No. 35, which may be obtained by addressing the Bullock Electric Manufacturing company, Cincinnati, Ohio.

The Auburn Electric Railroad company has been incorporated, with $50,000 capital stock, to construct and operate electric street railways in Auburn, Cal. The directors are A. S. Moore, B. F. Hartley, J. H. Wills and P. C. Moore.

Steam Turbines.

Mr. Francis Hodgkinson presented a paper on "Steam Turbines" before the Engineers' Society of Western Pennsylvania in Pittsburg on November 20, 1900. The paper gave a historical treatise of the subject and dwelt upon the principles of the de Laval turbine, but treated especially of the construction and operation of the Westinghouse-Parsons steam turbines, with the building of which the author has been connected. An abstract of this interesting paper was printed in the Western Electrician of December 29th, with several of the illustrations. A valuable discussion was brought out by the paper and most of the remarks are given herewith, as published in the proceedings of the society:

Mr. Chester: As shown in Fig. 8 (Fig. 2, page 418), how do they prevent the steam passing backward? It has got to have some clearance, has it not, in order to turn?

Mr. Hodgkinson: There is, undoubtedly, some leakage, but, as I stated, the leakage is small in view of the results we get.

Mr. Chester: What becomes of the leakage?

Mr. Hodgkinson: It goes into the exhaust pipe. Suppose that piston (C) is leaking more so than the others, therefore more steam will pass through there, and the steam will leak up into (F) and do work. Of course, there is generally some leakage which goes into the exhaust pipe.

Mr. Chester: It is stated that you require 14 pounds of steam per electrical horsepower. In the pumping engine they have got it down below 11 pounds per pump horsepower. How does that compare with electrical horsepower?

Mr. Hodgkinson: I don't know what efficiency of transmission is used in a pumping plant. They must have had superheated steam.

Mr. Chester: I think the average was 80 per cent. You will find in a paper read by Mr. G. H. Barrus, before the New England Waterworks association, December 14, 1898, he averages up the efficiency of five different engines and gets about 80 per cent. Some of them had superheated steam and some did not. One or two had superheat. The 80 per cent. efficiency obtained as referred to the low-pressure cylinder or, mean effective pressure referred to the low-pressure cylinder divided by the theoretically mean effective pressure referred to the pressure near the throttle valve and the ratio of expansion at the same point. In the same paper, the per cent. of the friction of these engines varies from five to 10 per cent. I would, however, cite the recent test of the engine built by the Allis people for the city of Boston; a duty of 178.6 million foot-pounds was obtained for each 1,000 pounds of dry steam consumed, no superheat. This, as you know, is equivalent to about 11.2 pounds of steam per pump horsepower.

Mr. Hodgkinson: Of course, superheat adds very much to the efficiency. I think a first-class water plant should have more than 80 per cent.

Mr. Bole: It must be remembered that this leakage is charged up against the engine.

Mr. Hodgkinson: In this instance as soon as the steam is consumed it is charged against the horsepower produced.

Mr. Chester: I did not really see how it could be accounted for, but I see now that it would do some work passing back.

Mr. Albree: Does the machine run noiselessly?

Mr. Hodgkinson: There is a certain amount of humming, but it is so slight that a wooden partition would generally keep it out. At 1,500 revolutions per minute, it runs perfectly noiselessly. Of course, the generator makes some noise; otherwise it is very silent.

Mr. Flanagan: I would like to call the attention of the members to the remarkably clear and lucid explanations of a machine with which most of us are anything but familiar. I think all will agree with me when I say that Mr. Hodgkinson has put more facts into a small number of words than are usually found in scientific and technical papers. I have tried to think up a question to ask him which he has not already answered, and the only one I can think of is: What kind of material are the blades made of? Those passed around are apparently bronze. I would like to ask if other materials would be affected by the steam, whether this is a subject that has been gone into much, and whether there is one metal that is preferred over another?

Mr. Hodgkinson: Hard-drawn bronze metal is preferred because it does not corrode and by reason of its great strength. You will notice how very rigid the blades are in the specimens passed around. Such blades would be used in a 500-horsepower turbine.

Mr. Bole: Mr. Hodgkinson has called attention to the fact that the pressure is exceedingly small on each blade. It is expressed in ounces. The greatest tax of strength of the blade is that imposed by centrifugal force.

A member: I would like to ask the clearance between the blades.

Mr. Hodgkinson: It is desirable that it should be as fine as possible, about 0.025 inch clearance. We also have them as much as 0.050 inch. The larger the blade the more leeway you must allow. As stated before, the blades receive motion from two causes—one from the steam striking them and one from the steam leaving them.

Mr. Stewart: I would like to ask the price of these turbines as compared with a regular steam engine of the same power.

Mr. Hodgkinson: I would say, generally, that a steam-turbine generator, with all the outfit, can be sold at the same price as a Westinghouse compound engine and generator outfit.

Mr. Bole: In other words, a steam-turbine generator can be sold at about the same price as any other machine of equally high efficiency. The price of a turbine engine and generator can be said to be about on a par with a high-class compound triple-expansion engine.

A member: Stress has been laid on the turbine being suitable for driving an alternating generator. I want to ask the difference.

Mr. Hodgkinson: There is always a difficulty in driving an alternating generator in multiple. The difficulty is in the fact that it is impossible to give a perfectly uniform rotation. That is, the revolving shaft will go a little quicker at one point than at another during one revolution. That would not matter much in a direct-current, but it would in an alternating, generator. The machine would "buck" and would get out of step, but in the turbine there is substantially no such variation.

Mr. Bole: That is of the utmost importance in the successful running of very large electrical plants. We all appreciate the difficulty in driving several engines in a factory by means of tooth gears, on account of back lash and difference in their velocity. The ordinary engine revolves not in a perfectly uniform manner, but in fits and starts. The flywheel is the means usually employed to keep it at a uniform velocity. By this means the engine does not start and stop at every revolution, but keeps a sustained rotation in one direction only. Nowadays power stations are assuming sizes that a few years ago we never dreamed of. The application of the turbine is very hopeful. Flywheels are now being built for large engines to apply to ordinary engine service, weighing as much as 300,000 to 350,000 pounds for single engines. The difficulty of driving alternating generators in multiple might be explained by Mr. Scott.

Mr. Scott: The difficulty in driving alternating-current generators in multiple does not apparently lie in the alternator, but in the engine, and the difficulty of securing uniform angular velocity which Mr. Hodgkinson has just spoken of in the comparison of the turbine and the engine is rather a difficulty in the design to be taken up at the beginning and arranged for once for all than a difficulty in operation. That is, the engine must be designed with the flywheel in proportion and the governor adjusted so as to meet certain conditions, and if these things have been done, it is usually a comparatively simple matter to operate in multiple. There are many stations operating in multiple now, and I don't recall any station which it is desired to operate in multiple and in which reasonable provision has been made, in which the operation is not carried on. That is, operation with engines of the present class is a thoroughly practical matter.

You notice in the figures that were shown that the alternator is not of the usual form, as there are but two poles. The alternator mentioned gives 7,200 alternations per minute. Two poles and 3,600 revolutions give that product. To give the same number of alternations an alternator run at 100 revolutions would require 72 poles, and if run at a lower speed would require still more poles. It would be impossible to run an alternator at more than 3,600 revolutions and obtain 7,200 alternations, so that, in this way, the speeds which can be used for a given number of alternations are definitely fixed. The number of alternations, 7,200 is the one in common commercial use. In this case the turbine speeds would have to be 3,600, 1,800, 1,200 or less; so that these interesting limitations are brought on by rate of alternations of the alternators, and the fact that the alternator must have an even number of poles.

A member: Can you give the number of these machines in use in this country?

Mr. Hodgkinson: There are not many in use in this country, probably seven or eight. There are many being built in Europe. They vary in size. The last one built by the Westinghouse Machine company has a capacity of 3,000 horsepower.

Mr. Bole: The demand upon the engine builder in this matter of speed and velocity might be expressed in a homely way in some such fashion as this: That engines of large size and power may have flywheels in diameter 28 feet. The two sets of engines intended to produce alternating currents in multiple must be possessed of such qualities that if two flywheels were marked at given points, those two points would never deflect from each other, say, an inch. If you imagine a 28-foot flywheel running absolutely uniformly and running alongside of it one of the same diameter, each marked, these two marks must remain in the same relation to each other. So that to design an engine which will transmit 500 horsepower one minute, 1,000 the next, and 3,000 a few minutes later, and keep that flywheel running in the same uniformity is one of the tasks that is imposed upon engine builders.

A member: Mr. Scott has called attention to the high speed, and I presume that we are not to look forward to any material reduction of speed in that class of machines.

Mr. Hodgkinson: In case of the turbine, of course, we are working always in the direction of reducing these speeds, but have not succeeded very much yet.

Mr. Bole: A slower speed turbine would involve a larger diameter turbine, which would increase the cost of the turbine.

Government-owned Telegraphs in the British Empire.

Sir Sandford Fleming has addressed a letter to Hon. William Mulock, the Canadian postmaster-general, at Ottawa, in favor of a state-owned telegraph service to girdle the globe. The letter is said to be the beginning of a movement to nationalize the cable and telegraph service of the British Empire. Sir Sandford says that it is an opportune moment to consider a question which affects Canada, as well as Australia. The arrangement for the establishment of the all-British cable across the Pacific Ocean has been completed. That arrangement implies joint ownership, and, in the opinion of Sir Sandford, is the harbinger of a complete system of state-owned telegraphs, by land and by sea, ramifying throughout the whole British Empire. The existing lines of telegraph between distant portions of the empire pass in part through foreign countries, or traverse shallow seas in proximity thereto, where at a critical moment they are liable to speedy interruption. The rates, too, are said to be oppressive, by reason of the monopoly. The reason the friends of the Pacific cable have never relaxed their efforts is the fact that the Canadian route between England and Australia is absolutely the only one by which the globe can be girdled by an all-British chain of telegraphs. With the telegraph system nationalized, as suggested, Sir Sandford Fleming says that messages will be transmitted to and from the most-distant British possessions at one-eighth or one-tenth the rates now levied by the companies.

This proposal to nationalize the telegraph lines throughout the empire, and with it the proposition that Canada should take over the lines of private companies in the Dominion, has caused a great deal of discussion throughout the country. Prominent business men stated that they had had a correspondence regarding the suggestion before it was made public. This would seem to indicate that the Dominion government had previous knowledge of Sir Sandford Fleming's letter before it became public. The difficulty of operating public lines in Canada touching and merging in the lines of private companies at many points on the United States border is an objection noted by those who are now discussing the proposition.

Large Photograph Taken by Electrically Ignited Flashlights.

A photograph which is said to be the largest in existence was recently taken of the general office of Swift & Co. at the Union Stockyards, Chicago. The work was in charge of George R. Lawrence, who has made a special study of work of this kind. The office is said to be the largest single office room in the world, it having a floor area of 46,918 square feet and seating capacity for about 700 clerks. The size of the room and the arrangement of the windows made it necessary to use a large number of flashlights, which were instantaneously ignited by electricity. For the purpose of electric ignition a storage battery of 20 cells was installed temporarily, and connected to the temporary circuit in pairs, giving a pressure of four volts and a large current capacity. Three hundred charges of flashlight powder were arranged around the room, and the fuses to ignite them were all connected in multiple, to insure simultaneous ignition. Each fuse required 1½ amperes, making a total of 450 amperes required from the battery. A stage was built in one corner of the room for the large camera, the plate used being 4½ by eight feet in size. The plate is of heavy plate glass, and in developing it four men are required for its handling. The picture shows the clerks at their desks, together with the officers of the firm.

Legal Victory for Chicago Elevated Railways.

Two decisions were handed down last week in suits brought against Chicago elevated-railway companies by owners of property adjoining the right-of-way of the roads. Both were in favor of the defendants. The more important of the two suits was that of the trustees of the Monadnock building against the Union Elevated Railroad company for $300,000 damages for alleged depreciation in the value of the building by reason of the noise caused by the trains and the obstruction offered to light and air on the lower floors. The court sustained the demurrer filed by the railway company, and held that the allegations were too general in character. The other suit was brought by an individual property owner for damages for alleged depreciation in the value of property due to the proximity of the Metropolitan elevated road. It was conceded that if the annoyance had been caused by a private person in the pursuit of his lawful business no liability would arise, and the court held that the law should be similarly interpreted in the case of a corporation. Both cases will be appealed.

Transmitting Sound under Water.

[From the New York Sun.]

Boston, January 5.—Prof. Elisha Gray, the inventor, and Arthur J. Mundy of this city have, after more than two years of experiment and study, invented delicate machines with which to transmit submarine signals. By means of the apparatus already constructed messages have been transmitted and received on board a steamship twelve miles from the signal boat. The inventors say that the submarine boat Holland would not be able to surprise warships equipped with the receiving or hearing instruments, for the reason that the working of the Holland's machinery could be detected while she was still some miles away. The members of the United States Lighthouse Board have had the plan explained to them, and all, from Rear-admiral Higginson down, are of the opinion that the system would be of value to the lighthouse service. It could also be used to announce the approach of ocean steamships to port.

The idea first occurred to Mr. Mundy while sitting on the deck of a Mississippi River steamboat shortly after Dewey's victory in Manila Bay. He sat down and wrote a long letter to Professor Gray, who was so impressed with the idea that he left his home in Chicago and has been in Boston ever since working with Mr. Mundy to make the scheme a success. Every schoolboy knows that if two stones are cracked together under the surface of the water a sound is produced which may be heard under water for a long distance. This simple fact suggested to Mr. Mundy the possibility of a signaling system by means of which ships at sea might communicate with each other, or with stations on the shore, or by which warnings might be sent to ships from the shore in times of fog or darkness. The idea was communicated to Professor Gray, who undertook the task of providing the necessary mechanical devices for carrying it out. Work was begun in July, 1898, and has been steadily prosecuted ever since by both Professor Gray and Mr. Mundy. As a result of their joint labors a practical test was made on the last day of the century, which is described in the following statement:

We, the undersigned, hereby certify that we have this day heard the submerged bell (struck electrically from the experimental station on board the Sea Bell) through the electrical receiver (submerged from the deck of a steamer engaged for the purpose), at distances of 1½, four, eight and 12 miles in the open sea. At 1½ miles the sound of the bell was heard very loud and very distinctly; at four miles the sound was quite as distinct and almost as loud as at 1½ miles; at eight miles the sound was quite as distinct as at 1½ miles and almost as loud as at four miles; at 12 miles the sound was heard at times quite distinctly and at times somewhat feebly. Even at 12 miles the sound received was sufficient to give a practicable warning signal. The bell was also heard in the forehold of the steamer, without any receiving apparatus whatever, at a distance of one-quarter of a mile, so loud that it seemed to be right alongside the ship, and at a distance of 1½ miles it was heard faintly but unmistakably, in the same position in the hold and without any apparatus for detecting sound.

The statement is signed, among others, by Henry M. Whitney, Commander Arthur P. Nazro, U. S. N., Professor Wallace C. Sabine of Harvard, Professor William Y. Allen, Professor Elisha Gray, Arthur J. Mundy, Henry M. Soule, Captain E. Baker of the steamer H. F. Dimock, and A. P. Bartow, master U. S. S. Mayflower.

The experimental boat, the Sea Bell, was built last summer by the inventors for the purpose of enabling them to make a practical test of their theories. Very little has been known heretofore about the action of sound waves in water, experiments in acoustics having been made principally in the atmosphere. Before building the Sea Bell the inventors made many experiments with sound in the water, using as sound producers explosives, water whistles and other devices. They finally selected a bell as the best instrumentality for producing the sound. Accordingly the Sea Bell is equipped with an 800-pound bell, such as is used for fog signaling in the atmosphere. The current for supplying the necessary power comes from a small dynamo driven by a six-horsepower gasoline engine. The bell is lowered through a well-hole directly in the center of the boat until it is 20 feet below the surface of the sea. By an ingenious mechanism it may be rung continuously, just as a church bell is tolled, or it may be made to ring any desired number or numbers, at the will of the operator, who is thereby enabled to send intelligible messages, each letter of the alphabet being represented by a number. It is obvious that, instead of suspending a bell from a boat, it may be suspended from a buoy, and anchored under water of any depth at any distance below the surface. In such a case the current for operating the clapper would be brought to the bell from the shore by means of a submarine cable.

This much for the transmitting station, which produces the sound. The problem of picking up the sound thus produced from the depths of the sea is another story. The inventors have devised a great variety of receivers, operating pneumatically and electrically and mechanically, and have carefully tested their relative efficiency. The simplest way to receive the sound on board ship is to go below in the hold of the vessel as close to the keel as possible, without any apparatus whatever, and listen. At a distance of a mile or more the sound of the bell may be distinctly heard by the unaided ear. It comes through the water and passes through the sides of the ship into the atmosphere of the hold, and is there recognized by the ear. If one end of a wooden rod is placed against the skin of the ship, the other end being placed against the ear, the sound is heard at even a greater distance. A common tin ear trumpet, such as used by a deaf person, screwed on the end of a piece of gaspipe, the mouth of the trumpet being sealed by a tin diaphragm and submerged six feet under water, enables the observer at the other end of the pipe to hear the submerged bell at a distance of three miles.

For greater distances the inventors have constructed an electrical receiver, by means of which the bell has been heard distinctly at a distance of 12 miles. The submerged end of this receiver may be lowered over the side of the ship or attached to it on either side of the bow, under the water line, like a pair of ears. The submerged part is connected by means of an ordinary telephone receiver, which may be carried to any part of the ship, say, the pilot house, where the navigator can listen for the sound of the bell. Professor Gray has devised an improvement for the electrical receiver by means of which a large gong will be rung automatically in the pilot house, or any other part of the ship, whenever the submerged bell is rung. That is to say, the gong rings sympathetically, following the bell, stroke by stroke, there being no connection between them other than the sound waves traveling through the water from the bell to the gong. Thus a bell may be submerged at some dangerous point, like Norman's Woe, and a vessel coming within two or three miles of it will be automatically warned of her danger by the strokes on the gong in the pilot house. Ships are often lost by getting out of their course, and come to grief at the very moment when the captain thinks he is perfectly safe, and is therefore keeping no lookout. This apparatus will be always on the lookout, and sound an alarm whenever necessary.

There are several uses to which these devices may be applied. The first and perhaps the most important is to enable the navigator to determine with precision his position at sea, when within 10 or a dozen miles of the shore. Both the English and the United States governments have spent a great deal of money and time in trying to secure an atmospheric fog signal that can always be depended upon in any condition of weather, but without success. The most powerful steam siren, that can often be heard at a distance of 15 miles, will sometimes be inaudible at the distance of a ship's length. The cause of all the trouble seems to be the varying conditions of the atmosphere as to density, temperature and motion, which break up, reflect and refract the sound waves, so that the signals sometimes utterly mislead the observer, and are often entirely inaudible. These perverse conditions do not exist in the water, which has a uniform density, and therefore a sound once started will radiate in all directions steadily and without deviation and reflection. It is proposed by the inventors to station along the coast at intervals of, say, 10 miles, a series of submerged bells to be thus rung electrically from a shore station. These bells will announce their identity by ringing each a different number. Their position will be charted, so that the navigator hearing the number will know which bell is sounding it, and the chart will tell him its position geographically.

It is of course obvious that by equipping ships with these sound producers and sound receivers intelligible messages may be sent back and forth, either between ships or between ships and the shore. Again, vessels thus equipped may avoid collision by notifying each other of their approach and the direction of their course. Again, lightships can be put into communication with the shore by merely anchoring a submerged receiver within a short distance of the light-ship, which, being equipped with a submerged bell, can announce the arrival of incoming vessels. This is a problem which has bothered the government, owing to the difficulty of attaching a telegraph cable to a ship which is swinging around a mooring.

The electrical receiver can be used for detecting the approach of a submarine torpedo boat, the noise of which can be plainly heard at a distance of several miles, the sound being intensified by the fact that the submerged boat must transmit all its vibrations to the water, which incloses it on all sides. Even small steam tugs on the surface of the water can be heard at a distance of two miles, the click of their machinery being distinctly audible. In the latter case only a fraction of the sound produced by the tug enters the water, most of it being transmitted through the air; but a submarine boat must give all her vibratory noises to the water. As the receiver will tell the direction whence the sounds proceed, the warship thus attacked may choose between running away or waiting till the torpedo boat comes within range and then fighting her with her own weapons under water.

Coroner's Jury's Verdict on Northwestern Boiler Explosion.

The coroner's jury which investigated the cause of the boiler explosion that occurred at the power house of the Chicago and Northwestern Railroad company, Kinzie and Kingsbury streets, on December 3d last, concluded that the boilers at the power house were not of sufficient capacity to furnish steam for the power required. The jury was also of the opinion that all steam boilers in the city of Chicago should be inspected at least twice in one year, and it recommended that the City Council pass an ordinance to that effect.

The testimony taken did not disclose conclusively the cause of the boiler explosion. It is believed that John Butterworth, assistant engineer of the plant, is the only man who could explain the cause of the accident, and his mental condition, resulting from the shock, is such that, were he to testify, it is thought he might become permanently insane. The inquiry failed to bring out the date of the last inspection by the city boiler inspector.

ANNUAL MEETINGS.

Lake Street Elevated.—The stockholders of the Lake Street Elevated Railroad company of Chicago held their annual meeting on January 9th. It was announced that the floating debt, amounting to about $600,000, would be funded by the issue of five per cent. debenture bonds, which will result in an appreciable showing of interest charges, as during last year the company paid out $37,756 interest on its debt. The trusteed stock will be released and delivered in exchange for certificates. These statements were made by Charles T. Yerkes, and in continuing he said: "Aside from the saving we expect through funding our floating debt, we expect to cut our expenses for power this year about $30,000. We get our power from the Cicero and Proviso road, and under an agreement with them we have to pay a certain percentage of the cost. The last year our power has cost us about 2½ cents a kilowatt-hour, as against about 0.75 of a cent on the Northwestern line. With the improvements that have been made in the power house, we expect this year to get our Lake Street power for about one cent a kilowatt-hour. Under our old agreement with the Cicero and Proviso we guaranteed them a profit of 10 per cent. on their investment. We have now reduced that guarantee to six per cent."

The statement for the year ended December 31, 1900, as presented by C. E. Yerkes, president of the Lake Street road, shows a total income of $757,954.83, against $697,513.27 for the previous year; the operating expenses for 1900 were $378,661.28, and the surplus was $4,752.34, against a surplus of $3,639 in 1899. The daily average number of passengers was 40,048. Altogether the prospects of the road are better than at any time since it came into its present management in 1894. Harvey T. Weeks, W. W. Shaw and Clarence A. Knight were elected to the board of directors to serve three years.

Northwestern Elevated.—The annual meeting of the stockholders of the Northwestern Elevated Railroad company was held on January 9th. Charles F. Ayer was named as a director to succeed John C. Welling, and Charles T. Yerkes was re-elected to the board. President Owsley in his report called attention to a number of points of interest to shareholders and patrons of the road as well. In spite of the fact that when the road was opened on May 31, 1900, only 10 of the 21 stations were ready for use, and that it was not until a month and a half later that all of them were opened, the road has earned 2.46 per cent. on its preferred stock, which is at the rate of 4.2 per cent. a year. For the last three months the earnings have been at the rate of over five per cent. a year. All the metal work has been received and erected. Since the opening of the road 15 new motor cars and 25 coaches have been ordered, as well as a new generating unit for the power house, which will increase the capacity of the latter 29 per cent. The financial statement for the seven months' operation showed gross receipts of $525,023.06, operating expenses $180,451.98 and a surplus of $123,018.04. The average daily number of passengers carried was 47,594.

Electrically Operated Pneumatic-tube Mail System Recommended for Chicago.

According to an order issued by Postmaster-general Smith on August 13, 1900, the postmaster of Chicago, Mr. Charles U. Gordon, and the superintendent of the sixth division railway-mail service, Captain E. L. West, were constituted a local committee to investigate the question of the quicker transmission, delivery and dispatch of mail in Chicago. This committee's report has been submitted to the postmaster-general, and its recommendations have in turn been sent by him to Congress.

The report is quite long and contains interviews with manufacturers, testimony collected by the committee and data showing the need of a more rapid mail-transmission system. Various methods and systems were investigated, and it was found early in the inquiry that a system of underground conveyance of mail in pouches by electric cars or carriers was apparently possible, yet the prospect of a system being actually established and operated seemed more or less remote.

The system recommended is a pneumatic one, with three lines of eight-inch tubes radiating from the temporary postoffice building on Michigan avenue. One line will run to the Chicago and Northwestern depot, one to the Union depot and the third to the stockyards district, each line connecting with stations en route. Each line will consist of double tubes for going and returning

mail, and the total length of the routes will be nearly eight miles.

The committee is of the opinion that a system directly operated by electricity is preferable to a system directly operated by steam, and also that at this time it is more advantageous for the government to rent a pneumatic-tube system than to own one outright.

CORRESPONDENCE.

New York Notes.

New York, January 5.—An injunction has been issued against the Metropolitan Street Railway company, restraining it from operating cars in Lexington avenue, north of Forty-second street. The basis of the decision is a provision of the railroad law which makes it illegal for a franchise on more than one branch or extension of a line to be sold on one bid. A franchise was obtained by the company to extend the Lexington avenue line north of Forty-second street and to build a cross-town line in One-hundred-and-sixteenth street, and the court held that this constituted a violation of the law. The injunction was stayed for 30 days, as the company gave notice of an appeal. If the decision is affirmed, the railway company will be liable for damages to all property owners along Lexington avenue, besides having to apply for the sale of the necessary franchises to continue operation in the streets named. It is said that other franchises of the Metropolitan company will also be endangered, although not at present involved.

It is practically decided that the rapid-transit tunnel will have to be built under Forty-second street, instead of under the Grand Central station, as the New York Central is formulating plans for making the station a two-storied terminal. According to the present project, the lower level will be used by the suburban trains, for which a loop will be built, and the operation will be similar to that in the large terminal at Boston. There will be a passageway between this level and the rapid-transit tunnel, and it is possible that direct connection by rail will be made, so that suburban trains of the New York Central and New Haven roads may run to the City Hall and possibly to Brooklyn, through the East River tunnel. The New York Central officials want to do away with steam locomotives before carrying out the plan. A bill is to be introduced into the Legislature providing for the construction of pipe galleries simultaneously with the construction of the tunnel. The estimated cost is about $3,000,000. William F. King, president of the Merchants' association, is preparing the bill, and Comptroller Coler and the Rapid Transit Commission are said to be in favor of it.

The State Board of Railroad Commissioners has decided in the matter of the complaint of the Broadway Board of Trade of Brooklyn against the Brooklyn Heights Railroad company that it has no jurisdiction to compel the granting of transfers by the company at Myrtle avenue and Broadway and at Lorimer street and Broadway.

The strike of the Electrical Workers' Union No. 3 has been called off. The advance in wages demanded was not obtained, on account of the competition of a rival union, and the only point gained by the strikers was the recognition of their organization.

At the monthly meeting of the Chamber of Commerce, on January 3d, a resolution was passed favoring the establishment of an American transpacific cable by private enterprise. It was stated that to be commercially valuable the cable should touch Japan and China, and that the governments of those countries would probably not consent to a cable controlled entirely by the United States government. M. L. G.

Canadian Intelligence.

Ottawa, Ont., January 5.—George H. Collins of Greenwood, B. C., has sold to Nelson capitalists all his interests in the Greenwood and Phœnix tramway and the Phœnix Electric Light company. The new owners propose commencing operations in the spring on the tramway which is to connect Greenwood with Phœnix.

The council for the town of Lindsay, Ont., has approved of the submission to the ratepayers of the town of a by-law authorizing the corporation to operate a municipal street-lighting plant.

Messrs. Ely and Turner of Wiarton, Ont., propose installing an electric-light plant in that town, and have asked permission from the municipal authorities to erect poles and wires on the streets.

A meeting of a number of capitalists was recently held in Essex, Ont., and it was decided to ask the Ontario government for a charter for an electric railway from the city of Windsor, Ont., to a point on the lake shore.

C. H. Mitchell of Niagara Falls, Ont., has made an inspection of the source of power at the falls, for the waterworks, and at the power house of the International Traction company, with a view of devising some means of increasing the waterpower and preventing ice blockades. Two plans are favored, one to enlarge the intake and the other to build a submerged dam.

A few minutes after midnight on the 1st inst. the Toronto Electric Street Railway company inaugurated the new century by starting a new 1,600-horsepower generator and a large engine to drive the street cars of the company. The generator is one of the best in the company's power house, and, in a patriotic vein, it has been christened the "Father O'Leary," in honor of the brave Catholic chaplain of the first Canadian contingent to South Africa, which has recently returned to Canada. The generator was built by the Siemens & Halske company of Chicago.

Next spring work will be commenced on a large pulp mill and electric power house at the Chaudiere Falls. Plans are now being prepared for the new buildings, and application has been made for the incorporation of the new company, which will be capitalized at $1,000,000. It is the intention of the company to develop electric power for rental, as well as for the operation of the mill. A. V. W.

Rochester, N. Y.

Rochester, January 5.—Work has been begun on rebuilding the plant of the Citizens' Light and Power company of Rochester, N. Y., which was burned on November 25th last. The contract for restoring the plant was let to the Archibald Brady company of Rochester. Superintendent J. A. Almstead states that in four weeks the company will be in working order. The company, which supplied light and power for commercial purposes, suffered a heavy loss by the fire, and the customers dependent on the plant were subjected to no little inconvenience. The electrical machinery consisted of eight 200-kilowatt Westinghouse generators and two Western Electric arc machines. These were so badly damaged that they will necessarily be replaced by new machinery, except in one or two cases. The switchboard, which was built of white marble and which was the particular pride of Superintendent Almstead, was practically ruined. It was built as a model board by the Westinghouse company and was one of the most complete and expensive in the country. The steam plant was only slightly damaged. The walls of the power house, which is located on Brown's race, at the foot of Factory street, were not injured, as they are of an unusually substantial construction. The roof of the structure was entirely destroyed. The plant is to be operated by waterpower, with steam as an auxiliary.

The State Railroad Commission will hold a meeting in Rochester on January 25th, to consider the application of the Buffalo, Niagara Falls and Rochester Railway company for a franchise. If a favorable decision is given by the commission, it is stated that construction on the road, which will connect Rochester, Lockport, Niagara Falls and Buffalo, will be commenced at once. The company has obtained, it is announced, consents for the right-of-way in 90 per cent. of the cases, and boards of supervisors in every county along the proposed route have declared in favor of the project. The road from Rochester will follow the boulevard from the Ridge road about 3½ miles north of the Niagara Falls branch of the New York Central to Lockport; thence the road will go direct to Buffalo, a branch running to Niagara Falls. The length of the railway will be about 100 miles. The officers of the company are: President, Allen C. Beach, Watertown; vice-president, Theodore Tone, Rochester; secretary, George Moss, Rochester; treasurer, George Brown, Rochester; attorneys, Baker, Davis & Baker, Rochester.

The Common Council of Rochester has adopted an ordinance for regulating the operation of "automobiles and other horseless vehicles." Each vehicle must carry two lamps and a gong or bell. For a mile from the corner of Main and State streets, the center of the business district, the speed is not to exceed six miles an hour, and on all other streets in the city the rate must not be greater than eight miles an hour. Automobiles must keep to the right of streets, pass to the left of vehicles proceeding in the same direction and slow down at crossings. Lamps are to be lighted within an hour after sundown. The gong or bell must be sounded at crossings, corners, and in passing other vehicles going in the same direction.

In his message to the Legislature on January 1st Governor Odell of New York made the following recommendation in reference to the organization of gas and electric-light companies: "I recommend that gas and electric-lighting companies and the questions relating to their organization, administration and control shall be placed in the hands of the Railroad Commission, care being taken to provide such limitation on their discretion as will secure due regard to the wishes of every locality and prevent the commission's sanctioning the creation of such corporations without the consent of the local authorities." D. W. J.

Information from Indiana.

Indianapolis, January 7.—The citizens of Richmond are greatly aroused over the proposition of the City Council to expend over $144,000 for a municipal electric-light plant. All of the bids recently opened are above that figure. Prominent taxpayers are practically a unit in opposition to the project, and it is probable that a suit will be brought to enjoin the council from making the appropriation. It is charged that a pool was formed by the construction companies and that the bids are far too high, the lowest being that of the Varney Electrical Construction company of Indianapolis.

City Engineer Jeup of Indianapolis says that his examination of the maps of the several heating and lighting companies which have secured hot-water and electric-light franchises for particular districts of the city and of the plans of the proposed companies, leads him to believe that their main purpose is to furnish electric light, and that the Indianapolis Light and Power company, which now has the contract for at least two years longer, will enter a vigorous protest.

The City Council of Kendallville has taken steps toward securing an incandescent electric-light plant. It is proposed to make the new municipal plant auxiliary to the arc-light plant, which has been operated by the city for several years.

The Stone & Webster syndicate has arranged to locate a new $200,000 rolling mill at Brazil. The company states that it will build one or more electric railways out of Brazil into the populous rural districts touching Carbon, Diamond, Cardinia, Benwood, Perth and Bridgeton. This company owns the Terre Haute street-railway system and electric-light works and the Brazil street-car system and electric-light plant, besides the interurban line between these cities.

The Board of Public Works of Indianapolis and the several interurban lines have at last agreed upon a contract for franchise privileges. It is as follows: Straight five-cent fares may be charged by the interurban companies; no transfers are to be issued or received; two cents a trip for each car is to be paid to the city for the first 10 years of the franchise and three cents a trip for the remaining 22 years.

Announcement has been made that all financial arrangements for the Indianapolis, Morristown and Rushville Traction company have been completed, and that the contracts will be awarded soon. The line will pass through Norwood, Irvington, Julietta, New Palestine, Reedsville, Fountaintown, Morristown, Gwynville and Arlington. In each of these towns the road will extend through a principal street. From Morristown a branch line will be extended south to Shelbyville, a distance of 12 miles.

Regular traffic on the interurban electric line of the Union Traction company, between Anderson and Indianapolis, began on the 3d inst. The first trip over the new line was made with a train of four cars loaded with 150 invited guests, newspaper men and officials. No accident or hindrance occurred. This line brings the capital city in close touch with all the cities of the gas belt. The schedule is hourly. F.

Northwestern Notations.

Minneapolis, January 5.—The new street-railway line to Walkerville, Mont., from Butte has been completed and put in operation.

The city of Menominee, Mich., has contracted with the Street Railway and Power company to furnish light for the coming year at $62 per annum for each of the 58 arc lights.

The Municipal Construction company of Chicago has made a proposition to furnish an electric-light plant for Juneau, Wis., and sell to the city on easy terms. The estimated cost of the plant is $15,000.

The electric-lighting system for Hutchinson, Minn., has been completed and put in operation.

The Des Moines Edison Light company will resume work for underground wires in Des Moines, Iowa, as soon as the weather will permit, in the spring.

The Marshalltown Light, Power and Railway company of Marshalltown, Iowa, is defendant in an action to recover $10,000 damages for the death of Joel Heald, a man of 69 years of age. Failure to provide fenders is made the chief cause of action. The company has just adopted a fender and will equip its cars at once.

If the action in Des Moines, Iowa, to eject the telephone company from the streets on the ground that it has no franchise is successful, a similar action will probably be brought against the street-railway company. It is claimed that the company's franchise has expired.

M. L. Bervis has been granted a franchise for an electric-light system at Republic, Wash. It will be operated from power furnished from the San Poil.

The commissioner of public works at Tacoma, Wash., has been directed to prepare plans and estimates of cost for a complete electric-lighting plant for the city.

The street-railway company of Des Moines, Iowa, has secured an injunction to prevent the county treasurer from selling its property for taxes. The action was asked on the ground that it would place a cloud on the title and would thereby damage the property of the bondholders.

The council of Creston, Iowa, has ordered the Creston Gas and Electric company to discontinue street-lighting service at once.

The council of Mankato, Minn., has voted to extend the franchise of the Mankato Electric Street Railway, Light and Power company.

Application has been made to the council of Astoria, Ore., for a franchise for a street-railway and electric-lighting system. Martin Foard, Frank R. Stokes and Charles H. Page, all of Astoria, are interested.

It is announced that the projected electric line between Des Moines and Newton, Iowa, will be completed and in operation within a year.

The rumor is revived that the power will be developed in the St. Croix River, between Taylor's Falls, Minn., and St. Croix Falls, Wis., and transmitted electrically to Minneapolis and St. Paul. There has been no definite step taken in the matter,

as the land on each side of the river is owned by the Isaac Staples estate, and no option has been granted by the Staples heirs.

The street-railway company in West Superior, Wis., has completed the work of relaying its tracks on Connors Point, to carry the new double-truck cars which are soon to be put in service.

The agitation for a steam railroad from Eau Claire, Wis., to La Crosse has revived the old project of a trolley line from La Crosse to Black River Falls and Neillsville. It is stated that capitalists are ready to invest in the projected electric line.

The council of Tacoma, Wash., voted to forfeit the present franchise of the Tacoma-Seattle electric railway, and to refuse to consider a new application from the company until the full payment of the forfeit bond shall have been paid.

The Seattle Electric company has offered a reduction of $12 a year on street arc lights for the city of Seattle, Wash., for the coming year.

The Automatic Fire Alarm company of Milwaukee has asked permission to install a fire-alarm system in Fond du Lac, Wis.

The cost complete of the new electric-light plant for Corydon, Iowa, was $15,106. There is a balance of $1,728 from the gross receipts from the bonds, the charges for wiring houses and the material on hand.

The electric-light plant at Pipestone, Minn., has again changed hands. Several Twin City capitalists are now in control. The present manager, D. J. McNerney, will continue his interest and, it is understood, will remain as manager. It is rumored that the company will make a number of changes and extensions.

Catherine M. Hall sues the Duluth Street Railway company for $8,000 damages for injuries sustained in being thrown from the platform of a car while in the act of alighting. R.

PERSONAL.

George A. Yuille, who has been associated with Chicago street-railway interests for nearly 20 years, has retired from active connection with them. He was assistant general manager of the Chicago Union Traction company, vice-president of the Cicero and Proviso Street Railroad company and director of the Lake Street Elevated Railroad company.

Everett Frazar, consul-general for Corea in the United States, who died at his home in Orange, N. J., on January 3d, was well known for many years by his connection in the Chinese-Japanese trade. Among the more important achievements of Frazar & Co., the firm he established in the far East, was the introduction of electric lighting in China and Japan. In the mikado's new palace in Tokio 3,000 electric lights were placed.

Mr. H. F. Parshall is in this country to place a large order for railway supplies for the Central London railroad and the Glasgow corporation tramways. In reference to his reported connection with the Yerkes interests in London, Mr. Parshall said that he had been negotiating with Mr. Yerkes' representatives for some time and had made them a proposition to which he might receive a favorable answer, but that no definite arrangement had been made.

Dr. I. A. Lumpkin, president of the Illinois Telephone Association and of the Mattoon Telephone company, was in Chicago this week. He reports that the business of his company has been such as to necessitate the addition of a new 100-drop board, which is now partly filled. He regards the outlook in the state as on the whole favorable to the Independent interests if they can be made to work together, and he urges attendance at next month's meeting at Champaign.

Mayor J. M. Head of Nashville, Tenn., was in Chicago recently with George W. Stainback, superintendent of public works of Nashville, and C. S. Brown, professor of mechanical engineering at Vanderbilt University. Professor Brown has recently accepted an engagement as consulting engineer for the city and the three gentlemen are making a tour of large cities investigating electric-lighting systems. Mayor Head said that Nashville had voted in favor of municipal ownership of electric-light plants, which will furnish light for both public and private purposes.

Charles Kimball Bannister, a well-known civil and mechanical engineer, died on January 10th of pneumonia at Ogden, Utah, at the age of 53 years. He was connected at different times as division, consulting or chief engineer with the Chicago and Northwestern, Chicago, Milwaukee and St. Paul, Union Pacific and Colorado Northern roads and is said to have surveyed more transcontinental lines west of the Mississippi River than any other engineer now living. His greatest engineering feat was the building of the large electrical power-transmission plant at Ogden. At the time of his death he had just completed the plans and financiering of another large power plant to be built near Ogden on the Weber River. He was an honored member of the American Society of Civil Engineers and had numerous degrees conferred upon him by universities.

ELECTRIC LIGHTING.

The Chicago council has ordered the city electrician to extend the city's lighting system, work on which was stopped last year for lack of funds. About 300 lights are to be added.

The city of St. Michaels, Md., will erect an electric-light plant in the near future.

The City Council of San Jacinto, Cal., contemplates the erection of a new electric-light plant.

A company has been chartered at Midland, Md., for the construction of an electric-light plant. C. C. Dailey is interested.

Two-thousand-dollar bonds for the purpose of purchasing an electric-light plant at Hartington, Neb., have been voted.

The Evanston-Yaryan (heating and lighting) company of Evanston, Ill., has increased its capital stock from $2,500 to $400,000.

The finance committee of Allegheny, Pa., has passed an ordinance providing for the issuance of $100,000 electric-light bonds.

The Legislature of Alabama has appropriated $100,000 for completing the electric-light plant at the Girls' Industrial School, Montevallo, Ala.

Sealed bids will be received up to January 28th by E. F. Susler, village clerk of Spencerville, Ohio, for the purchase of $8,000 five per cent. electric-light bonds.

Walter S. Morse of Thayer, Mo., is planning to build an ice and electric-light plant at Thayer and wants estimates on the necessary machinery, water-power to be used.

A certificate of increase of capital stock of the Connecticut Lighting and Power company of Hartford, Conn., from $1,000,000 to $15,000,000 has been filed with the secretary of state of Connecticut.

ELECTRIC RAILWAYS.

The Everett (Wash.) Railway and Electric company has decided to make extensive improvements on its system.

The Town Board of Eaton, Ind., has granted F. G. Brownell a franchise to operate a street railway in that town.

The Metropolitan Elevated Railroad company of Chicago has asked for a franchise for an extension of its line in Harrison street from Austin avenue to Fifty-second avenue. The extension is to be a surface line.

It is stated that a rate war is about to be inaugurated between the rival railway companies of Richmond, Va. The Passenger and Power company recently reduced fares to three cents on one of its lines, and has asked the council for an ordinance to permit a charge of three cents on other lines. Consolidation of the two companies is hinted at.

A change of route is announced by the promoters of the Chicago, Evanston and Northern Electric Railroad company, the new route to be in Wilson avenue from the terminus of the Northwestern elevated road to Western avenue, then north to Evanston. Ravenswood will be given a five-cent fare to the downtown district under the new plan. A 20-year franchise will be asked for the part of the road lying in Wilson avenue.

The Murphy third-rail system was given a private test last week in the Camden yards of the Baltimore and Ohio railroad. The system has recently been installed in the Camden yards and the Baltimore and Ohio tunnel, and was put in by Captain Murphy, the inventor, at his own risk, with the agreement that he should remove it and stand all the cost if not satisfactory. The trial was highly successful, and a public test will be held on January 15th.

AUTOMOBILES.

It is reported that preparations are about completed for the removal of the Woods Motor Vehicle company from Chicago to New Haven, Conn., and that within a few weeks it is expected the entire manufacturing plant of the company will be installed in the latter city. It is believed that the cab service will be continued in operation during the winter, but that eventually it will be discontinued.

The Automobile Club of America has decided to hold an endurance test for automobiles next fall. A prize fund of $2,500 has been established for the purpose, and there will be two classes, one for manufacturers and the other for private owners. In making the awards due consideration will be given to the number of stops, the weight in passengers carried and the repairs required, machines to maintain an average speed of from 12 to 15 miles an hour.

PUBLICATIONS.

Dixon's silica-graphite paint, a durable and protective coating for steel smokestacks, boiler fronts, heated surfaces, etc., is discussed in a circular distributed by the Joseph Dixon Crucible company of Jersey City, N. J.

The twenty-second annual number of The Tradesman, Chattanooga, Tenn., is filled with valuable information regarding the South and its development, and the worth of the publication is further enhanced by a large number of illustrations.

An installation of chloride accumulators in the residence of Archibald Rogers, Hyde Park, New York city, is described in a recent circular issued by the Electric Storage Battery company of Philadelphia. Illustrations are shown of the battery room, the engine and generator room, and the generator and battery building.

The Emerson Electric Manufacturing company of St. Louis has ready for distribution its 1901 catalogue of fan motors and ceiling fans for alternating current, and a copy will be sent to any electrical dealer or central-station company on request. The catalogue has been carefully edited, and in its 64 pages the different types of Emerson fans are illustrated and described in detail.

The twenty-first edition of the illustrated catalogue of batteries and electrotherapeutical appliances manufactured by the McIntosh Battery and Optical company of Chicago has recently been published. A complete line of electrical apparatus for medical use is listed, including combined galvanic and faradic batterics, cabinet batteries, cautery transformers, electrodes and electrotherapeutical specialties, rheostats, milliamperemeters, standard meters, static machines, X-ray machines, etc.

The Ball Engine company of Erie, Pa., has recently issued a new catalogue devoted to its belted and direct-connected horizontal self-oiling engines. The engines described are built from entirely new designs and patterns, and are believed to embody in all details the highest development of modern high-speed-engine practice. The catalogue, which has been edited and arranged with care, illustrates single-cylinder, cross-compound and tandem-compound engines and shows in detail a number of the features of the Ball engines that possess points of marked excellence. Tables showing dimensions and power ratings at different speeds and pressures of the engines are given at the end of the catalogue.

A treatise on electromagnets has been issued by the Varley Duplex Magnet company of Jersey City, N. J. The company makes a specialty of the automatic winding of fine bare, cotton and silk-covered copper wire, its products being used in all kinds of telephone and telegraph work, shunt windings for arc lamps, high-resistance windings, fine-wire field windings for small motors, rheostats, etc. The catalogue illustrates the construction of the windings and lists telephone magnets, induction coils, spark coils, Ruhmkorff windings and other apparatus. Of particular interest are a collection of illustrations of special magnets and circuit diagrams showing the methods of testing telephone and switchboard apparatus, ringers, solenoids, etc.

SOCIETIES AND SCHOOLS.

The second quarterly meeting of the American Physical society was held in New York city recently. Professor Henry A. Rowland presided. The officers chosen were the following-named gentlemen: President, Henry A. Howland, Johns Hopkins University; vice-president, A. A. Michelson, University of Chicago; secretary, Ernest Miller, Cornell University; treasurer, William Haller, Columbia University; councilors, Henry Crew, Northwestern University, and Edward B. Ross, Wesleyan University.

The University of Vermont and State Agricultural College of Burlington, Vt., have recently issued their general catalogue for 1900-1901 and their bulletin of the engineering department. In the former are given lists of the faculty, officers and students and general information in regard to admission, courses of instruction, scholarships, etc. The bulletin of the engineering department contains a comprehensive account of the department and the courses of study, laboratory, field and shop work followed, and concludes with a complete register of engineering graduates of the institution. Over 20 very good illustrations of different college building and interiors of laboratories, shops and drawing rooms give a good idea of the facilities for instruction in engineering. William H. Freedman is professor of electriical engineering.

CALENDARS.

An attractive calendar is distributed by the New England Electrical Works of Lisbon, N. H., through Goldmark & Wallace, 67 Cortlandt street, New York, general sales agents for the concern. The concern manufactures magnet wire.

The Commercial Cable company has issued a convenient wall calendar, with a tear-off slip for each week of the year. The pad is attached to a card with a striking design showing the world afloat in a billowy sea. On the globe the cable lines of the company are represented.

The Chase-Shawmut company, dealer in electrical specialties and manufacturer of high-grade switches and switchboards, 390 Atlantic avenue, Boston, has distributed to the trade calendars for the new year, containing illustrations of its sample board of specialties sent to the Paris Exposition and a modern switchboard installed in Savannah, Ga.

One of the handsomest of the season's calendars is that "extended with compliments and best wishes for 1901" by the G. F. Brunt Porcelain Works,

manufacturers of high-grade porcelain for electrical purposes at East Liverpool, Ohio. It consists of six sheets of cardboard fastened together by a dainty red ribbon. Each of the sheets serves for two months of the year and is adorned with a picture of a spray of roses, the blossoms, buds, foliage and stems being of natural size and coloring. Red, yellow, pink and white roses are represented, there being a different design for each of the six sheets. The coloring is natural and rich, the drawing is excellent, and the whole series is effective and pleasing. The pictures bear the name of Paul de Longpré.

MISCELLANEOUS.

The Southern Engine and Boiler Works, Jackson, Tenn., are in the market for electric traveling cranes.

C. Hanika & Sons, Muncie, Ind., want bids on machinery and electrical supplies for their new architectural iron works.

Consul Listoe at Rotterdam states that he has received inquiries from persons in that vicinity concerning the addresses of American producers of zinc ore. It is stated that the European zinc mines are practically exhausted, and that there is a good demand there for zinc and zinc ore. As zinc ore is more valuable than iron ore, and could bear the freight charges better on that account, it would seem that a profitable export trade could be built up.

TRADE NEWS.

The United States Electric Contracting company of Syracuse, N. Y., has been incorporated, for $40,000. The directors are David Cronin, F. S. Rogers and E. R. Caldwell, Syracuse.

The Thayer Electric company of Peoria, Ill., has been incorporated, with a capital stock of $25,000, to manufacture electrical machinery. The incorporators are R. Lester Thayer, Louis B. Van Nuys and C. B. Murray.

Precisely at midnight on New Year's eve the motive power was turned on for the first time at the new boiler plant of the Babcock & Wilcox company in Bayonne, N. J. The plant, which had been removed from Elizabethport, N. J., covers an area of five city blocks long by three wide and has been more than a year in construction. The starting up of the works was celebrated by a dinner at which the mayor and other officials of Bayonne were the guests of the company.

Thomas H. Bibber and Charles E. Bibber have severed their connections with the Bibber-White company of Boston, and the latter-named gentleman will continue his business as contractor for railroad and electric-light plants at 37 Arch street, Boston. Thomas H. Bibber has opened up an office at the same address under the firm name of Thomas H. Bibber & Co., and will act as manufacturers' agent in the buying of electrical merchandise, making a specialty of bare and insulated wires. His firm will also cater to electric-light stations and street railways in specialty lines.

The Manhattan Electrical Supply company of New York will open a Chicago branch at Nos. 186 and 188 Fifth avenue on or about March 1st. It will occupy two floors and the basement of the building, and will do a wholesale and retail business. The company is building a large addition to its Jersey City factory, which, when completed, will place the company with the largest manufacturers of general electrical supplies in this country. The Manhattan company is now making a large variety of novelties and is constantly adding to the line.

BUSINESS.

The Electric Appliance company, Chicago, says that a plant, in order to be strictly a twentieth-century plant, should use Adams-Bagnall arc lamps.

The Richmondt Conduit company of Milwaukee reports a most satisfactory and constantly increasing demand for its conduit products. Mr. Richmondt says that his conduits have just been approved by the three electrical boards of New York, in which city the company has opened a branch office and warehouse for the benefit of its eastern patrons. This will insure prompt shipment on all short or rush orders in that territory.

The Tennessee Lumber company of Lewisburg, Tenn., deals in red-cedar and chestnut telephone poles, fence posts, barn poles, railway and highway piling, locust insulator pins and all kinds of hardwoods. It has a branch office at Kellerton, Iowa, and oak mills at Monticello, Ark. This company was organized December 1, 1900, by W. G. Liggett and C. C. Houston of the firm of Houston & Liggett, Lewisburg, Tenn., and E. R. Greenman and W. B. Greenman of the firm of Greenman Bros. of Wanamaker, Iowa. It has the following-named officers: President, E. R. Greenman; vice-president, W. G. Liggett; secretary, W. B. Greenman; treasurer, C. C. Houston.

The Central Electric company, Chicago, general sales agent for the Columbia incandescent lamp, reports a most flourishing business in this department. It seems that the Columbia lamp is daily increasing in popularity, and among its thousands of users all over the country, the experienced, discriminating buyer is the most noticeable. The Central Electric company, also reports a varied, steady growth in National lead-encased cables, particularly among the Independent telephone people. The Central company has just taken the sales agency for the Hylo lamp and is prepared to supply the trade, as well as consumers. The Hylo lamp is said to be one of the most successful lamps for use in sick rooms, where a dim light is required.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 1, 1901.

664,868. Electrically Operated Cut-off Valve for Engines. Louis Johnson, Milwaukee, Wis., assignor of one-half to Albert C. E. Icke, Milwaukee, Wis. Application filed November 18, 1899.

The inlet valve is mechanically operated and the cut-off is operated by electromagnets through a commutator which controls the valves for both ends of the cylinder. Electrical connections are made and broken by means of a ball governor.

664,869. Electric Wave Telegraph. Warren S. Johnson and Charles L. Fortier, Milwaukee, Wis., assignors to the American Wireless Telegraph company, Milwaukee, Wis. Application filed February 16, 1900.

A coherer is electrically connected with a local circuit including a source of current and a wave-indicating instrument. The transmitting mechanism comprises a wave-producing instrument, an operating key and source of current, a wave-intercepting or transmitting conductor and a switch normally connecting the conductor with the coherer and breaking the connection between the conductor and the wave-producing instrument. This switch is adapted to disconnect automatically the conductor from the coherer and connect it with the wave-producing instrument whenever the circuit is closed.

664,904. Microphone. August H. Sköld, Stockholm, Sweden. Application filed December 22, 1897.

This microphone has a single diaphragm bearing contact plates on one face and a number of granulated carbon contacts in series with the diaphragm and line and situated adjacent to the contact plates.

664,907. Electric Elevator Controller. Barrington S. Stephens, New York, N. Y., assignor to the Electrical Appliance company, Jersey City, N. J. Application filed March 17, 1899. Renewed May 24, 1900.

The electric switch is actuated by a bar which has a longitudinal slot embracing a pin extending from the switch rod. A latch lever is pivoted to the bar to extend into the slot. A separate hand rope is attached to the latch lever, and a spring to the separate hand rope and to the switch rod. The bar carries stop pins for the latch lever.

664,915. Electrical Device for Determining the Resistance or Conductivity of Bodies. Henry E. Warren, Newton, Mass. Application filed January 27, 1896.

A Wheatstone bridge comprises an arm having variable resistances whose values are arranged in geometrical proportion, an arm formed by the resistance to be measured, and a slide wire forming the other two arms, arranged in a circular path. A contact is arranged to engage the wire to balance the bridge. A pointer is controlled by the contact, and a scale so graduated that the pointer when the bridge is balanced shall indicate on the scale a decimal part of the unknown resistance. A telephone is in circuit with the bridge, and a vibrating arm carries a part arranged in the telephone circuit, the part being controlled by the current in the circuit, and arranged to indicate in the telephone the presence or absence of the current in the circuit.

664,939. Outlet Box. John Fountain, Jr., Elizabeth, N. J. Application filed October 27, 1900.

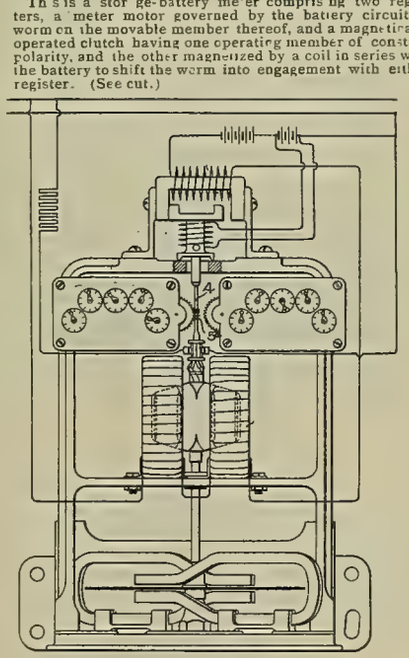
This outlet has one or more openings in its bottom or base, and a separate disk or disks, cast in position over the openings in the base, and similar openings in the sides of the box closed in the same way. The disks or plates in either the bottom or sides of the box are capable of being broken away to form openings.

664,941. Telephone Attachment. George W. Ganoe, Philipsburg, Pa., assignor of two-thirds to William C. Prickett and John S. Furst, Williamsport, Pa. Application filed July 2, 1900.

An arm is pivotally mounted adjacent to the transmitter and has a receiver held in its free end in such a position as to obstruct free access to the transmitter. A weight in engagement with the switch normally holds the latter open, and a flexible device is secured to the weight and adjustably attached to the arm whereby a movement of the arm will free the switch of the overpowering force of the weight and permit the switch to close the circuit when the operator gains access to the transmitter.

664,948. Electric Meter. Caryl D. Haskins, Newton, Mass., assignor to the General Electric company of New York. Application filed July 29, 1899.

This is a storage-battery meter comprising two registers, a meter motor governed by the battery circuit, a worm on the movable member thereof, and a magnetically operated clutch having one operating member of constant polarity, and the other magnetized by a coil in series with the battery to shift the worm into engagement with either register. (See cut.)



No. 664,948.

664,953. Electrical Resistance Board. Willis R. King, Newark, N. J., assignor to the Hanson & Van Winkle company of New Jersey. Application filed July 21, 1900.

This rheostat comprises a non-conducting base, segments or blocks secured thereto, and disposed in a circle around a common center, and a centrally arranged vertical post in the base provided with a vertically arranged screw-threaded portion. Sockets extend radially from the segments. One or more helical resistance coils are interally separate from and removably connected with the sockets. A centrally pivoted switch arm or lever electrically connected at its one end with the main circuit is adapted to make electrical contact at its other end with either of the segments. (See cut on next page.)

664,966. Electrothermostatic Cable for Fire Alarms. Adolph Münker, Schoeneberg, Germany. Application filed April 14, 1900.

This cable consists of two conducting wires insulated from each other, and a suitable number of thermal circuit-closers forming part of the cable, the circuit-closers consisting of two elastic contacts respectively secured to the conducting wires before insulating and a fusible piece between the contacts.

664,969. Electric Motor for Railways. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 30, 1897.

The field-magnet frame is divided into two substantially equal parts. There is a coil for exciting the pole piece of each part of the field magnet. A stationary shaft is mounted in one of the parts of the magnet frame, and a rotating sleeve carries the armature and commutator. The bearing between the sleeve and the stationary shaft is wholly inclosed by the magnet frame. (See cut on next page.)

664,971. Incandescent Lamp. Edward Riordan, New York, N. Y. Application filed April 5, 1900.

The bulb is fitted with a cap. Contact plates are partially embedded within and insulated from the cap, and a filament is secured to the cap and to one of the contact plates, wires connecting the remaining contact plates with the filament at points between its ends. The socket contains an annular insulated ring adapted to engage and contact with the cap. A wire is secured to the ring. A shaft projects through a partition within the socket and carries an arm adapted to contact with any one of the contact plates. A collar incloses the shaft and carries a pinion, and a second pinion meshes therewith. A knobbed shaft is secured to the second pinion, and a second supply wire is secured to arms on the collar.

664,986. Electric Switch. George H. Whittingham, Baltimore, Md. Application filed March 19, 1900.

In a power-operated switch, a vertical rod passes through a frame, and contacts are controlled by the frame. A spring is interposed between the frame and rod and a bar arranged to push against the end of the rod. A pinion engages with a rack on the bar, and an electromagnet is adapted to throw the rack and pinion into engagement and to act as an electromagnetic friction brake to retain the bar in position.

664,992. Trolley for Electric Railways. Louis d'Orville Chabut, Pittsburg, Pa. Application filed June 14, 1900.

A telescopic trolley pole carries a wheel. A spring is arranged to permit the vertical adjustment of the upper telescopic section, and supporting arms are journaled on the ends of the wheel shaft, oppositely extending arms being secured to the supporting arms. Yokes are pivotally attached to the oppositely extending arms, and carry chains having one end attached to the yokes and the other ends to the spring.

665,027. Printing Telegraph. Henry Mahnken, New York, N. Y. Application filed March 8, 1900.

The receiver comprises a type-wheel shaft, an escapement wheel connected thereto, and a ratchet wheel loosely mounted on the shaft. A spring connects the ratchet wheel to the shaft, and feed teeth are carried by the arms of an oscillating yoke and engage the ratchet wheel. An oscillating armature is connected to the yoke, and feed movements of the escapement wheel are permitted by the oscillation of the yoke.

665,040. Automatic Fire Alarm. Albert R. Thompson, Indianapolis, Ind., assignor of two-thirds to Clarence M. Zener and John Wocher, Indianapolis, Ind. Application filed September 22, 1899.

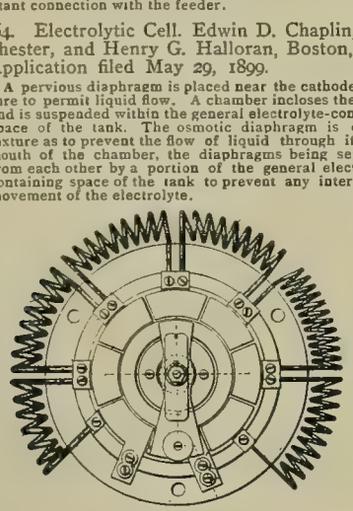
A thermostat consists of a pair of terminals arranged to form a part of an open circuit, a pin mounted between and insulated from the terminals, and a pair of spring conductors electrically connected and mounted upon the pin so as to be insulated from the terminals. A fusible connection between the spring conductors normally holds them out of simultaneous engagement with the terminals, and a pair of terminals is carried one by each of the spring arms and insulated therefrom, the arrangement being such that the terminals are normally held in engagement with each other by means of the fusible connection.

665,051. Electric Traction. Samuel G. Bennett, Wolverhampton, England. Application filed October 13, 1900.

A conduit system is described in which boxes contain contact pieces having hinged gripping jaws, and a flexible plow is carried on the car, the gripping jaws being in constant connection with the feeder.

665,064. Electrolytic Cell. Edwin D. Chaplin, Winchester, and Henry G. Halloran, Boston, Mass. Application filed May 29, 1899.

A pervious diaphragm is placed near the cathode of texture to permit liquid flow. A chamber incloses the anode, and is suspended within the general electrolyte-containing space of the tank. The osmotic diaphragm is of such texture as to prevent the flow of liquid through it at the mouth of the chamber, the diaphragms being separated from each other by a portion of the general electrolyte-containing space of the tank to prevent any intercurrent movement of the electrolyte.



NO. 664,953.

665,087. Controller for Electric Motors. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed September 25, 1900.

Regulating and reverse switches are mounted within a controller casing. A vertically movable sleeve is fitted on the shaft of the reverse switch, with a handle arranged to engage it detachably above a guard plate on the top of the controller. A lever pivoted within the casing engages the sleeve. A cam carried by the regulating switch impinges upon the lever to actuate it in one direction, and a spring actuates the lever in the opposite direction.

665,094. Means for Electrical Car Propulsion. John H. Hertner, Cleveland, Ohio. Application filed August 6, 1900.

A continuously running alternating-current motor is used with clutch devices mounted on the shaft of the motor. A direct-current generator driven from the alternating-current motor provides a separate circuit for the clutch mechanism. Differential gearing between the motor shaft and the axle of the car truck is provided, by means of which variable speeds are transmitted to the axle of the car truck.

665,120. Rosette. Andrew A. Moffitt, Pawtucket, R. I. Application filed October 16, 1900.

An insulating body has interior channels converging to form an orifice in the apex of the body, openings intermediate the channel openings and leading to the channels, and flexible lamp wires traversing the channels and looped through the openings, to relieve the strain upon the electrical connections.

665,127. Controller for Electric Motors. George H. Parmelee, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed July 25, 1900.

A reversing switch and a regulating switch are provided and handles for operating them, the shafts of the switches having the portions which receive the handles formed in separate sections. Cams secured to the handle sections of the shafts engage with the main shaft sections, and a pivoted lever has its arms engaging the respective cams to impart vertical movement thereto. A casing has pockets or guards to receive the handles and prevent operative access thereto except at certain times.

665,133. Electrical Valve Controller. Clarence B. Riggs, New Rochelle, N. Y. Application filed February 5, 1900.

This invention comprises an electric motor for moving the valve, a central device for closing the circuit of the motor, a second central device for opening the circuit, and electromagnetic means for actuating the circuit-opening device. Contact makers move with the valve for controlling the circuits for automatically stopping the valve motor.

665,134. Telegraph or Telephone Call Mechanism. Edgar E. Salisbury, Chicago, Ill., assignor to the National Autophone company, Chicago, Ill. Application filed March 21, 1900.

A break-wheel is provided with a locking lever for the call mechanism and break-wheel. A receiver-supporting arm carries means for releasing the break-wheel locking lever. A locking device for this arm when in its upward position is adapted to hold the arm until after the call mechanism has completed its full action. Means are provided for releasing the locking device from the arm after the break-wheel shall have made its proper movement.

665,139. Control of Electric Motors. Bennet C. Shipman, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Original application filed August 5, 1899. Divided and this application filed May 29, 1900.

For controlling an electric motor having different field windings, a switch and connections are provided for shifting the armature and field coils of the motor from series to shunt or the reverse relation, the switch also having connections with the field windings whereby its operation to effect the above-described change in the armature and field coils also changes the connection of the windings from a relation of low resistance to a relation of high resistance.

665,140. Portable Lamp Bracket. Harold W. Shonnard, Newark, N. J., assignor to James Jones and James Jones, Jr., New York, N. Y. Application filed January 15, 1900.

A plate has a twisted perforated end with a yoke riveted to it adjacent to the twisted end. A spring coil and spring arm integral with each other are connected to a support bar, passing through the yoke and secured thereto, the arm being in line with the plate. A pivoted coupler is connected by a pivot screw to the twisted end of the plate and adapted to swing on the pivot and to be connected to the key socket of an electric lamp.

665,143. Control of Electric Motors. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed June 5, 1900.

In a system of electric train control, an electromagnetic device actuates a motor controller. Controlling mechanism for the actuating device is arranged to control the current supply to the actuator and to vary the internal circuits of the same to produce a step-by-step movement of the controller. An automatic switch is arranged to open the motor circuit upon the failure of current thereto, and at the same time to close a circuit to the actuating device. Means are provided for closing the switch upon resumption of the current supply, the means operating only when the motor controller is at off position.

665,144. Controller for Electric Motors. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed June 16, 1900.

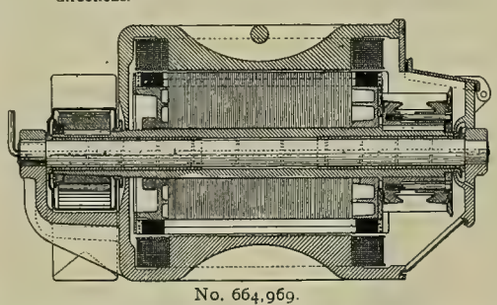
A series parallel controller with a switch for cutting either of the two motors out of service is fitted with a stop for limiting the movement of the main cylinder, and a magnet for holding the stop inoperative when both motors are in circuit, and for releasing the stop when either motor is removed from circuit.

665,156. Double-pole Switch. Robert E. Wood, Baltimore, Md. Application filed August 28, 1900.

Two levers are pivoted with their free ends extending toward each other, one of which carries contact pieces adapted to contact with the terminals. A pin is secured to the free end of each lever. A rocking bar engages the pins on both levers. An expansion spring is coiled on the rocking bar and its opposite ends press against the pins. Push-buttons connect with the levers.

665,186. Electric Shuttle Motion for Looms. John M. Cryer and William E. Bullen, Poulton-le-Fylde, England. Application filed September 4, 1900.

A magnet is provided for actuating the shuttle, a cord or wire for moving the magnet back and forth across the loom, and a drum or scroll on which the cord is wound. A differential cam on the shaft carries the scroll. The mechanism comprises in addition a guide pulley, treadle levers, cords passing around the guide pulley and in opposite directions around the cam and having their ends attached respectively to the treadle levers and to the cam, a cam shaft and cams thereon adapted to engage the levers for alternately rotating the scroll in opposite directions.



No. 664,969.

665,195. Storage Battery. Aubrey G. Eneas, Boston, Mass. Application filed October 9, 1897. Renewed June 13, 1900.

The claims describe the construction of one electrode comprising a conducting support having a number of permeable partitions mounted thereon, and active materials interposed and filling the entire spaces between and immediately adjacent on both sides of the permeable partitions whereby the electrolyte has free action on the peripheral surface of the material, and also through the permeable partitions on the adjacent sides or faces of the material.

665,248. System of Electric Traction. Lowell M. Maxham, Boston, Mass. Application filed April 28, 1900.

Longitudinally continuous stringers formed of insulating material have a central longitudinal channel. The electric conductor is laid within the channel. The insulating blocks fill the channel but are separated by short distances. The exposed rail is laid upon the stringers and blocks, and magnetically actuated circuit-closers are located in the channel between the blocks and normally in circuit with the electric conductor.

665,251. Mouthpiece for Telephone Transmitters. Winfield S. Moore, Indianapolis, Ind. Application filed May 21, 1900.

The subject of this patent is an extension mouthpiece attachment comprising a suitable mouthpiece proper, a tube extending therefrom, and a T secured to the ordinary transmitter mouth, to one arm whereof the tube is connected, the other arm extending across the transmitter and being open, while the stem of the T extends at right angles in toward the transmitter diaphragm.

665,305. Electrical Transformer. Arthur F. Berry, London, England. Application filed July 23, 1900.

This transformer comprises an iron core composed of a number of built-up laminated-iron plates arranged radially around a center and each containing a large hole. A length of cable wound to form a coil extends through the holes in the plates and is composed of two sets of separately insulated conductors and junction pieces connecting the conductors in the desired order to form primary and secondary windings.

665,318. Electric Motor Controller. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed August 24, 1899.

For controlling a number of electric motors and electromagnetic clutches for effecting a driving connection between the motors and the parts to be driven thereby, a switch has one set of contacts for connecting the motors in series, a second set for connecting them in multiple, and a third set for successively connecting into and removing from circuit the magnet coils of the clutches.

665,319. Alarm Device for Armature Shafts. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed September 16, 1899.

The armature of an electric motor has its body electrically connected to one side of the line circuit. A flexible contact device is arranged within the frame or casing between its pole pieces for engagement with the armature upon displacement of the armature shaft, and an electrical connection is made between the device and the other side of the line circuit. There is a signal in this connection.

665,320. Controller for Electric Motors. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed March 26, 1900.

In this system of electric train control, a motor controller is used, a series of electromagnets being connected thereto to actuate it. A commutator has a segment for each magnet of the series, the coils of adjacent magnets having their opposite ends connected to the same segment. Three brushes are arranged to engage three adjacent commutator segments, two of the brushes being connected in multiple with one side of the controlling circuit, and means are provided for effecting at will changes in the circuit to cause a relative polarity of certain of the magnets to move the controller either backward or forward.

665,321. Method of Controlling Electric Motors. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Original application filed August 24, 1899. Divided and this application filed March 26, 1900.

This patent covers the method of controlling a number of electric motors, which consists in starting them from a position of rest connected in series with each other and mechanically disconnected from the mechanism to be driven thereby, then effecting electromagnetically or mechanically a gradual mechanical connection between the motors and mechanism, and then shifting the motors over to parallel relation.

665,322. Safety Device for Electric-motor Controllers. Frank W. Garrett and George H. Parmelee, Johnstown, Pa., assignors to the Lorain Steel company of Pennsylvania. Application filed June 16, 1900.

The controller embodies a regulating switch for connecting two electric motors in series and in parallel, and a second switch for removing either one of the two motors from circuit. The switches have correlated contacts whereby, when the second switch is moved to a position to cut out either of the two motors, movement of the regulating switch beyond a certain predetermined point will open the motor circuit.

665,324. Means for Controlling Electric Motors. John Green and George C. Thom, Johnstown, Pa. Application filed June 15, 1900.

For controlling two electric motors having independent field and armature circuits, a switch has one set of contacts connected to the field and armature coils of one motor, a second set similarly connected to the coils of the other motor, and a third set connected to the source of current supply through the controller. The switch also has a movable member provided with contact devices which are electrically connected to the contacts of the last-named set, and are arranged to be engaged with the contacts of either the first or second set.

665,337. Electric-railway Motor. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed December 30, 1899.

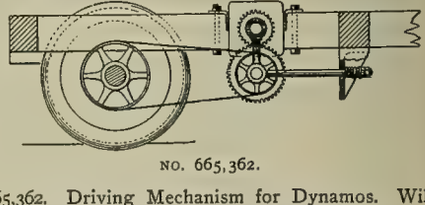
An electric-railway motor with a horizontally divided field-magnet frame has openings at its ends, holding end pieces, openings and securing bolts, each of which passes through a lug on the end of each of the frame sections and also through a lug on the end portion, a nut securing the lower end of the bolt and a key or cotter passing through the bolt below the lug on the end portion.

665,350. Electric Motor Control. Bennet C. Shipman, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed August 5, 1899.

This patent covers the method of accelerating electric motors having a number of field windings, which consists in starting the motors as series motors with their field windings in multiple with each other and with resistance, then shifting the circuit connections of the field windings to place them in series with each other and with resistance, then increasing the effective resistance in circuit with the field windings, then increasing the field strength by removing the resistance, then connecting the armatures in multiple with the fields still in shunt, and finally introducing resistance in series with the field windings to decrease the field strength.

665,352. Electric Fuse Box. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed March 21, 1900.

A door is pivoted at one of its edges, and a spring guide pivotally connected to the door at one end and loosely engaging a fixed portion of the box at its other end, the guide being arranged to have that end which is connected to the door carried past the center of the door pivot as the door is opened or closed. A spring on the guide bears at one end directly against the door and at its other end against the box.



NO. 665,362.

665,362. Driving Mechanism for Dynamos. William L. Bliss, New York, N. Y., assignor to the Bliss Electric Car Lighting company, East Orange, N. J. Application filed April 2, 1900.

For axle driving a dynamo is carried by the car truck and a rocking frame is suspended vertically from the dynamo shaft. Intermeshing gears are carried by the dynamo shaft and the rocking frame, and a pulley is mounted in the rocking frame on the same axis as the gear carried by the frame. A belt connects the car-axle pulley and the rocking-frame pulley and a spring connects with the rocking frame and tends to swing the pulley carried by the frame away from the pulley carried by the car axle for keeping tension on the belt. (See cut.)

DESIGN.

33,823. Casing for Arc Lamps. Allyn B. Walton, Lorain, Ohio, assignor to the National Vapor Stove and Manufacturing company, Lorain, Ohio. Application filed December 5, 1900. Term of patent, 14 years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, JANUARY 19, 1901. No. 3

New Niagara Pole Line.

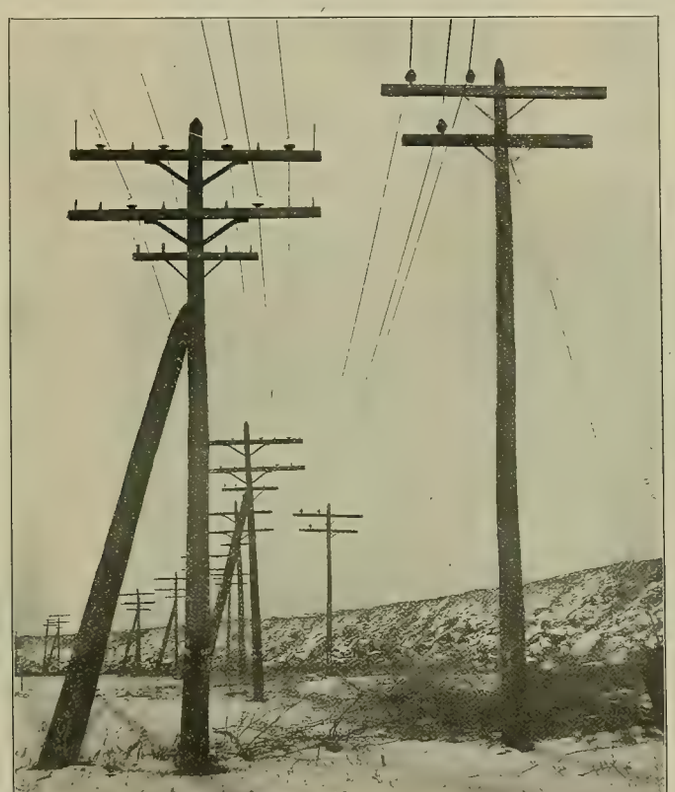
The second power-transmission line of the Niagara Falls Power company, between Niagara Falls and Buffalo, will soon be ready for operation. A force of men is now stringing the cables between Tonawanda and Buffalo, and it is expected that the line will be finished within a few weeks. This new line follows the old pole line from the central station in Niagara Falls over the old right-of-way to the south boundary line of the village of Tonawanda, where it diverges and runs over a new right-of-way to the terminal station on Niagara street in Buffalo. The point at which the old and new transmission lines separate is just to the west of where the old line crosses the New York Central tracks. From this point on to Ontario street the Niagara Falls Power company has purchased an entirely new right-of-way to Ontario street, Buffalo, the distance being 14,830 feet. Then the new pole line runs along Ontario street for a distance of 7,000 feet to the terminal station above referred to. By the new route a saving of 3.18 miles in distance is accomplished.

On the poles of the old line there are six copper cables, or two three-phase systems. The cables that are being strung on the new line are of aluminum. Their size is 300,000 circular mils and they are each made up of 37 strands, whereas the old copper cables have but 19 strands each. The diameter of the aluminum cables is larger than that of the copper cables, but both are bare. The lightness of the aluminum cables, as compared with the copper construction, allows the elongation of the spans, which on the copper line are about 75 feet; on the new aluminum line the average is 112½ feet. At present only three aluminum cables are being strung, which form one three-phase system. The insulators on the new line were manufactured by C. S. Knowles of Boston, Mass. The shank of the pin on which they set is 2¼ inches, which is a little heavier than the shank of the pin on the old line.

When the Niagara Falls Power company originally projected the Niagara power transmission it arranged for a transmission at either 11,000 or 22,000 volts, and all the transformers and other apparatus in use on the transmission are designed for that service. It has long been intimated that the voltage on the Niagara-Buffalo line was about to be changed, but up to the present time this has not been done. However, it is the intention of the Niagara Falls Power company, as soon as the new aluminum transmission line is completed, to change the voltage on both the copper line and the aluminum line to 22,000 volts. As the aluminum line is nearly completed, it is expected that this change will soon take place.

In the construction of the new transmission line every effort has been made to have it as straight as possible. With this object in view, the new right-of-way from the point where the old and the new lines diverge runs parallel along the practically straight right-of-way of the New York Central, the pole line following along the west side of the tracks. Then from Ontario street down to the terminal station, the line is almost straight. While the new line has been built on these ideas and plans, the Niagara Falls Power company has also been straightening out the old line in the vicinity of North Tonawanda, where it was quite crooked. The construction of the new line on as straight lines as possible and the bringing of the old line to the same condition is occasioned by a realization that there is less liability to interruption of the service where the line is straight. But the Niagara Falls Power company and its Buffalo patrons have no complaint to make owing to interruptions to the service for the company has been extremely fortunate in this respect.

In its general construction, the new line is built very much like the old line. The poles used average 35 feet in length, which allows 22 feet clear of the ground. The aluminum cable was manufactured by the Pittsburg Reduction company. In adopting it for service on this second transmission line, the Niagara Falls Power company displays its confidence in the product of a plant located on its own lands—in fact, in an industry that was the pioneer user of Niagara tunnel power.



NEW NIAGARA POLE LINE.—NEW ALUMINUM LINE TO THE RIGHT; COPPER LINE ON THE LEFT.

Thomas A. Edison in Indianapolis.

In October, 1864, there was trouble along the wires of the Western Union Telegraph company that ran into the Union station at Indianapolis. There had been a severe storm and much damage had been done to the company's service throughout the city. Superintendent John F. Wallick, who yet holds the responsible office of managing the great corporation's affairs in the state of Indiana, was out along the line with a corps of men repairing the damage, when a bashful, half-grown youth, with his trousers at his shoe-tops and his sleeves halfway to his elbows, showing an expanse of bony wrists, walked up to him and asked if he were Superintendent Wallick.

"I am," said the superintendent. "What can I do for you?"

"I want a job," said the boy.

Mr. Wallick questioned him and, discovering that the boy was a telegrapher, requested him to report at the Union station that afternoon. When Mr. Wallick went back to the Union station he found the boy with the round face and the outgrown clothing waiting for him.

"What's your name?" asked Mr. Wallick.

"Thomas A. Edison," said the boy, blushing.

The coming inventor was given a telegrapher's position at the old Union station on November 1, 1864, and worked there three months for $75 a month. While drudging in the dingy station, Edison, the author of over 600 inventions and one of the greatest benefactors of mankind, first turned his attention and his remarkable genius to invention.

Edison secured several old instruments, and one day Mr. Wallick visited Edison's den at the Union station and discovered that the embryonic inventor had the machines fastened to a table, and was working hard on some apparently difficult problem.

"What are you trying to do?" asked Mr. Wallick.

"I am trying to invent an automatic repeater," said Edison, in a shamefaced manner, adding, apologetically, "You know the ones in use are very unsatisfactory."

"That was the beginning of the greatest invention known to the electric telegraph, except the stock ticker, another of Edison's inventions," said Mr. Wallick, in relating the incident to the correspondent of the Western Electrician. "There is an interesting story connected with his invention of the ticker. In Providence, R. I., was the fastest sender in the employment of the Western Union Telegraph company. He was the terror of every other operator along the lines. Edison, who was not a particularly fast operator, ran up against the man a number of times, and this set him to thinking. The result of these thoughts was the stock ticker. One morning he was called up by the Providence man. 'Prepare to take a message,' ticked the instrument. 'Fire away,' Edison wired back. The Providence man began sending a long message of several thousand words with lightning rapidity. It was taken down as fast as he sent it. This surprised him 'Who are you?' wired the Providence man. 'Thomas A. Edison,' went back the answer; 'and if you can't telegraph any faster than that, you had better go to breaking stones on the road.' While the Providence man was working desperately Edison was sitting tilted back in his chair, eating a fall pippin, while the ticker was taking down the message," concluded Mr. Wallick.

Power House for the Lake Street Elevated Road.

The announcement has been made by C. T. Yerkes that the Lake Street Elevated Railroad company of Chicago has decided to erect its own power house to supply the necessary power for the operation of the road. Heretofore the company has purchased its power from the Cicero and Proviso station of the Chicago Union Traction company, the rate paid last year being between 2.35 and 2.5 cents a kilowatt-hour. "With our own power house," said Mr. Yerkes, "we should be able to produce current at 0.70 cent a kilowatt-hour. Interest on the investment will bring the cost up to about 0.83 cent, being as cheap as either the Northwestern or Metropolitan produces its current. I do not care to speak of the location or to give the cost of the plant."

Arrangements have been completed by the company for the exchange of $5,600,000, five per cent. first-mortgage bonds for its outstanding debentures, and the floating debt, amounting to about $600,000, has been provided for. The amount of bonds outstanding against the Lake street company will make its bonded indebtedness less per mile than that of either the Metropolitan or Northwestern companies.

Large Australian Power Scheme.

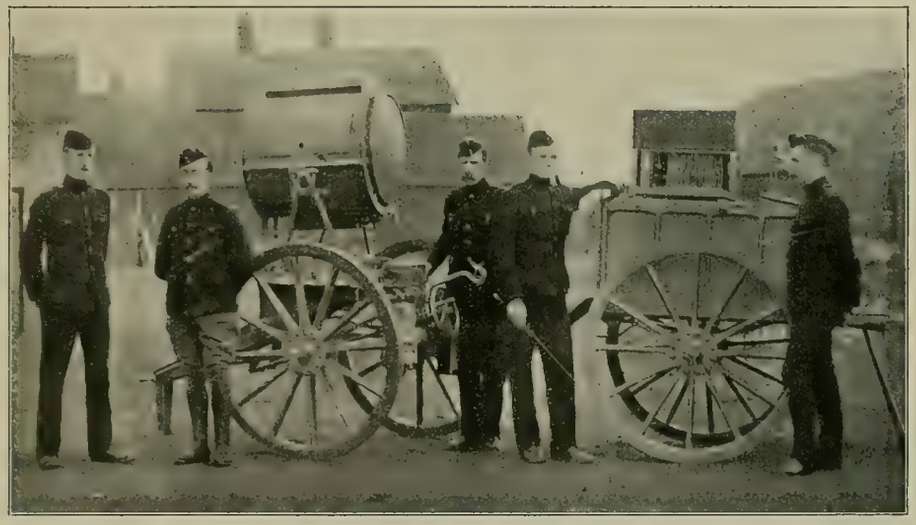
A very large municipal power plant is projected to supply Sydney, Australia, with electric power for lighting, transportation and general manufacturing purposes. The plans call for reservoirs in the mountains to store 40,000,000 gallons of water during the wet season, which would be sufficient to operate the plant at its full capacity for five months. It is stated that the plant will be strictly modern in design and equipment, and will be supplemented by storage batteries to utilize fully the available energy during hours of light demand. The total cost of the scheme is put at $7,500,000 and the estimated annual income at $3,200,000, with a net profit of $500,000 a year to the city.

The Electrical Engineers (R. E.) in South Africa.[1]

By Lieut-col. R. E. Crompton, E.E. (R.E.)V.

At the request of your president I have prepared a narrative of the war services of the small body of electrical engineers who left England early in the spring of this year for South Africa, and who have now returned. I must commence by reminding you that the corps of Electrical Engineers R. E. Volunteers was raised by the help of this Institution in order to enable electrical engineers to place their services at the disposal of the country in case of need. It is acknowledged that every year electrical appliances will be more and more used in military operations. Up to last year the special work on which the corps had been instructed and drilled for home service has been the management of the searchlight apparatus used at various points for coast defense, to which has been added some instruction in submarine mining and cognate matters.

As both officers and men of the corps felt that the training which everyone in the electrical profession must go through has made us all handy men, not only for electrical, but for general mechanical, engineering work, we offered our services for the war in South Africa. Our offer was accepted in December, 1899, and after some consultation with the War Office an equipment was designed by our own officers, and was manufactured with such rapidity that our first detachment was ready for embarkation early in March. Five officers and 47 men were mobilized in February, and on March 16th five officers and 47 men embarked from Southampton on the steamship Tagus. On the 17th two officers and one non-commissioned officer embarked on the Custodian in charge of the equipment. I will remind you that the main



SEARCHLIGHT EQUIPMENT USED IN SOUTH AFRICAN WAR.

feature of the equipment was portable searchlights, mounted on carriages somewhat similar to those used for field-artillery guns, the electrical energy being generated by dynamos carried on small compound steam-traction engines. Special cable carts were also provided.

Although steam-traction engines were chosen, it was foreseen that the oil engines to which the corps is so well accustomed at its annual trainings would have had great advantages if a portable type of oil engine had been procurable. A supply of arc lamps, with special lanterns which could be readily packed, and incandescent lamps with fittings were also sent out for the electric lighting of working parties, depots and railway sidings. A novel feature of the equipment was that 20 bicycles were provided with reels on which fine, uninsulated copper wire was coiled, to serve as telephone conductors, and a special, light and very portable type of telephone was obtained, which, as will be seen hereafter, gave excellent results. The whole of the remainder of the equipment, which contained, among other things, complete sets of repairing tools, tube wells, pumps and portable forges, was carefully considered, and subsequent experience showed that it was well chosen.

The Tagus arrived at Cape Town on the 4th, and the unit disembarked on the 6th, and were encamped at Fort Knokke for a few days. The Custodian arrived on April 12th, and the equipment, including two of the eight-ton traction engines and four five-ton wagons, was unloaded that night. Colonel Girouard, the director of railways, at once applied to have the electrical engineers attached to the railway-reconstruction trains, and they weer ordered to get ready to move up country as quickly as possible. On Saturday night, April 14th, the whole of the equipment was packed on five large bogie trucks, but even their start seemed likely to be delayed, as the line was blocked with press of traffic.

After a journey of three days and four nights it arrived at Bethulie at 5 a. m., April 20th, and at once off-loaded the equipment, and within a few hours the first installation of temporary electric light for war purposes was erected on the Bethulie road bridge, which was then temporarily in use for railway purposes, during the time that the low-level deviation railway bridge was then constructed by the Railway Pioneer Regiment to replace the original railway bridge which had been destroyed by the Boers. At first six arc lamps were found sufficient, and these were erected and worked nightly from one of the dynamos mounted on its traction engine at the river bank. As soon as the low-level railway bridge was complete the installation on the road bridge was dismantled and transferred to the new bridge, the approaches to which, being tortuous and having steep gradients, had to be worked by the engine drivers with the greatest caution, so that for some days the arc lights were used to light these approaches.

The first time the field telephones were put to work was at this place. A line was laid across the bridge for the use of the railway, and a good telephone service established. During the time that the corps was at Bethulie Sergeant-major Brown, R. E., and Sapper Phillips, E. E., were sent out with part of the telephone equipment to accompany a flying column which left Bethulie on May 2d, to join General Hart, who was then moving south from Smithfield.

As the telegraph line between Bethulie and Smithfield had been destroyed, the new field telephones were brought into use to maintain communication with the flying column, and this was kept up without any failure during the time the column advanced until it met General Hart. General Hart was thus enabled to be put into communication with Lord Roberts, via Bethulie, temporary communication being made between General Hart's camp, 1½ miles from the telegraph line, by bare copper wire, No. 22 gauge, laid on the ground from the bicycle reels supported by a special belt to the body.

On May 6th the unit arrived at Bloemfontein, and was split up into two sections, one going on direct to railhead, which was then at Vet River, the other section remaining at Bloemfontein, to carry out the electric lighting of the goods yard and locomotive shops. At this point an installation of arc and incandescent lamps was erected and worked by No. 1 engine and dynamo, and has been running ever since, the installation being gradually increased in size, until there are now 16 arc lamps and a large number of incandescent lamps installed.

The advance section at Vet River joined the reconstruction trains and remained with them during the months of May and June—i. e., until the work of reconstructing the railway was completed through the Orange Free State up to the Vaal River. The equipment of this No. 1 section consisted of No. 2 traction engine with its dynamo, two wagons, subsequently increased to four wagons, two projectors, with their limbers, two cable carts, extra cable coiled on drums, 16 arc lamps, with suitable poles, hoisting gear and the necessary accessories, a supply of incandescent lamps with suitable fittings, 14 sets of field telephones, a supply of insulated and bare copper wire, telephone conductors coiled on reels, which could be either carried on the bicycle or on special slings strapped to a man's chest in such a position that he could either pay out or wind up a conductor.

The work at Vet River may be taken as typical of many other works at which it was necessary to work all night by artificial light. The Railway Construction Corps, R. E., was engaged in constructing a main bridge across the river approached by long deviations from the main line; in these were three smaller bridges. The lighting plant had therefore to be erected at each of these bridges in turn.

When the Vet River work was completed the section moved on to Smaldeel, and there was joined by Major Crompton with a draft, which had left Cape Town on May 4th. Major Crompton brought with him a third traction engine, with its dynamo, an additional supply of concentric cable, two additional five-ton wagons, stores, bicycles, etc. Major Crompton then took over command of the unit, and, as the occasion arose, the whole of the Bloemfontein section, with its stores, was gradually moved up to join the unit, leaving only a small detachment of six men, under the command of Corporal Bicker Caarten, to work the temporary lighting plant at Bloemfontein.

Early in May Colonel Girouard required the services of additional railway-telegraph men, and Captain Bain was detailed for this work, and, with a detachment of seven men, was sent on to repair the telegraph in advance of railhead. This was a service of great importance, entailing considerable personal risk and exposure.

The No. 1 section commenced lighting work at Zand River on May 18th, this work being of a very similar nature to that of the Vet River. It afterward advanced with the railhead construction trains to the Rhenoster Spruit, to assist the working party building a crib bridge at that point. Here a particularly smart piece of lighting work was carried out. The orders were received at 2 p. m. The traction engine was off-loaded from its truck and hauled its wagons and stores down to Rhenoster Spruit, three miles away, the light stores going down the damaged railway line on a trolley. Eight arc lamps were fixed on poles, and light was furnished to the working party by nightfall, 5:30 p. m.

During the time that the unit was at Taibosch Major Crompton, taking with him Sergeant-major Brown, R. E., and Company Sergeant-major Rorke, went south with the field telephones to attempt to make temporary communication at the point where the telegraph lines had been cut by the Boers. Major Crompton returned to his command at Taibosch, leaving the two non-coms. with Lord Kitchener, who arrived at Kopjes on the 9th. They were able to establish communication with the south, and thus kept him in touch to north and south until the telegraph lines were again in working order.

Railhead reached the Vaal River on June 10th, and at this point an installation of 12 lamps was erected, and on the 11th the first train crossed into the Transvaal, and some supplies were sent to Lord Roberts at Pretoria. It may be here remarked that, as during the advance of railhead from Bethulie to the Vaal, the arc lamps were worked on 19 nights, it is probable that the period of reconstructing the line was shortened by nearly the same number of days, but even if one night's work is only considered to be equal to two-thirds of a day's work, the night work rendered possible by the section must have hastened the advance of railhead by not less than 12 days, and the money value alone of this to the nation must have many times repaid the entire cost of equipping and sending out the Electrical Engineers.

After one night's lighting at the Vaal the very thorough destruction of the line to the south by De Wet necessitated the sending south for a second time both construction trains; the unit accompanied them, leaving the lighting equipment at Viljeon's Drift under Sergeant Brown. The construction trains working south were constantly threatened by De Wet, and on the night of June 14th both trains were attacked by him, and were summoned to surrender. Although the Electrical Engineers engaged on this occasion were comparatively a small party, yet, owing to so many of the night-working party having been surprised and dispersed in the first instance, they formed nearly one-third of the troops left to defend the trains. If De Wet had been successful in catching and destroying these two trains, which contained so much construction material and all the tools, as well as the most skilled body of reconstruction officers, the break in the line of communications would have remained open for a long period, and certainly would have seriously affected the future movements of the more advanced portion of the army then in the Transvaal.

After arriving at Pretoria, the engineer-in-chief found quantities of electrical work for the corps, as all the forts which defend the town had been fitted up with various electrical apparatus, not only for electric lighting, but there were signal signaling, telephone and other wires which required to be sorted, labeled, and their uses understood. The oil engines which supplied the motive power for driving the dynamos had purposely been damaged by the Boers, and had to be repaired and set to work. The small and inefficient searchlights which had been used by the Boers were replaced by a system of incandescent lamps, placed so as to illuminate certain points which were liable to be threatened by the enemy during night attacks.

This work at the forts, which was of a very interesting nature, was followed by teaching the garrisons how to use and maintain the electrical apparatus in working order. Other parties of our men were employed in fitting up electrical lighting in various public buildings which served as supply stores, and in the large hospitals which were then being started inside and outside Pretoria. In some cases these new installations were worked from the public supply of the town, in other cases separate generating machinery—i. e., steam engines, dynamos and systems of conductors—had to be put down for each job. The plant for this was made

1. Abstract of lecture delivered before the Institution of Electrical Engineers in London, December 20, 1900.

up from material found at or near Pretoria, most of which was in a damaged condition and had to be almost re-made before it could be usefully employed.

During this time, as the whole of the Rand district surrounding Johannesburg is supplied with electric light and power partly from a distant generating center at Brak Pan, the military governor of Johannesburg asked for and obtained the services of Captain Leaf as his electrical adviser, and from time to time various works were supervised by him and other officers of the corps, so that the electrical plant of Johannesburg and district was gradually got into order. Among others, the government printing works of Pretoria, worked by their own electric generating plant, transmitting power to motors driving each set of printing machinery, was put in order and worked by us.

Toward the latter part of August a party of electrical engineers, under Captain Lloyd, were sent up to Brugspruit with a set of searchlight apparatus and accessories, which was erected, and the light shown from the top of the shaft of a colliery near Brugspruit station, the dynamo being driven from the mine engine. Captain Lloyd returned to Pretoria and left the detachment for some weeks under the command of Lieutenant Bigg, and there is no doubt that the presence of this searchlight greatly reduced the liability of night attacks from a strong commando under Erasmus, which threatened the Pretoria and Delagoa Bay railway at this point. On September 4th one of the engines, with dynamo and 16 arc lights, was taken down to Machadodorp by Captain Leaf and a small party of Electrical Engineers, and at this point an installation was erected to supply light to the various running sheds and loading stages, as at that time convoys which supplied three columns with food had here to be loaded.

On August 31st Sergeant-major Brown, R. E., and Corporal Dalton were attached to Lord Kitchener's staff to use their bicycles and field telephones as required at the front. Up to the time of the arrival at Pretoria, as the officers and sappers were constantly employed on railway work, little opportunity was given for the sappers to use their bicycles, but after arrival at Pretoria they proved to be of the greatest value; for as the work at the forts and buildings was scattered over a large area, it necessitated the officers and men moving rapidly from point to point, and the whole of the bicycles were in full use, so by their aid the 20 men who rode them were almost doubled in value.

On September 17th, the writer, accompanied by Captain Leaf, was sent down by Lord Roberts to the low country to the east of Machadodorp, in order to report whether any of the traction engines could be efficiently used there.

Early in October the writer was ordered to England by Lord Roberts, in order that his recent experience might be utilized in designing traction engines for military purposes. Captain Lloyd re-

BICYCLE USED IN LAYING TELEPHONE WIRE IN THE SOUTH AFRICAN WAR.

assumed command. From this date the work went on uninterruptedly until the latter end of October. The unit by this time was in a very scattered condition.

Toward the end of October orders were received from the engineer-in-chief to concentrate the unit and hand over the majority of the stores so as to be ready to move homeward on receipt of further orders. The various detachments were gradually collected, and on October 25th, exactly four months after they arrived in Pretoria, the unit steamed south for Bloemfontein. Seven men were left behind in Pretoria to take their discharge there; four of these had been given civilian employment under the imperial military government, and three were taken up by private employment on the Rand.

A 48 hours' journey took us to Bloemfontein, where we completed the handing over of equipment and packing for our final departure.

Yet one more check was met ere the unit finally arrived at Cape Town. No transport was absolutely ready, and so, to avoid the possibility of the hardened and fierce warrior striking terror into the hearts of the peaceful inhabitants of Cape Town the bloodthirsty Electrical Engineers were kept for three days in the safe camp of Stellenbosch, and not until Saturday, November 17th, did they reach the port, where the train took them right alongside the Norham Castle. After an uneventful and extraordinarily fine passage the ship was brought alongside the quay at Southampton on the evening of December 6th.

James R. Chapman to Engage in Electric-railway Work in London.

Charles T. Yerkes continues to show his appreciation of American brains and energy by surrounding himself in his new field in London with the men who have been closely associated with his large undertakings in this country. His latest acquisition is James R. Chapman, well known in Chicago as the efficient electrical engineer of the Chicago Union Traction company.

Mr. Chapman first started in engineering work as a rodman on the old Portland and Ogdensburg railroad in 1872. The next year he was made di-

JAMES R. CHAPMAN.

vision engineer on the Carolina Central railroad. In 1877 the development of western railroads had created a demand for experienced constructing engineers, and Mr. Chapman went to Denison, Texas, and built several small lines in the northern part of the state for what was then the Gould Southwestern system, now a part of the Missouri, Kansas and Texas railroad. He also laid out a large number of townsites in that region, many of which are now flourishing towns. In 1881 Mr. Chapman was appointed superintendent of bridges and buildings for the Denver and Rio Grande railroad, and spent eight years in that field, which was gradually enlarged until all construction, as well as operation, pertaining to bridges, buildings, snow sheds and shops came under his charge. He spent three years at Kansas City in charge of the Kansas City, Independence and Park railway, now part of the Metropolitan system. While there he built several steam lines belonging to the Kansas City, Pittsburg and Gulf Railroad company.

In 1891 Mr. Chapman went to Grand Rapids, Mich., as vice-president and general manager of the Consolidated Street Railway company, which at that time operated about 40 miles of horse and cable roads. These Mr. Chapman converted to electric lines and operated until 1894, when he came to Chicago to take charge of the electrical departments of the North and West Chicago Street Railway companies, which had just obtained franchises for the equipment of their horse and cable lines with electric power. Since coming to Chicago Mr. Chapman has built 430 miles of electric roads, and has had charge of the electrical equipment of the Western avenue, Cicero and Proviso, California avenue, Hobbie street and Union Elevated power stations. He had charge of the building and equipment of the Northwestern Elevated power station and installed the electrical equipment on the Lake Street and Northwestern elevated roads and on the Union Loop.

Regarding his London appointment, Mr. Chapman says that he does not know in detail what his work is to be, but that his duties in connection with the London road will be similar to those he has performed in Chicago for Mr. Yerkes' interests. His appointment is for three years, and his successor in Chicago has not been named as yet.

The joint committee of the Postoffice Department, appointed to investigate pneumatic tubes for the transportation of mail in Chicago, has reported in favor of the installation of the system. However, the House committee on postoffices and post roads has made its report to Congress, and has submitted the postoffice appropriation bill without any reference to tubes, thus practically defeating Chicago's chances for the pneumatic mail service.

Reported Changes of Ownership in Cincinnati and Vicinity.

It is reported that all the lighting interests of Covington, Newport and other Kentucky towns near them have been consolidated under one company, which is yet to be named. Eastern capital has been interested in this matter and the North American Trust company, which held some of the bonds, aided in making the transfer. It is stated that this company and the Standard Oil company will each own half of the new concern, which is to be capitalized at $1,500,000. The properties consist of the Covington Gas company, the Newport Gas company and the Suburban Electric company. Bradford Shinkle received $750,000 for the plant of the Covington Gas company, and Charles Shaw, receiver and principal stockholder of the Suburban Electric company, received $150,000. No figures have been secured on any of the other properties. It is believed that this is the beginning of a company which will later on include the lighting interests of Cincinnati. The report is that General Hickenlooper, president of the Cincinnati Gas Light and Coke company, has expressed his willingness to dispose of his holdings to a company of that kind. The North American Trust company owns the greater part of the Cincinnati Edison company, so it will not be a very difficult matter to secure it.

Reports have been circulated of the probable sale of the property of the Cincinnati Street Railway company to the Whitney-Widener-Elkins syndicate, and the smaller stockholders became a little worried over the matter, but the officials of the company, including President Kilgour, have assured them that no proposition has ever been made to the company to purchase the system and that the concern has never held negotiations with any corporation or individual in regard to the matter. It has been stated, with seeming authority, however, that a proposition may be made by this syndicate to lease the system for a term of years, guaranteeing six per cent. dividend on all stock. The stock of the company is widely scattered and no syndicate or set of men owns a majority of it; so it would be a difficult matter to do anything of that kind without submitting the deal to a vote of the stockholders. Another deal which is said to be in progress is that of the sale of the Cincinnati, Covington and Newport street-railway properties to the Whitney-Widener-Elkins syndicate. In this case it is said that it will be a clear sale if the transaction goes through, in which the stockholders will realize about 90 on their stock, the syndicate to assume a bonded indebtedness of $2,404,000. This company owns all the suburban roads on the Kentucky side of the river, opposite Cincinnati.

Large Electric-sign Flasher.

The illustration on the next page shows what is believed to be the largest commutating device for electric-sign flashing in existence at the present time. It is a 352-circuit machine, with a capacity of 1,750 lamps, although but 350 are used at present. It operates an electric sign 75 feet long, each lamp socket being connected to an independent wire. The wording of the sign is in script, and the entire sign is lighted up, beginning with the first lamp, and continuing, one at a time, just as it would be written out with a pen, until all are lighted. After holding all on a few seconds, the lamps are extinguished simultaneously and the operation is repeated.

The base of the commutating apparatus is 24 by 62 inches in size and contains four brass cylinders, each 23 inches long and six inches in diameter. Two of the cylinders are connected to the positive side of a three-wire circuit and the remaining two to the negative side. The first quarter of the load is taken on the positive side and the second quarter from the negative side, balancing the load. The remaining half load is taken on the positive and negative sides in the same way. The cylinders, which revolve at the rate of two revolutions a minute, are driven by a small one-eighth-horsepower motor, connected with a belt. The current is taken from the cylinders by means of phosphor-bronze brushes, each terminating in a two-ampere cut-out, thus fusing every lamp lead. These cut-outs, as well as the base, are of slate, not a particle of inflammable material being used in the construction of the device.

This flasher was ordered by the Sanborn Electric company of Indianapolis, Ind., on December 6th. Active work was started on it in Chicago on the 11th, and it was on the cars ready for shipment on the 19th. This remarkable time is due to the fact that the contract required it, and as the manufacturer is engaged in this class of work only, it is able to do quick work. The flasher was built by the Reynolds Electric company, 221 Fifth avenue, Chicago, after designs by Egbert R. Dull.

The Batavia (Ill.) City Council has granted a franchise to the Aurora, Wheaton and Chicago Electric Railway company, to enter that city from the east, and a franchise for the proposed road from St. Charles to Aurora.

NORTHWESTERN ELECTRICAL ASSOCIATION.

Another successful convention was added to the list of the Northwestern Electrical association by the ninth annual meeting at the Hotel Pfister in Milwaukee on Wednesday, Thursday and Friday of this week. The attendance was about 160, and there was no diminution of the spirit of good-fellowship which always marks the gatherings of this association. Mr. Pliny Norcross, the retiring president, was present, and occupied the chair. Several papers of much value were presented and also the important report of the committee appointed to consider the correspondence schools in their relations to central-station employes. It was decided to hold a summer convention at Sheboygan, Wis., during the last week in June. Mr. E. L. Debell, secretary of the Sheboygan Light, Power and Railway company, was elected president of the association for the ensuing year. The report of Mr. T. R. Mercein, the secretary and treasurer of the association, showed that the organization is in a flourishing condition, and several new members were admitted.

Among the central-station men and educators present were the following-named:

Pliny Norcross, Janesville, Wis.; C. C. Hammond, Mason City, Iowa; F. A. Copeland, La Crosse, Wis.; H. J. Gille, St. Paul, Minn.; S. Mainland, Green Bay, Wis.; W. P. Bragg, Monroe, Wis.; Prof. D. C. Jackson, University of Wisconsin, Madison, Wis.; E. L. Debell, Sheboygan, Wis.; Prof. W. E. Goldsborough, Purdue University, Lafayette, Ind.; Prof. B. V. Swenson, University of Wisconsin, Madison, Wis.; H. W. Tolle, Mattoon, Ill.; H. C. Higgins, Marinette, Wis.; Thomas Higgins, Neenah, Wis.; Charles Cuno, Oconomowoc, Wis.; W. Worth Bean, St. Joseph, Mich.; John Schuette, Manitowoc, Wis.; R. F. Kountz, Neillsville, Wis.; E. Daniell, Menominee, Mich.; George A. Davis, Neenah, Wis.; T. F. Grover, Fond du Lac, Wis.; Irving P. Lord, Waupaca, Wis.; A. C. Gates, Newton, Iowa; James Bradshaw, Milwaukee; R. C. P. Holmes, Chicago; B. H. Strong, Baraboo, Wis; S. B. Livermore, Winona, Minn.; G. B. Wheeler, Eau Claire, Wis.; P. H. Korst, Hartford, Wis.; G. H. Strang, Richland Center, Wis.; S. K. Adams, Richland Center, Wis.; B. D. Viles, Chippewa Falls, Wis.; W. H. Thorp, Beaver Dam, Wis.; G. L. Thayer, Toledo, Iowa.

On the Chicago Train.

A special car was attached to the Chicago, Milwaukee and St. Paul train that left Chicago on Wednesday at 9 a. m. It contained a party of about 35, under the competent direction of Mr. James Wolff, bound for the Milwaukee convention. The names of the convention visitors in this party are as follows:

Almert, Harold, Lincoln Park lighting department.....Chicago
Anger, Ed. W., Jr.....Chicago
Brooks, John W., Pass & Seymour.....Chicago
Colbert, Frank E, Electrical Review.....Chicago
Collins, W. Forman, Western Electrician.....Chicago
Cooke, Joseph H., Buckeye Electric company....Chicago
Crockett, W. P., Hart Manufacturing company..Chicago
Cutter, George, George Cutter company.....Chicago
Dibble, S. F., General Electric company.....Chicago
Eddy, Henry C., American District Steam company.....Chicago
Goldsborough, Prof. W. Elwell, Purdue University.....La Fayette, Ind.
Harding, J. H., La Porte Electric company.....La Porte, Ind.
Highlands, E. M., Clinton Gas Light and Coke company.....Clinton, Ia.
Hill, Joseph M., Electric Vehicle company.....New York
Jackson, I. S., Western Electric company.....Chicago
Johnson, Samuel A., Viscosity Oil company.....Chicago
Keech, George C., Bryan-Marsh company.....Chicago
Kelly, William E., Western Electrician.....Chicago
Kitt, M. B., John A. Roebling's Sons company.....Minneapolis
Kuehmsted, A. Louis, Gregory Electric company..Chicago
Low, Willard W., Electric Appliance company..Chicago
Marsh, Converse D., Bryan-Marsh company...New York
Meade, Charles A. (with Mrs. Meade), Shelby Electric company.....Chicago
Messer, Charles, Dearborn Electric company.....Chicago
Pierce, O. D., Shelby Electric company.....Shelby, O.
Rall, S. A., Electric Appliance company.....Chicago
Raymond, Francis, General Incandescent Arc Light company.....Chicago
Ross, Clarence A., Sawyer-Man Electric company.Chicago
Rotchka, F. E., Western Electrician.....Chicago
Watson, R. H., Gregory Electric company.....Chicago
Whyte, George S., Macomber & Whyte Rope company.....Chicago
Wolff, James, New York Insulated Wire company....Chicago

President Norcross' Address.

After the usual opening exercises on Wednesday, President Norcross delivered the presidential address:

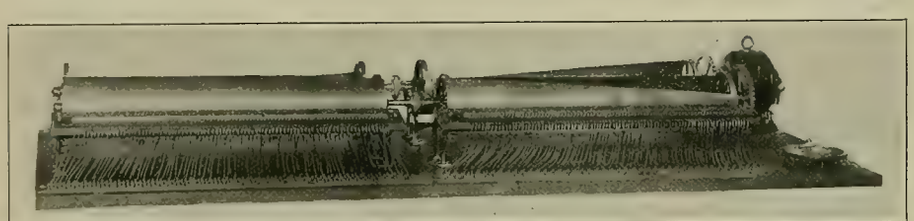
This association, as well as others of similar character, rests firmly upon the proposition that producers, dealers, buyers and users are benefited by an exchange of opinions and experiences. This exchange is not always found in public debate, or in carefully prepared papers, but very frequently in the quiet talk of men engaged in the same pursuit or in the examination of improved machinery and material on exhibition at these meetings, as well as in consultation with salesmen. Not only do we gain information upon business matters, but we become imbued with a spirit of fraternity and friendliness. I have noticed this especially at the summer meetings, where business was almost ignored. Our last summer meeting at Waupaca was especially pleasant, from the fact that all parties seemed to have forgotten that they were grown-up business men. For a few days they were boys again.

The very able address of my predecessor at this place a year ago called especial attention to the matter of municipal ownership; since then, the fourteenth annual report of the commissioners of labor has been issued. It includes data from 952 plants in the United States, of which 320 are owned by municipalities, while 632 are operated under private or corporate ownership. Neither the names nor locations of these plants are given, but each plant is reported by a certain number. The report itself includes about 1,000 pages of carefully prepared matter.

At the twelfth annual convention of the National Association of Officials of Bureaus of Labor Statistics in the United States, held at Albany, N. Y., the following resolution was unanimously adopted:

"Resolved, That it is expedient for the offices represented in this association to undertake an investigation of the private and municipal ownership of water, gas and electric-light plants, substantially as recommended by the executive committee, and that for the purpose of determining the methods and limits of such an investigation and the preparation of blanks to be used therefor, the matter is referred to a committee consisting of the president of this association and two others, to be appointed by him, which committee shall report its conclusions and recommendation to the various bureaus of correspondence."

A committee was appointed, consisting of Mr. Lee Merriweather, commissioner of labor of Missouri; Mr. Horace G. Wadlin, chief of the Bureau of Statistics of Labor of Massachusetts, and the president of the convention—the United States commissioner of labor. This committee has done an immense amount of work in the preparation of its report.



LARGE ELECTRIC-SIGN FLASHER. (SEE PRECEDING PAGE.)

A study of this report develops many interesting facts. I desire to call attention to a few of the electric plants cited therein. In one municipal plant, No. 151, there were eight private arc lamps, 1,200-candlepower, and 10 public street lamps. The users of the eight private arc lamps were obliged to pay the city 12 cents a kilowatt-hour, while the city paid nothing for its 10 street lamps. In other words, a few enterprising citizens paid for their own light five or six times as much as they would have paid to a private company, and they alone thereby carried the burden of lighting the streets, which should have been borne by all of the taxpayers.

In No. 152 the private user was compelled to pay six cents a kilowatt-hour for eight arc lamps, and $1 apiece for two other arc lamps, while the city reports that for its 26 arc lamps it pays but 2⅓ cents a kilowatt-hour. In No. 156 it costs the city 5¾ cents a kilowatt-hour for 42 street arc lamps. In this town or city there seems to be no private user willing to bear the burden of lighting the city. In No. 160 it costs the city over 12½ cents a kilowatt-hour to light 75 street lamps. In No. 161 a private company furnishes the city and private users light at the uniform and moderate price of 2½ cents a kilowatt-hour. In No. 163, 15 private arc-lamp users pay the city plant a little over nine cents a kilowatt-hour, and thus enjoy the honor of supplying the city with 14 street lamps free of cost to all other residents. In No. 165 there seem to be no public-spirited citizens who take arc lamps, and thus the cost to the city is over three cents a kilowatt.

In No. 167 the city owns and operates the plant and furnishes arc lamps to 17 private users at 4½ cents, and admits a cost to itself for 50 arc lamps of over 11.6 cents per kilowatt. It is barely possible that the private users are public officers. While in No. 168 a private company gets between eight cents and 12 cents from private users and receives from the city about 8½ cents. In No. 174 a municipal plant furnishes incandescent lamps for eight cents a kilowatt-hour, and thereby gets its own lamps for nothing. In No. 175 the same policy is pursued by a municipality; the private users alone pay for city lighting. In No. 179 the city furnishes 1,050 incandescent lamps for 10 cents a kilowatt-hour, and thereby gets its 24 arc lamps for a trifle less than one cent a kilowatt-hour. In Nos. 187 and 188 it costs the city 0.0461 and 0.0347 respectively. No private users. These samples are taken from one or two pages as they run.

But I forbear further details. The book, or report, is very interesting, and it establishes, as I think, the fact that a city is not as well equipped to perform the intricate work of making and selling electric current as a private company which makes this class of work a close, careful study, for the sole purpose of furnishing to all customers reliable light or power, or both, at a fair price, and at a very small profit to itself. I beg your indulgence for adding a few suggestions: In cases of municipal ownership the city pays no direct tax on its plant, but indirectly it does pay a tax, because it does not receive the tax which a private company would pay into the treasury. Ordinarily, a municipal plant makes no allowance for depreciation or for the exchange of improved appliances for the old system. A city cannot buy material any cheaper than a private company, and usually not so cheaply; generally it pays more wages for inferior service. It is handicapped in the matter of adopting improvements. In the matter of personal-damage suits, a city occupies an unfortunate position. A city is not so well situated for speedy recovery from damage by freshets, cyclones or fire, as a private company.

Not long ago a Texas city gave bonds for over $1,500,000 for the construction of an immense dam and power plant, in the belief and hope that it could not only light its streets and public buildings for nothing by selling current to private consumers, but could secure a large profit thereby. It is a matter of record that the dam when built would not hold water, and utterly failed to furnish power for the use of the city alone. The enormous burden thus placed upon the city has reduced the price of real estate and discouraged investment.

I note, in the last issue of Municipal Engineering, that an Indiana city has been compelled to raise the price of a 16-candlepower lamp to 75 cents per month to private consumers, with the sure prospect of a further raise of seven cents a kilowatt-hour in order to make its own plant self-sustaining. Numerous instances can be readily cited to sustain the proposition that, although the theory of municipal ownership is very bright and full of promise, yet the actual practice, as shown by the majority of cases, is not encouraging.

Aside from figures and details, there is, to my mind, one insurmountable obstacle to city ownership and continued successful operation of electric plants: All city officers must be elected by the people at large; as a rule, they never have been, and probably never will be, elected for their fitness to discharge the various duties which they so willingly assume.

I readily concede that in many instances they are intelligent, honest, public-spirited men, and if they could remain in office long enough, and could afford to give up their own business and would devote their energy and time to the city's business, they would soon become competent to perform the duties incident to their positions. The whole matter of streets, sidewalks, gutters, sewers, parks, bridges, pavements, schools, courts, police, sanitary regulations, water and light supply, etc., is in most instances entirely new to them. They are nominated and elected by their friends, and, when elected, they must take care of their friends, and that fact alone prevents such a discharge of their duties as they themselves would desire; but outside of those who are honest and intelligent, a great many are nominated for the sole reason that they can be elected when nominated. The same clique or "pull" which nominated them also elects them. There is no pretense that they are capable, and there is no thought or care as to their honesty. If their record is a little shaky on that score, all the better for the purpose of those who secured their election.

When elected, they must help their friends; but whether honest or dishonest, capable or incapable, most of them have had no experience in the work which comes to them, when once in office. Their terms of office are short and uncertain; they generally receive no pay for their work; they are blamed and abused by the press or a part of it, and by a good part of those who elected them, and by all who opposed them. No sensible business man would for one week trust his business to such control or management.

The "fad" of municipal ownership of electric plants may sweep over the country as other socialistic, communistic, impracticable schemes have done, but it will in the end be a ruinous experience, and I firmly believe that there is not now so strong a sentiment in its favor as there was a year ago. As the matter of municipal ownership is more fully understood, the desire for it will diminish.

One reason for its adoption by many towns is the fact that unpleasant relations have grown up between the local plant and the municipality. The citizens are impressed with the idea that the local company is making too much money out of the business, while the company is confronted with the fact that the original outlay was not always a judicious one, and in all cases was very expensive.

I well remember the time when carbons, dynamos, lamps, etc., cost three times as much as they do now. In every case the original plant was too small, and people who first invested were glad enough to get out of it at any sacrifice. Most of the plants in operation to-day stand upon the ruins of one or two earlier plants. The competing gas companies at first were somewhat disturbed by the new illuminant, and cut prices in order to hold their plants in operation. New electrical inventions then, as well as now, have compelled the abandonment of the earlier equipment.

Cities are besieged with applications for apparently better contracts, and too often forced the old companies, which had struggled bravely to hold up against the rising tide, into bankruptcy. The city often gave franchises to new companies, or, still worse, practically confiscated the existing plant by putting in one of its own. In this way many of the pioneer plants proved to be unfortunate investments. Most of these unfortunate facts could have been prevented by a little mutual concession.

We are now called up in the matter of taxation. Many persons believe that none of the existing corporations are paying their proper proportion of the public expense. We cannot speak for others, but we believe that electric corporations are paying more than their share. The city insists upon getting the very lowest figure for its own service, in streets and public buildings, under the threat of municipal ownership, or of permitting outside competitors to sweep away the local investment—then, after getting the very lowest figure, proceeds deliberately to give the local electric company another twist by raising the taxes from 50 to 100 per cent.

I sincerely believe that all of this unpleasant condition could be very much improved, if the state and municipality would adopt a new method of procedure. Instead of treating us as enemies to the public welfare, we should be treated as men who are engaged in the laudable effort of endeavoring to promote and enlarge one of the most useful industries known in the history of civilization. Treat us fairly; remember that the road which we have traveled for the last 15 years is literally strewn with the wrecks of hundreds of failures. Almost all other corporations, such as railroads, telegraphs, telephone companies, water companies, gas companies, have passed through the trying years of experiment and disaster, and are now standing on firm financial ground. Their bonds are listed in all the market quotations of the world, and their stocks have a definite value, while our stocks and bonds are, in the main, unquoted and unsalable.

I would suggest, as one way of reaching a better and fairer understanding between the local companies and the municipalities and states, that we promptly and honestly open our books to the inspection of the new board of taxation in this state or to an inspector of that board, if such an officer should be appointed in that board, as recommended by our present governor, in his recent address to our Legislature.

Such action on our part would certainly give us the right to ask that our taxes should bear a proper relation to the salable value of our plants and to our net earnings, and would in a large degree settle the question of whether or not the price of our product was reasonable, and would have a tendency to satisfy our own customers, including the cities where we individually operate, that we were treating them fairly. It would further give us the right to insist that the present board of tax commissioners should not name a percentage or license fee at any arbitrary figure, until the commission has fully examined the facts in each case.

Fifteen years ago an electric plant was considered an experimental and dangerous luxury. To-day it is an established fact that such a plant is one of the most necessary, useful and practical equipments of any city, town or village. It furnishes, not only a cheap, safe and healthful light, which, of itself, is a most valuable assistant in preventing crime and securing good order, but it furnishes power at a low price for the local grain elevator or grist mill, creamery, factory, woodyard or water tank, as well as for the dentist, blacksmith or sewing girl. It will cool the dwelling, office or hotel in summertime, and, when connected with the hot-water or steam system, it will heat the same in winter. It puts the town or village in close companionship with the adjacent city by means of the suburban road. It is utilizing every waterpower on the face of the globe, thereby adding millions of horsepower, which since the creation has remained dormant.

Instead of being opposed in its onward march and made the victim of unreasonable competition and of constantly increased taxation, it should be encouraged and sustained. The practice of confiscating such a plant, or compelling it to produce current at less than cost, and continually and persistently raising its tax, makes it a precarious business and prevents improvement. The matter of depreciation (which with us is a very serious one), the price of fuel and the freight thereon, varies almost 100 per cent. in different parts of the northwestern states; the price charged for our products, the wages paid, etc., tend to make the gross earnings of an electric plant an unjust standard of assessment. Yet, it may be the only method to adopt.

I would suggest further that the Board of Tax Commissioners recommend a sample of uniform books for our business. Then, after we have fairly done our part in the matter of furnishing to all our patrons good light and reliable power, we want the state, as well as the municipality, to stand by us, and not confiscate our property or ruin us by unjust competition. Competition cannot reduce cost; it takes from the poor and weak, and gives to the rich and strong. No city or state should use it as a club to ruin its own citizens or taxpayers.

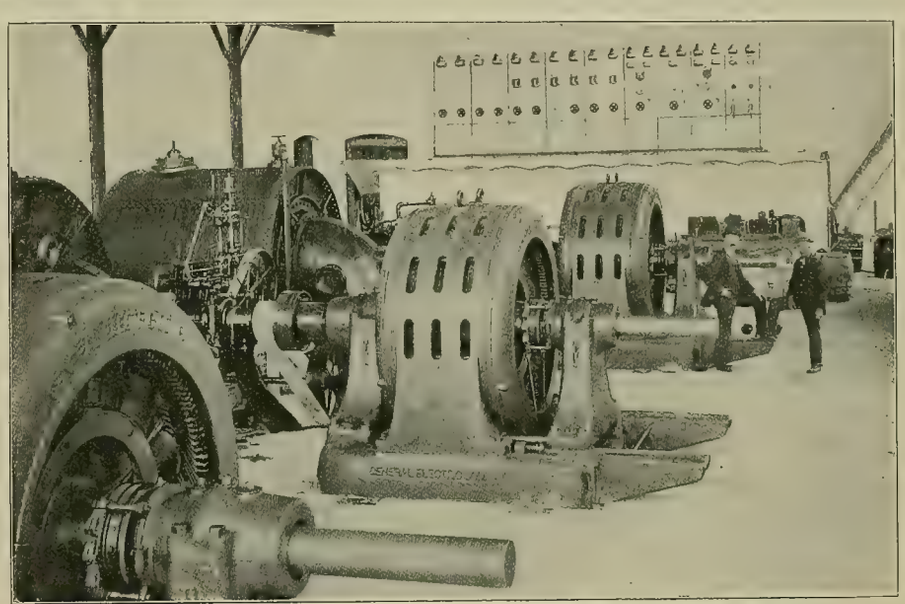
We must eventually pay our bonds, and our stock ought to be worth par. We must pay interest on our bonds, and we should be able to pay fair dividends on our stock. We must allow more for depreciation than any other of the public industries, and we should be allowed to put aside a reasonable surplus for disaster and for the replacement of present equipment by improved equipment.

If the state and municipality would be fair toward us, we should in a short time possess electric industries which would combine the superior attention, care, economy and experience of the private company, with public inspection and oversight, which, in my judgment, would be an almost perfect system. It would secure fair prices, good products, and would be a bulwark against failure or bankruptcy.

We, as well as other taxpayers, cannot entirely overlook the fact that the disbursement for the state of Wisconsin, in the year 1889, was in round numbers $2,574,227, while the disbursement for the year 1898 was $3,708,582. It is barely possible that the state is open to some criticism in the expenditure of funds, as well as the owners of property, for evading the proper assessment of their property. I have great faith in the industry and impartiality of our new tax commissioners. They have assumed a great task. It will require time, patience and persistence to achieve moderate success. Their work is but fairly started; let us do all that we can to aid them in their efforts.

I have been requested to present to this convention a copy of bill No. 11350, House of Representatives, for the purpose of having the same examined, and, if found to be a good measure, to recommend its passage by the national Congress.

In conclusion, I think it can be truly said that our association is in a prosperous condition, and is yearly improving. You will hear several very able papers upon interesting subjects, and I bespeak for the readers your careful attention.



ELECTRICAL EQUIPMENT OF A LARGE PAPER MILL.—GENERATOR ROOM. (SEE PAGE 51.)

Wednesday's Transactions.

In his report Mr. Mercein, the secretary and treasurer, said a good word for summer conventions and for the work of Mr. James Wolff in preparing for the amateur minstrel show at Waupaca last summer. The affairs of the association were shown to be in a satisfactory condition. At Mr. Mercein's suggestion, a committee was appointed to prepare suitable resolutions in relation to the death of Mrs. Pliny Norcross, and such resolutions were later presented and adopted.

Mr. Debell presented the report of the committee on legislation, reviewing the tax situation in the state of Wisconsin. He said that about 85 per cent. of the central-station men of the state favored the license fee or percentage tax in preference to the valuation plan. Objection was made, however, to a proposed increase in the rate.

The following-named new members were elected: Ernest Buck, Elroy, Wis.; T. W. Bowen, Kenosha, Wis.; Milwaukee Electric Railway and Light company, Milwaukee, Wis.; Superior Water, Light and Power company, West Superior, Wis.; W. E. Jeannot, Tomahawk, Wis.; E. V. Benjamin, Mauston, Wis.; Mattoon Heat, Light and Power company, Mattoon, Ill.; H. Almert, Chicago; George Cutter, Chicago; O. C. Little Pulley Coating company, Menasha, Wis.; Edward A. Jenkins, Milwaukee; Browning Manufacturing company, Milwaukee; Milwaukee Electric company, Milwaukee; W. P. Crockett, Chicago; John T. McRoy, Chicago.

Letters were received from H. W. Frund of Vincennes, Ind., and H. L. Doherty, now in Denver, regretting their inability to be present. Mr. Doherty, in his letter, nominated Professor D. C. Jackson for honorary membership and invited the association to hold its summer meeting in Madison, Wis.

The Edward P. Allis company invited the members of the association to visit its plant in Milwaukee.

As a committee to nominate officers for the association, the president appointed T. F. Grover of Fond du Lac, Wis., P. H. Korst of Hartford, Wis., Edward Daniell of Menominee, Mich., H. J. Gille of St. Paul, Minn., and G. L. Thayer of Toledo, Iowa.

The question of holding a summer convention was referred to a committee consisting of E. L. Debell of Sheboygan, Wis., W. W. Low of Chicago and S. B. Livermore of Winona, Minn.

Mr. H. L. Doherty's paper on "The Rate Question" was then read, and it was followed by a paper on "Practical Line Construction," read by L. W. Burch of Madison, Wis.

On Wednesday evening a large number of the members and visitors attended the Bijou Theater in a body and witnessed the startling melodrama, "Caught in the Web." Some of the actors wore the association badge and were wildly applauded in consequence.

Events of Thursday.

The convention was called to order by President Norcross at 11 a. m. The subject of gasoline lamps was brought up and excited much discussion. Among those taking part in the discussion were Vice-president Gille, Mr. Hill, Mr. Thayer, Mr. Cutter, Mr. Strong, Colonel Bean, Mr. Debell, Mr. Livermore, Mr. Lord, Mr. Kountz, Mr. Grover, Mr. Davis and Mr. Bowen. A motion introduced by Mr. Livermore that a committee be appointed to investigate the entire subject and report at the next summer meeting was carried.

Chairman Debell presented the report of the committee on summer meeting, recommending that there be a summer meeting held during the last week in June, 1901, or at such other time as the committee should designate, and suggesting that Sheboygan be the place of meeting. After discussion participated in by Messrs. Bowen, Bean, Livermore, Low, Grover, Kountz and Wheeler, the report of the committee was adopted and Sheboygan chosen as the place for the meeting.

Professor W. E. Goldsborough of Purdue University then read a paper on the subect of "Synchronous Converters," discussion on which was postponed until the afternoon session.

At the afternoon session the following-named officers were elected for the ensuing year:

President—E. L. Debell, Sheboygan, Wis.

First vice-president—S. B. Livermore, Winona, Minn.

Second vice-president—W. Worth Bean, St. Joseph, Mich.

Secretary and treasurer—Thomas R. Mercein, Milwaukee.

Directors—For Wisconsin, L. E. Kerns, Madison, and Charles Cuno, Oconomowoc; for Indiana, J. H. Harding, La Porte.

Mr. Debell was escorted to the chair and made a brief speech of thanks.

Thomas R. Mercein was chosen as a delegate to the National Electric Light association's convention in New York this year.

[*Continued on page 53.*]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 20,000.

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Are our American electrical manufacturers and supply dealers fully awake to their possibilities in the Philippines? From advices which we receive from the distant islands it appears evident that there is already a considerable demand for electrical machinery and fittings in the archipelago, while there seems to be no question that the future requirements will assume proportions of much importance. Established houses for the special purpose of providing electrical supplies for the Philippine markets are very few. There is one place in Manila where there is a line of supplies for small dynamos and motors, some fixings for electric lights and wirings and for fans and kindred devices, and, as a rule, one can secure almost everything required in these lines in the capital city; but there is a woeful lack of electrical furnishings in all of the other cities and towns of the archipelago. The Americans, as well as representative men from other nations, have been establishing new industries everywhere, and the need of mechanical and electrical supplies is sadly felt. This shortage of the necessary supplies is a source of delay to the electrical progress of the islands; but it may be hoped that this trouble will be remedied soon.

The varieties of electrical apparatus in demand are arc lights with fittings, batteries and jars, bells and buzzers, burglar alarms, telephones, telephone material and switchboards, tapes, insulating goods, linemen's tools, meters, mica, packing, insulated wire and cables, rheostats, sparking plugs, incandescent lamps, fan outfits, fuses and fuse wire, connectors and terminals, dynamos and motors of various sizes, coils and magnets, carbons, copper in sheet and bar, bolts, screws, set-screws, small castings, and general supplies for the processes of electroplating. These goods, or some of them, are now carried by some of the firms in the Philippines as a side line, and in several instances these "side lines" pay the owners of the stores much greater profits than the regular goods carried by them. There are sewing-machine agents and dealers in typewriters and photographic supplies who are doing only a light business in their original lines, but who are rushed with work in connection with the "side lines" of electrical machinery and supplies. Some hardware stores are making considerable money by having electrical stocks in store, while the same may be said concerning some of the other lines of trade. Thus it will be seen that the electrical business of the Philippines is extending in a somewhat haphazard fashion. No doubt a more systematic and energetic effort to extend the market for American electrical apparatus in the Philippines would meet a rich reward, while the introduction of electrical improvements would greatly hasten the development of the country.

By the high class of papers presented at the Milwaukee convention this week the Northwestern Electrical association again demonstrates its right to rank among the leading organizations of its kind in the country. Much of the credit for this gratifying state of affairs is due to the untiring efforts of the active and energetic secretary, Mr. Mercein. Professor D. C. Jackson of the University of Wisconsin has taken a laboring oar in the technical discussions of the association, and it is fair that his name should be mentioned when the present standing of the society is the object of praise, without overlooking, of course, the steady adherence of such men as Colonel Copeland, Mr. Norcross and other practical men of affairs of that class, who are, in the last analysis, the pillars of the temple. The association has always been liberal with the electrical manufacturers and dealers, and is in consequence very popular with the supply men of the West, who always furnish a large proportion of the attendance at the meetings. Unfortunately, the number of central-station men who attend the conventions is not as large as it should be. This fact seems to be an inevitable limitation, but it does not in the least detract from the value of the work of the association, as disseminated by the pamphlet proceedings and the technical press. Owners or managers of electrical plants in the Northwest who do not ally themselves with the organization or who, being members, fail to attend the meetings, simply cut themselves off from the real benefit to be obtained by touching elbows with their coworkers and by participating in the discussion of the live questions presented.

A particularly valuable feature of this week's convention was the report of the committee appointed to consider the advisability of central-station managements encouraging their employes to enroll themselves in courses of correspondence schools. This is a twentieth-century question and an important one. So far as we are aware, the Northwestern association is the first organization of employers to take the matter up carefully and systematically. The committee which made the report was wisely continued and will doubtless proceed with its good work. It consists of Professor Jackson of Madison, Wis., Colonel F. A. Copeland of La Crosse, Wis., and H. L. Doherty, now in Denver. It has collected valuable data on the work of four of the correspondence schools, and, more than that, its work has been constructive in outlining what a central-station course ought to contain. After listening to the report the association voted to request the four schools mentioned to reorganize their courses for central-station employes to conform as nearly as possible with the requirements of the committee. Now this is certainly good, practical work for an electrical association. The method of technical instruction by correspondence has reached proportions that are truly enormous, and the Northwestern association has shown wisdom and foresight in seeking to point out wherein the course that touches their own employes may be improved. The committee has rendered conscientious service, and we have no doubt that the correspondence schools will be among the first to recognize its value. Certainly central-station men and all, in fact, who believe in self-help are laid under a tribute of gratitude to the authors of this excellent report, which the Western Electrician expects to present more fully in a forthcoming issue.

President Norcross' address was largely devoted to the municipal-ownership question and gave the central-station side of the argument in a clear and straightforward manner. Professor Goldsborough presented a well-written and scholarly paper on "Synchronous Converters." This was one of the best papers presented to the meeting and was greatly appreciated by the more thoughtful members and visitors. Mr. Burch's paper on "Practical Line Construction" was as practical as its title indicated. It was not too long, went to the point at once and is a good paper. It is an excellent idea to have at least one paper at each meeting on some subject that is dealt with by all central-station managers, big and little, urban and rural—in short, a "practical" subject. The practice so well begun should be continued. Mr. Doherty's paper treated the important question of methods of charging for electric current. The author has given much study to this subject and detailed the method which he has evolved as the result. The remaining paper was on "The Series Incandescent Lighting System of the Future" and was read by P. D. Wagoner. The writer described a new method of controlling series incandescent circuits by an automatic constant-current reactive coil.

All the papers were printed in advance and distributed at the meeting. This is an innovation—a step upward—for the Northwestern association, and the practice should be continued, for its obvious advantage as an aid to discussion. All writers of papers like to have their contributions discussed, and if they will co-operate with the secretary by forwarding their "copy" in ample time for advance printing their efforts are more likely to meet the attention they deserve.

An unannounced feature of the convention (and herein the advantage of personal attendance is illustrated) was the discussion of gasoline "arc" lamps for street lighting. The subject was brought up by a letter of inquiry, and although the members were of opinion that the danger of competition from this source was not very threatening, the question was deemed of sufficient importance to be referred to a committee instructed to report at the next meeting.

This brief review of some of the results of the Milwaukee convention will show that while the Northwestern Electrical association has still much opportunity for useful work, it has already a record of meritorious accomplishment. An outline report of the convention is presented in this issue, together with the papers of Messrs. Burch and Doherty. Other papers and discussions will be given in succeeding numbers of this journal.

Electrical Equipment of a Large Paper Mill.

About 18 months ago work was begun on the new mill of the Great Northern Paper company at Millinocket, Me. The mill is now in operation and is the largest of its kind in the world. The company owns over 350,000 acres of timber land on the Kennebec and Penobscot rivers, from which is drawn the wood for the manufacture of the product.

The wood, mostly spruce, is floated to the mill in the form of logs. It is first brought into the wood room, passing saws which cut it into four-foot lengths. These lengths are then run through barkers to the chippers, in which the wood is cut into chips a little larger than hickory nuts, the chips being then run through a crusher and reduced to pulp by a chemical treatment. By another method the four-foot lengths may be run directly to the grinders. The pulp goes through various processes and is finally pumped to the paper machines.

The Penobscot River furnishes power for the mill. A dam 1,200 feet long has been built, and in the generator room six 36-inch Hunt turbines have been installed, arranged in pairs on three shafts, each pair developing about 1,500 horsepower. Each pair of turbines is directly connected to a General Electric 1,000-kilowatt, 600-volt, three-phase generator. Two 60-kilowatt exciters are provided, each driven by a 125-horsepower turbine. All of these wheels are supplied by a single flume, and are controlled by Lombard governors.

Tiled conduits are used to convey the cables from the generators and exciters to the switchboard, which is on a gallery at the end of the generator room, and the circuits to the buildings are carried from the switchboard in tiled ducts to a tunnel running from the boiler house to the machine room. The tunnel carries the duplicate steam-piping systems, as well as the lighting and power circuits.

Most of the motors installed are of the three-phase, induction type, provided with starting resistances, to be connected in the armature circuit, but the equipment also includes three 300-horsepower synchronous motors. This mill has been equipped to run with as small a force of men as possible, and, indeed, a paper mill is peculiarly adapted in most of its departments for continuous running with little attention. For this reason it has been found possible and desirable to adopt the system of driving by groups, rather than by individual motors, as is so often advisable in other factories. While in this particular case this plan results in greater economy in operation, large motors being used throughout, it necessitates the adoption of a type of motor developing a large starting torque. Hence the type of induction motor with starting resistance was decided upon, this motor giving a large starting torque with a moderate current, while the synchronous motor would not fulfill this requirement. The equipment includes one 10-horsepower, two 30-horsepower, two 50-horsepower, one 75-horsepower, one 100-horsepower, one 200-horsepower, five 250-horsepower and six 300-horsepower motors.

The lighting circuits are supplied from the same generators that feed the power circuits, step-down transformers being employed to lower the voltage to 115 volts. The lighting system comprises about 80 arc lights and 1,000 incandescent lamps. The illustration (page 49), reproduced from the Paper Mill and Wood Pulp News, shows the generator room of the Millinocket plant.

New Plant of British Westinghouse Electric Company.

The British Westinghouse Electric company of Manchester, England, has sent out invitations for bids for over $500,000 worth of machine tools for its new works on the Bridgewater Canal in Manchester. Contracts for the engines have already been awarded to the Westinghouse Machine company of Pittsburg, and it is probable that nearly all the tools needed by the concern will be furnished by United States manufacturers. The buildings, which are already well under way, will cover about 26 acres, and the capacity of the plant will be about 80 per cent. of the East Pittsburg plant of the Westinghouse Electric and Manufacturing company. The main building will be 90 feet long and 427 feet wide, divided in five bays. Steel-casting, brass and malleable-iron foundries are also being erected, the intention of the company being to manufacture the same product as the Westinghouse Machine and Electric companies do at East Pittsburg, with the exception of steam turbines. The plant will employ about 3,000 men at the start, and when running full will give employment to 5,000.

The proposition to erect an electric-lighting plant in Belington, W. Va., to be owned by the city, was carried by a large majority at a recent election.

Annual Meeting of Chicago City Railway Company.

At the annual meeting of the stockholders of the Chicago City Railway company on January 15th the former directors were re-elected, and their proposition for a $5,000,000 increase of capital adopted. The board is composed of S. W. Allerton, D. G. Hamilton, Joseph Leiter, Arthur Orr, George T. Smith, William B. Walker and Otto Young. The new stock is for the purpose of retiring the bonded indebtedness of the road, amounting to $4,619,500, which comes due July 1, 1901. President Hamilton, in his address, spoke of the good condition of the property and the reconstruction of the lines in many places which has taken place during the last year, including the welding of a large number of rail joints. The financial and operating statements, with comparisons, make the following showing:

	1900.	1899.
Passenger receipts	$5,506,313	$5,162,665
Income from other sources	36,866	31,774
Totals	$5,543,180	$5,194,439
Operating expenses, taxes, reserves for replacements and renewals, and damages	3,655,001	3,325,677
Interest on bonded debt	207,877	207,877
Totals	$3,862,879	$3,533,554
Net income	1,680,301	1,660,884
Dividends, 12 per cent	1,575,000	1,499,997
Surplus for year	$ 105,301	$ 160,887
Percentage of operating expenses, taxes and reserves to total gross earnings	65.94	61.92
Percentage of operating expenses, taxes and reserves to passenger receipts	66.38	64.42
Passenger receipts per day	$15,085	$14,141
Fare passengers	110,843,202	103,888,307
Transfer passengers	46,118,004	41,555,323
Totals	156,961,296	145,443,630

Car Miles Run.

	1900.	1899.
Electric	15,702,330	14,517,690
Cable	13,425,920	11,741,840
Horse	104,960	111,470
Totals	29,232,360	26,371,000

Miles of Single Track Operated

	1900.	1899.
Electric	173.203	169.005
Cable	34.75	34.75
Horse	1.8663	1.731
Totals	209 8193	205.486

A meeting of the directors was held on January 17th, at which it was decided to issue $4,500,000 of the authorized new issue of stock on July 1st. This, with $119,500 taken from the surplus, will make up the $4,619,500 necessary to meet the indebtedness falling due at that time. The new shares will go at par to stockholders of record June 15th. The total amount of stock outstanding when the $4,500,000 shares are put out will be $18,000,000, and the company will be free from bonded indebtedness. The directors re-elected the former officers, the list being as follows: President, D. G. Hamilton; first vice-president, Joseph Leiter; second vice-president, W. B. Walker; secretary, Frank R. Greene; treasurer, T. C. Penington; auditor, C. N. Duffy; general manager, Robert McCulloch.

Car Lighting in Germany.

A recent rear-end collision on a German road which resulted in a violent explosion of gas from the Pintsch illuminating apparatus on one of the injured coaches has caused a renewal of popular interest in electric train lighting. Experiments are now being made on a train between Berlin and Cologne with the Stone system, in which each car carries a small dynamo geared to a wheel axle, and an accumulator, both hung beneath the floor of the car. This system has proved successful in England, but it is said that the varying speed on the Berlin-Cologne line and the stoppages of the train cause variations and unsteadiness in the light, which the accumulator does not successfully correct. Electric lighting has, however, been adopted for the postal cars, of which there are about 3,000 in Germany. A postal car requires for ordinary service the illumination afforded by about 14 ordinary gaslights, which not only consumed rapidly the oxygen in the car, but in summer made the cars too hot for efficient working of the clerks. For this reason, the electric light has become all but universal in the postal cars of Germany, each of which either carries its small dynamo and accumulator, and thus operates independently, or is provided with storage batteries that are charged from an outside source before the car begins its journey. The storage battery used for this purpose is of a type known as the Böse accumulator, four of which, each containing eight cells, carry sufficient energy to supply nine to 11 12-candle incandescent lights during two nights. Consul-general Mason, from whose report these facts are taken, thinks that the electric system will not come into general use for passenger-coach lighting in Germany, because of the expense of making the change, which would involve, besides the additional cost of the new outfits, the discarding of a large amount of costly Pintsch apparatus, no part of which could be utilized.

Financiers and Inventions.

[From the New York Times.]

In the special and very handsome New Years number of the Western Electrician there appears an interview with Mr. Thomas A. Edison in regard to the electrical outlook in general and to the future of telegraphy in particular. After prophesying that immediate progress in telegraphy would lie in the direction of improved methods of automatic transmission and of receiving in typewritten letters, Mr. Edison added this significant remark: "But there is no incentive to-day to anyone to devote time or money in attempting to increase the rapidity of telegraphic communication in this country. As you very well know, telegraphy in the United States is in the hands of financiers, and any business man will understand me when I say that it is only too evident that the present policy of the great companies is to 'let well enough alone.'" Mr. Edison has himself been something of a financier in recent years, and his associations with several great companies have been close enough to give his opinion of their tendencies and policies much value. It is, therefore, a pity that he did not go on and explain just what he means by "letting well enough alone." Information on the subject, however, though not exactly abundant, is still not rare. The public has not knowingly suffered much from corporate refusals to give the best possible telegraphic service, but almost all of us are to some degree aware of the cruel treatment we and the inventors have received from the telephone people. Simply for the sake of getting every possible cent out of old patents and existing plants, improvements in the telephone that might have been made years ago are only now come into general use. The delay has been profitable to the companies—or, rather, to the company—but it has caused a terrible wear and tear on the temper of a helpless population, and relief arrived only on the appearance of competition that could be neither frightened nor bought. Mr. Edison now tells us that the same thing is true of telegraphy, and perhaps, if all were known, many other public utilities have been exploited in the same conscienceless way.

Words of Appreciation.

Detroit Journal: The Twentieth Century souvenir issue of the Western Electrician is a work of art and a magazine of merit. It contains interviews with Edison and Tesla, the two modern wizards, and a full-page group picture of the eminent electricians of the nineteenth century. The really most impressive feature of the issue is the vast volume of advertising and its artistic display.

Chicago Times-Herald: The Western Electrician, located at 510 Marquette building, this city, has issued a handsome twentieth-century souvenir number. It contains authorized interviews with Nikola Tesla, Thomas A. Edison and others famous in the field of electricity, a careful review of the electrical business of the past year in the United States, several articles from men of prominence on the electrical features of the nineteenth century and many other original and valuable features. The colored cover displays a striking allegorical design.

Buffalo Courier: One of the handsomest twentieth-century editions received at this office is that of the Western Electrician of Chicago, one of the leading trade journals in the country. In its typographical appearance, its illustrations and its special news features it shows the results of careful and competent supervision. Among the articles of general interest are exclusive interviews with Thomas A. Edison and Nikola Tesla and an illustrated summary of "Progress at the Pan-American Exposition." Not the least attractive part of this publication is the portion devoted to advertising. These pages are filled with the announcements of leading electrical concerns, so well printed and displayed that they are sure to be seen and read.

Twentieth-century Knowledge.

According to the London Electrician, a West of England paper discourses learnedly about electricity in these terms: "The word electricity is formed from the Greek 'electron,' meaning 'amber.' The ancients knew that when amber was rubbed other things stuck to it. That which caused the object to stick was and is electricity. Just what electricity is, no man knows. Electricity is in everything. Rubbing is a way of bringing it to life. Rub a comb with a piece of silk and bits of paper will cling to the comb. You have brought electricity to life. Brushing the hair sometimes makes the head itch because electricity is produced by friction, and touches the nerves in the scalp. Cats rub their ears when it is likely to rain because the air is filled with more electricity than usual, and the electricity pierces the skin of the animal. Electricity at this time is also in the hair of the cat and makes her feel as though she were covered with cobwebs. Electricity may make light and heat; yet electricity, itself, no one can see. Electricity has a smell of its own. If you stand near a big motor you smell something called ozone—the same odor you will notice in the summer after a heavy shower."

The Greensburg and Versailles (Ind.) Railway company has been organized by J. M. Gore, W. A. Bristor and G. W. Bryson.

DEVELOPMENT OF THE TELEPHONE FIELD.

Annual Meetings of Chicago and Central Union Telephone Companies.

At the annual meeting of the stockholders of the Chicago Telephone company on January 16th President John M. Clark presented his annual report in which he stated that to complete extensions of the plant now under consideration, $2,000,000 may be required during 1901. To provide for this 20,000 shares of stock probably will be offered for sale to stockholders at par pro rata, $1,000,000 in April and the balance in October. At present $7,000,000 stock is outstanding. The annual statement shows a gross revenue of $3,129,238, a gain of $460,524 over the preceding year. Net earnings were $870,457, an increase of $193,898. President Clark said in his report that the sum expended on new construction was larger and the gain in number of subscribers greater than in any former year. A total of 36,414 telephones were in operation at the end of the year, an increase of 8,751. The financial results of the year, as compared with 1899, were as follows:

	1900.	1899.
Gross revenue	$3,129,238	$2,665,714
Gross expense (operation, taxes and maintenance)	2,258,780	1,992,154
Net earnings	$ 870,458	$ 676,560
Dividends	749,808	559,550
Surplus for year	$ 120,650	$ 117,010

The development of the company's plant in 10 years was shown as follows:

	Dec 31, 1891.	Dec 31, 1900.	Inc. 1900.	Per ct. Inc. in 1900.
Number of exchanges	15	81	14	20.9
Toll stations	62	101	.....	....
Number of exchange telephones	9,043	36,414	8,751	31.6
Underground con. st. miles	30	121	17	16.3
Underground duct miles	109	874	347	65.8
Miles of wire underground	8,291	68,593	28,836	64.3
Miles of wire, aer. cables	2,113	19,194	4,749	32.9
Miles of wire on poles	9,956	22,818	4,126	22.1
Total miles wire	20,360	110,635	35,711	47.7
Capital stock	$2,000,000	$7,000,000	.....	....

The president's report showed that during the year three exchange buildings, owned and occupied by the company (Main, South and Oakland offices), have been remodeled, one of them (Main) more than doubled in size, and two new buildings (North and Monroe offices) have been built, in all of which new switchboards and new apparatus have been installed and are now in successful operation. In proportion to the number of subscribers and amount of business handled the complaints of defective service have been much less during the last year than in any preceding year in the history of the company. From the latest reports of the inspection department it appears that the time required by a subscriber to get the attention of the office—that is, from the moment of taking the telephone off the hook until answered by the operator—averages 6.2 seconds. It is found that in the Chicago exchange to-day the average distance a message is carried is about 3.37 miles, and the total mileage of all messages sent by its telephone wires during an ordinary business day would exceed 1,250,000 miles, or 50 times around the globe. The company's Chicago ordinance of January 4, 1889, requires that two miles of underground conduit shall be put down each year. That amount has been far exceeded by the company. In 1900 14.30 miles were constructed.

The members of the board of directors elected are as follows: J. Russell Jones, John M. Clark, Robert T. Lincoln, Arthur D. Wheeler, Byron L. Smith, Albert A. Sprague, C. E. Perkins, William A. Jackson, Joseph P. Davis, Chauncey Keep and Alexander Cochrane. Of these gentlemen all were re-elected, with the exception of Mr. Cochrane, the president of the American Telephone and Telegraph company, who was elected to succeed the late John E. Hudson.

The annual meeting of the stockholders of the Central Union Telephone company was also held on January 16th. President W. A. Jackson presented his annual report, in which he stated that for the purpose of protecting the company's interests in Iowa, the directors have deemed it wise to take over the entire Iowa Telephone company as soon as possible. The Central Union's interest now in that state amounts to more than 99 per cent. Arrangements have been perfected to carry on some necessary improvements in Iowa.

Following are the comparative figures of the financial transactions of the company for the last two years ending December 31st:

	1900.	1899.
Gross earnings	$2,307,742.70	$1,999,312.56
Expenses — For administration, taxes, operating, maintenance and interest	1,990,129.56	1,690,753.44
Net revenue	$ 317,613.14	$ 308,559.12
Surplus	317,613.14	308,559.12
Added to construction account—		
At exchanges	1,265,779 30	1,403,256 07
For toll lines	310,025.06	690,540.65
Total	$1,575,804.36	$2,093,793.72
Real estate accounts	178,778.23	139,441.48
Capitalization—		
Stock outstanding	6,962,130.00	6,605,300.00

The amount charged to maintenance in 1900 is $680,000, $124,000 in excess of that charged in 1899. This sum appears in the expense items, and is therefore deducted from the net revenue for the year. The following figures give some interesting information concerning the physical condition of the company:

	1900.	1899.	Inc.
Number of stockholders	540	484	56
Number of exchanges	191	193	*2
Number of subscribers	68,997	59,810	9,187
Number of toll stations	2,324	2,090	234
Number of miles of wire in toll lines	53,338	43,935	9,403
Number of miles of poles in toll lines	11,422	11,168	254

*Decrease.

As indicated by the figures given above, the increase in subscribers during the year was 15 per cent., and in toll earnings the increase was 17 per cent.

At the election of directors the following-named gentlemen were chosen, Mr. Cochrane succeeding the late John E. Hudson: C. H. Brownell, R. C. Clowry, Alexander Cochrane, Arthur G. Fuller, F. H. Griggs, W. A. Jackson, J. Russell Jones, Robert T. Lincoln, L. G. Richardson, John F. Wallick and Arthur D. Wheeler.

Pupin Patents Sold to American Bell Company.

Pursuant of the policy followed by the American Telephone and Telegraph company in securing control of valuable telephone inventions, this company has recently concluded negotiations with Dr. Michael I. Pupin of New York city, resulting in the sale of his patents covering improvements in long-distance telephony to the corporation. This invention, it is asserted, solves the problem of ocean telephony and will permit of transmission of intelligible speech over long-distance land lines of almost any desired length. Dr. Pupin, who is adjunct professor of mechanics at Columbia University, has been at work on the invention for five years and read a paper entitled "Telephony Over Cables and Long-distance Air Lines," in which he discussed his investigations at some length, before the American Institute of Electrical Engineers at Philadelphia, May 18, 1900. United States letters patent Nos. 652,230 and 652,231 were granted to him on June 19, 1900, the title of the patents reading "Art of Reducing Attenuation of Electrical Waves."

The problem that Dr. Pupin set out to solve was the reduction of the retarding influences on an electrical circuit caused by induction and capacity and the balancing of these influences by distributing inductance and capacity through the circuit. This solution had been attempted by other experimenters, but its successful realization awaited the investigations of Dr. Pupin. He arrived at his conclusions by complex mathematical deductions, based on the consideration of the physical analogy between the case of a vibrating string and that of an electrical conductor transmitting waves, in which he determined the dimensions of inductance coils and condensers necessary to add to a given circuit so as to produce a practically "distortionless" circuit.

After securing his patents here and abroad, last July the inventor offered his discovery to the American Telephone and Telegraph company. The company immediately bought an option on the invention, extending to January 1, 1901. Under Dr. Pupin's direction an experimental line was constructed from Bedford station on the Harlem railroad, partly under water, to New Bedford, Conn., thence to Albany and on to Pittsburg. Where the line ran overland the coils were placed at intervals of about two miles and were enclosed in glass insulators on the poles. The experiments were very satisfactory to the officers of the Bell company, and before the option expired the contract for the purchase of the patents was closed, according to the terms of which it is stated that Dr. Pupin receives about $400,000 and in addition an annual royalty of $15,000 during the life of the patents.

It is believed that the invention would not have been purchased if the question of ocean telephoning had been the only one under consideration, as its great value in the operation of long land lines is probably most important to the company at the present time. Dr. Pupin announces that by the use of his system a saving of about $120 a mile can be effected. The coils which will be used with the telephone wires and cables will be distributed at intervals of a mile on land lines and at intervals of an eighth of a mile on cable lines. It is announced that the first utilization of the system for ocean work will be on a cable that the American Telephone and Telegraph company is to build between Florida and Cuba for the United States government. Steps are also believed to be in progress looking toward the use of the system on a transatlantic telephone line.

The Western Electric Telephone company of Britt, Iowa, has purchased the lines of the Iowa and Nebraska Telephone company. The system consists of about 300 miles of line in northwestern Iowa and southwestern Minnesota, and local exchanges located at Estherville, Sibley, Spirit Lake, Sheldon and Cherokee, Iowa.

Regulation of Telephone Rates in Mississippi.

A war has been waged for some time by the Cumberland (Bell) Telephone company against the Independent companies in Mississippi. The Bell company succeeded in crushing some of the local companies by temporarily offering ruinously low rates and then raising the prices to exorbitant figures as soon as it gained control. This severe competition has caused the Mississippi Railroad Commission to assume jurisdiction of the telephone companies now operating in the state, and after thorough consideration of the methods of business now in vogue and the abuses that seem to prevail, it has taken steps to regulate and make uniform the entire system of charges. Following is the text of the ordinance passed by the commission:

It is ordered by the Mississippi Railroad Commission that the charges now in use by the telephone companies, both for long-distance and local business, are approved, except that the maximum charge between points located in the same county shall never exceed 25 cents for any service of three minutes or less time; that the maximum charge for business within the state of Mississippi outside of the same county shall not exceed $1 [instead of $1.50] for any service of three minutes or less time; that the maximum charge for local residence telephones shall not exceed $2, nor be less than $1 per month. It is also ordered that if any telephone company puts in above minimum rates at any place in this state, it shall make the same rate at every other place, similar in population and conditions, and to every other place of smaller population. No telephone company shall increase its present rates except where such rates are now less than minimum rates, and in such cases said increase shall be to a sum equal to rates now charged in places similarly situated.

Indiana Telephone Items.

Jerome Herff has secured a telephone franchise at Peru, and will put in a plant in opposition to the Central Union.

An interesting telephone case has been appealed to the Indiana Appellate Court. The appellee bought a claim of $2.50 against the Rushville Co-operative Telephone company from a young man who had worked for it. The money had been withheld from the young man's wages to pay a bill which one of his creditors had sent to the treasurer of the company for collection. The next time demand was made on the appellee for his telephone rent he refused to pay except by turning in the account he held against the company. His telephone was disconnected and when he demanded telephone service it was denied until he should pay up. He made 10 demands and then sued to recover the statutory penalty of $100 for each refusal to give him telephone service, and recovered a judgment for $1,000. The company appeals on the ground that it was under no obligation to furnish him service until he should pay his back dues in money and not by presentation of an account. The decision is being awaited with interest. F.

Situation in Madison.

The Dane County Telephone company in Madison, Wis., has issued a circular stating its position with regard to the Wisconsin Telephone company. The Independent company has been in operation for about five years, starting with about 400 subscribers. The business has grown until at present the company has about 1,130 subscribers at a rate of $24 a year for business telephones and $18 a year for residence service. The circular states that the older company has only about 250 instruments in use, some of which are slot machines, and that considering the extent of the service offered the competitive rate of $12 a year made by the Wisconsin company is much higher than the Independent rate of $18 for a service reaching over 1,100 subscribers, the latter being equivalent to $4 a year for 250 connections. The Dane County Telephone company operates an extensive long-distance service in the neighboring counties, having connections with 120 towns, and is owned, operated and managed entirely by citizens of Madison.

MANUFACTURERS AND DEALERS.

The Telephone Specification company of Jackson, Mich., and Charleston, S. C., is prepared to write specifications for building toll lines, etc. The specifications are very complete and embody all the necessary details as to material and construction.

The new hotel telephone which is manufactured by the Electric Appliance company of Chicago is built in such a manner that it practically eliminates the possibility of tampering by unauthorized persons. This is a feature that will be appreciated by those who have had the care of hotel systems.

Northwestern Electrical Association.

[*Continued from page 49*]

A vote of thanks was extended to the retiring president.

Professor Goldsborough's paper was then discussed by Professor Jackson, Mr. Gille and Mr. Almert.

A paper on the "Series Incandescent Lighting System of the Future" was read by P. D. Wagoner of Schnectady, N. Y. It was discussed by Mr. Livermore, Mr. Hewitt, Mr. Almert and Mr. Korst.

Professor D. C. Jackson then presented the valuable report of committee on correspondence schools, the report being entitled, "Trade Education of Central-station Employes." This report was discussed by Mr. Bean, Mr. Bowen, Mr. Livermore, Mr. Gille, Mr. Almert, Mr. Cutter, Mr. Elliott and Mr. Strong. It was the unanimous sentiment that the report was able and exhaustive, and a motion was made that the correspondence schools referred to in the report be individually requested to reorganize their courses for central-station employes to conform as nearly as possible with the requirements set forth by the committee. This motion was carried.

Mr. Thayer gave notice of a proposed amendment to the by-laws, in accordance with which papers should be given precedence on the programme to routine matters.

In the evening about 100 members and visitors sat down to the annual banquet at the Hotel Pfister. Secretary Mercein was the toastmaster, and toasts were responded to by General Charles King, Captain George Chase, Professor Jackson and Messrs. Underwood, Low, Whyte, Wolff, McMaster, Burch, Munson, Donohoe, Collins, Searing, Almert, Grier, Massey, Pinckard, Cutter and Lovett. The feature of the affair, however, was the presentation of a very fine watch to Mr. Mercein by some members of the association and other friends. Mr. Underwood made the presentation speech.

ADJOURNMENT ON FRIDAY.

No business of importance was transacted on Friday morning, and the association adjourned sine die.

Convention Notes.

Who failed to get one of Billy Low's peanuts?

George B. Foster of the Wagner company was on hand, as usual.

Tommy Grier wandered around and did his share in making everybody happy.

Samuel A. Johnson, president of the Viscosity Oil company of Chicago, was again in attendance.

The New York Insulated Wire company was there in the person of James Wolff. 'Nuff sed!

Richard O'Connor, representing the National Carbon company of Cleveland, was a welcome visitor.

H. B. Kirkland of New York did not neglect to say a few kind things for American circular loom.

M. B. Kitt, the Minneapolis representative for the Roebling company, did the honors for his company acceptably.

George Cutter, president of the George Cutter company, explained to all the delegates "why that lamp didn't drop."

Frederick L. Merrill of the Chicago office of the Manhattan General Construction company creditably represented his company.

F. E. Donohoe of the American Electrical Works arrived on Thursday and did not escape without making a speech at the banquet.

The Standard Carbon company was represented by Wallace O'Connor, who had his usual glad smile and corresponding hand with him.

Charles F. Hart seemed to be enjoying himself as much as usual, and, incidentally, had something to say about the Skinner automatic engines.

B. F. Stewart found time to run up to Milwaukee to greet his friends. Mr. Stewart is at present connected with J. Holt Gates & Co. of Chicago.

A. O. Kuehmsted was missed by all the "boys," but the Gregory Electric company's interests were well taken care of by R. H. Watson and A. L. Kuehmsted.

R. C. P. Holmes, purchasing agent of the Chicago Edison company, came in on Thursday and found many of his acquaintances awaiting him with the glad hand.

A. B. Anderson was on hand in the interests of Julius Andrae & Sons, who made a display of telephone apparatus, lamps, fans, sockets and Sprague motors.

E. Kuhlman came up from Hoosierdom in order to tell people about the Kuhlman Electric company's transformers. It is safe to say that everybody heard about them.

Pass & Seymour and the Crouse-Hinds Electric company were represented by John W. Brooks, who was shaking hands with all his friends in the usual electrical way.

One of the busiest men at the convention was William H. Perry, secretary of the Electrical Construction company of Racine. Perry wasn't very far from home, but far enough.

George S. Searing of Chicago, known as "everybody's friend" and incidentally representing the Hart & Hegeman Manufacturing company, was late in arriving, but he got there just the same.

Frank Travers saw that things ran smoothly. He did everything in his power to avoid any friction, and as he sells the product of the Viscosity Oil company, this was not a very difficult matter.

The General Incandescent Arc Light company had a really handsome exhibit in charge of Francis Raymond, its good-looking western sales agent, who has headquarters on Jackson boulevard, Chicago.

Henry C. Eddy was there for the purpose of instructing central-plant managers in the mysteries of turning exhaust steam into big, round silver dollars. He still insists that the Holly system is "it."

The thanks of the newspaper men are due to the official stenographer, H. D. Goodwin of Milwaukee, for his exceptional promptness and accuracy. Mr. Goodwin is one of the best convention stenographers in the country.

A. L. Severance, the manager of the Hotel Pfister, found his resources taxed to the utmost by the convention and the people already in the house, but he exerted himself to please everybody, and there were few complaints.

Frank H. Clark of the Chicago office of the Electric Storage Battery company was visible on Wednesday; but he seemed to have something of importance on hand that kept him away from the convention much of the time.

James B. Coale, northwestern manager for the Columbia Incandescent Lamp company, arrived in time to shake hands with his many old acquaintances, make a lot of new ones and participate in the good things of the banquet.

Loren W. Burch of Madison didn't miss anything that was going on. He read a paper on Wednesday and afterward made some good suggestions on the relation of the association to practical work. He did much to make the banquet a success and made a speech at it.

George S. Whyte of the Macomber & Whyte Rope company, Chicago, was to be seen at any and all stages of the game. If anyone attending the convention did not meet and learn to know Mr. Whyte to his sorrow or satisfaction, it certainly was not that gentleman's fault.

M. B. Austin, A. H. Friend, C. M. Jackson, E. H. Belden and last, but not least, Albert Meinema, did the honors for M. B. Austin & Co. Belden lamps and Dayton fans were the principal features of this exhibit, and were apparently of much interest, as the "Austin parlor" was always well filled.

The Illinois Electric company of Chicago was represented by L. K. Cushing and C. W. Bacon. "Peerless fan motors, transformers and lamps" was the burden of their song, and, judging from the popularity of their headquarters, they evidently struck a responsive chord in the hearts and minds of their hearers.

Not necessarily for publication, but merely as an evidence of good faith, Charles Messer, president of the Dearborn Electric company, broke away from his busy office long enough to mingle with the "boys" for a day or two. Messer says that the Northwestern convention is one of the few vacations he allows himself.

The O. C. Little Pulley Coating company, which manufactures a compound for the purpose of preventing belt slipping, confined its display to a small model which illustrated the difference between coated and uncoated pulleys in pulling power. This difference was represented by that between 11 and 26 in pounds on the model.

The Electric Appliance company of Chicago was well represented and always and everywhere in evidence. The Appliance aggregation consisted of President W. W. Low, S. A. Rall, William P. Upham and B. B. Downs. It is safe to say that very few orders for electrical supplies escaped after any of the above-named gentlemen got to the windward of them.

Naturally, the Western Electric company of Chicago was among the principal exhibitors, with an elaborate display of arc lamps, incandescent lamps and ceiling and desk fan motors. E. P. Warner, Irving Jackson, A. L. Tucker and Fred Basedow were kept busy "illuminating" principles and features (as well as the lamps) for the benefit of interested visitors.

One of the old-timers, so far as Northwestern conventions are concerned, is Joseph M. Hill, now of the Electric Vehicle company of New York. Mr. Hill's personally conducted excursion on the steamer Northwest is still remembered with delight, and his interest in the association has been unflagging. He attended the gathering in Milwaukee this week and was warmly welcomed.

The Sawyer-Man Electric company had an attractive exhibit of incandescent lamps in Room 10. It also had a complete photometer outfit, by which it was able to demonstrate the efficiency of its lamps. The large Westinghouse electric sign was equipped with Sawyer-Man lamps. The gentlemen in charge of this exhibit were C. A. Ross, manager of the Chicago office, and R. S. Mueller.

As usual, the Dearborn Drug and Chemical company's headquarters were "general" headquarters, Mr. James W. Harkins being the presiding genius. If you wanted to find anyone, you either found him under Harkins' hypnotic spell or just recovering therefrom. Mr. Harkins carried with him quite a museum of antiquities and novelties in the drug line, some of which were distributed among his visitors.

The Browning Manufacturing company of Milwaukee exhibited a line of small motors designed for dentists' use and similar service, where a small, noiseless and perfectly operating machine is required. The company was represented by William Stark Smith, who did much toward the entertainment of delegates and visitors. An urgent business trip to the East prevented the personal attendance of Mr. Browning, a fact greatly regretted by his many friends "who were there."

The exhibit of the Bryan-Marsh company was in charge of Converse D. Marsh, president, George C. Keech, manager Chicago office, Guy V. Williams, manager Minneapolis office, and Roy P. Sawyer. One of the leading features of their exhibit was a photometer which the company manufactures and sells at a nominal price to central stations for the purpose of testing the efficiency and life of incandescent lamps. Mr. Keech says that his photometer will measure any lamp just as well as the Bryan-Marsh, and he insists that it is an absolutely impartial piece of apparatus.

It may be true that too many cooks spoil the broth, but it would be impossible for any number of Cookes of the Joseph H. kind to do anything to an electrical convention but improve it. Mr. Cooke does, indeed, enjoy the sincere respect and esteem of every man who knows him, and the number is a large one. It is a pleasure again to bear witness to the fact on the occasion of the Milwaukee convention, which Mr. Cooke attended. The Buckeye Electric company and the Jandus Electric company, which Mr. Cooke represents in Chicago, are certainly fortunate in their representative.

A feature of the exhibit presented by the Shelby Electric company was the operation of two photometers, with which was demonstrated the efficiency of useful light, as exemplified in the Shelby lamps. The exhibit was in charge of O. D. Pierce, W. S. Reynolds and C. A. Meade, who were all kept busy explaining the advantages of the Shelby lamp and the operations of the photometer. Mr. Meade was probably the happiest man at the convention. If not, he should have been, as he was fortunate enough to persuade Mrs. Meade to come with him. The Shelby company reports business as being in most satisfactory condition, and very much better than at any time in its previous history.

An exhibit which attracted much attention was that of the Milwaukee Electric company, which was in charge of the Carey brothers, with T. G. Whaling and W. H. Perry. Walter Carey is the vice-president of the company and a man who can make a purchaser feel that he has been done a favor in being allowed to buy a motor, or any other old thing the Milwaukee company makes. When it comes to that, however, I. B. is not far behind, while Perry—well, everybody knows Perry; "he loves them all." This company had several motors on exhibition, among them a special 7½-horsepower machine for direct connection, especially adapted to printing presses, fans, etc., and which attracted much attention.

The McRoy Clay Works exhibit was in the hands of E. F. Kirkpatrick, whom everybody in the electrical business has known since he was knee high to a duck. Mr. Kirkpatrick has been with the McRoy people since the beginning of the year, and is evidently as successful in selling holes in the ground as he has been in other lines. His experience with the Westinghouse and the General Electric companies has extended over a period of 15 years, and it is safe to say that a better-known man or a more pleasant gentleman is not at the present time connected with any of the electrical industries. The McRoy people's conduits are so well known that "Kirk" has only to let people know he is selling them in order to keep him busy.

The Westinghouse Electric and Manufacturing company occupied Room 10 with an exhibit of detail apparatus, consisting especially of its well-known Westinghouse wattmeter, which was shown in operation in connection with suitable switchboard instruments, particular attention being called to a new line of long-scale indicating instruments. The company also exhibited the various types of lighting arresters, fan motors, cut-outs, etc. A prominent feature of the exhibit was the new O. D. type transformer, which is said to represent the most modern practice in its details of construction. A large electric sign suspended across the west end of the hall, bearing the name "Westinghouse," was very noticeable. The gentlemen representing the company during the convention were W. R. Pinckard, C. G. Burton, T. P. Gaylord, W.

S. Rugg and Ervin Dryer. Mr. Arthur Hartwell, manager of the Chicago office, was expected to be present, but was detained by matters of importance.

The Fort Wayne Electric Works were represented by Edward A. Wagner of the transformer department, E. J. King of the meter department and W. C. Knight and Frank McMaster of the sales department. The company exhibited its new line of meters and transformers, which attracted a great deal of attention on account of practical features not herefore embodied in apparatus of the kind. There was always a crowd around the motor-starting rheostat, and the representatives were kept busy answering questions. Colonel Charles A. Munson, the manager of the Chicago office, attended the banquet and made a happy little speech. The Fort Wayne people also furnished a very pretty souvenir, in the shape of a miniature transformer.

The new method of control for series incandescent lighting, shown by the General Electric company, was one of the novel features of the convention. While this device has been on the market for nearly a year, the sale has not been pushed until actual, practical service demonstrated the efficiency and satisfactory results expected. Installations in the vicinity of New York and Boston have been operating for months with the most gratifying results. The method differs from that of constant-current transformers, which gives a secondary voltage which may or may not be the same as the generator voltage, whereas in this case the reactive coil is installed in series with the lamps and across the generator voltage or any other constant potential that will give a lamp capacity suitable to the local conditions of operation, this voltage being obtained from the generator or by the use of constant-potential transformers. The principal advantage of the system is that the regulation is automatic, and that the system is entirely flexible in relation to the number of lamps installed. The efficiency is said to be high under all conditions of load, and the power factor at full load is approximately 98 per cent. The automatic feature of the regulator is very important, as it permits of maintaining a current more nearly constant than can be obtained with any method of hand control; this, of course, has an important bearing on the life of the lamps. The regulators can be constructed for any range of control desired, up to 100 per cent., and can be wound for any standard current. The General Electric company was represented by F. N. Boyer, manager supply department, J. Scribner of the lighting department, and S. F. Dibble, all of Chicago, P. D. Wagoner of the Schenectady office, F. G. Vaughen of the meter and instrument department, and Thomas Ferris, manager of the Milwaukee supply department. The exhibit was an extensive one, and embraced everything manufactured by the company in the line of electric lighting.

Street-railway Regulations in Liege.

In a recent consular report from Liege, Belgium, details are given concerning municipal ownership of street railways in that city. The city has purchased the franchises of the three roads in operation, and has leased the roads, with all equipments and rolling stock, to an operating company for 10 years and one month. The minimum yearly rental under the contract is equal to 25 per cent. of the price paid by the city for the roads, and provision is made for payment to the city of a percentage of all gross receipts above a certain amount in addition to the fixed rental. The city is to provide all new equipment, side tracks, extensions, etc., and is to be the sole judge of what is needed. It is to have a general supervision of the running of the line. The books of the company are to be open at any time to a properly authorized representative of the city. The lessees are to make all repairs of the line and rolling stock, keep the roadway between the tracks and for 19 inches on either side in good repair, and pay all damages resulting from accidents. Under the former owners the rates of fare varied with the distance traveled. Under the new system a uniform fare of two cents a trip will be charged, with double fare after 11 p. m. There will be no second-class accommodations. The usual speed is 6.2 miles an hour and the maximum allowed is 7.4 miles an hour. The operating company is required to pay motormen and conductors not less than nine cents an hour for a nine-hour day, and 11 cents an hour for overtime, and to give them one holiday out of every two weeks at full pay.

London Metropolitan Proposals.

London reports state that Ganz & Co. of Budapest have submitted a bid of $1,500,000 for the equipment of the Metropolitan District Underground railway with the Ganz alternating-current system. This bid is far below that of any of the other firms competing for the contract. Mr. Lemuel Bannister of the Westinghouse company is credited with the statement that this system has been tried in this country and found not altogether satisfactory. A London paper states that American bidders are determined to get the contract and that Underground shares are being bought heavily on orders from the United States.

A Method of Charging.[1]

By Henry L. Doherty.

At the last meeting of the National Electric Light association, I read a paper entitled "Equitable, Uniform and Competitive Rates." I proposed a rather radical departure from our present methods which seemed to me a logical solution of many of the difficulties which now confront us. Before adopted a rate system differing radically from all methods with which I was acquainted, I wished to attain an expression of opinion from representative central-station men which I thought would prove my plan either meritorious or otherwise. The discussion this paper provoked was not general, and no valuable points were developed. The sentiment of the meeting was unfavorable to the plan I outlined. The paper received but little comment from the electrical press, and was read in full only by those who chanced to obtain an advance copy, published for the meeting. Since the Chicago convention to the present date I have been kept busy answering correspondence regarding this rate system, and few of my correspondents seem to have gained from my paper a clear understanding of my views. The plan I then outlined seems to have grown greatly in favor, and many of its early and most pronounced opponents now express themselves as believing that it offers the best solution yet proposed toward the establishment of equitable and uniform rates.

After reading my former paper, I found it a hardship to answer all of the correspondence received, owing to the fact that many inquiries were made without having carefully read and considered my paper. To have answered some of them fully would have necessitated a repetition of much that had already appeared in printed form. I cannot attempt another exhaustive treatise on this subject, but if anyone is sufficiently interested in this matter to carefully read this paper, and also my former paper, which will be found in the published proceedings of the last convention of the National Electric Light association, I will not only willingly answer any inquiries they care to make, but will welcome any discussion of the subject by correspondence.

There are really but two distinct methods of charging for electric service, viz.: First, flat rates; second, meter rates.

An analysis of flat rates would mean a definite charge for a fixed capacity, regardless of quantity of current used, within a limit of no use to constant use. This would work out to a minimum kilowatt rate for current of the fixed rate, divided by the maximum consumption, to a maximum kilowatt rate, to infinity, if no current were used.

The analysis of meter rates would mean a fixed charge per unit of current sold, regardless of capacity demanded. In this case the station's cost to produce would vary from the very low cost per kilowatt-hour, if total capacity were used continuously, to infinity, if no current were used. In the abstract, flat rates are preferable, as they give the station the advantage of the infinity end of the variation, but both systems seem to me almost absurd.

Theoretically, flat rates can be placed sufficiently high to protect absolutely the station from loss, but such rates would drive away much profitable business.

Meter rates cannot be placed so high but that loss may result. Even if a consumer agrees to pay $1 a kilowatt, his consumption may be so small that his total payment will not equal the cost of reading his meter, keeping books for his account, core loss of transformer capacity and shunt loss of meter.

It is probably unnecessary to comment on the inequity of flat rates, but rates based solely on consumption, without considering the maximum demand that the station must be prepared to supply, are often even more inequitable.

An analysis of the accounts of one central station with which I am familiar will illustrate the relative worth of different consumers supplied on meter basis. A minimum bill of $1 per month is now charged, if no current is used. This means a minimum of $1 per lamp per month, if the consumer has but one lamp, and $.001 per lamp per month, if the consumer has 1,000 lamps. At this particular station:

The average yearly bill is $1.96 per lamp.

The minimum yearly bill is $.24 per lamp.

The maximum yearly bill is $38.46 per lamp.

Assuming that the station represents an investment of $20 per lamp wired up, this means that for these different classes of consumers, were all the consumers of one particular class, the lengths of time for our gross revenues to equal our investment:

For the average consumer 10 years and two months.

For the minimum consumer 83 years and four months.

For the maximum consumer no years and six months.

If the entire amount paid by the minimum consumer were clear profit, you would be earning but 1.4 per cent. on your investment. The consumer using the least current may add just as much to your absolute maximum demand as any other consumer you have. I once cited the case of a church, which is generously equipped with lights, but which for several years past has used light but one night each year, and that night is Christmas Eve or the preceding night.

Charging a fixed rate per kilowatt-hour on meter basis bears no relation to cost of service. Cases may sometimes be best illustrated by exaggerations. Suppose you should receive an application for a 2,000-light connection to be used as a relay in case of a breakdown of an isolated plant. At what rate per kilowatt could you afford to supply the applicant with current? This is the same problem which confronts us on a modified scale with each consumer.

Our costs are fixed by:

1. The number of consumers we have.
2. Distance from the station.
3. Capacity they demand.
4. Amount of their consumption.

Distance from the station is influenced by where we locate our station, and I see no reason why we should vary the cost to different consumers because of varying distance from the station, except in extreme cases. For lack of time I will drop this item of cost from further consideration and go on to the others.

There are certain costs, such as bill making and meter reading, which are entirely fixed by the number of consumers or meters, and many of our other costs are virtually fixed by the number of consumers or meters we must care for, such as meter testing and maintenance, office rent, complaints and gratuitous work, superintendence and inspection. To cover such expenses as these, I propose to have a fixed charge for each consumer, regardless of his consumption or the size of his installation, provided no more than one meter is installed.

There are certain other costs which are fixed by the capacity demanded, such as interest on investment, transformer losses, maintenance, depreciation, etc. To cover such expenses as these, I propose to have a fixed charge for each lamp the consumer's connection will permit him to demand, without regard to the number of lamps installed, or amount of current used.

There are other charges which are fixed by the quantity of current generated, such as boiler fuel, lamp renewals, etc. To cover such expenses as these, I propose to charge a fixed and uniform rate per kilowatt-hour consumed.

A moment's consideration will, I think, convince all of you that outside of boiler fuel and lamp renewals, your operating costs would not be greatly increased if you operated 24 hours per day at your maximum load, nor would they be greatly diminished if you operated but five minutes per day at your maximum load, assuming, of course, that you stood ready to serve current at any time throughout the 24 hours should it be called for.

A charge for "readiness to serve" fixed on this basis and a low kilowatt-hour rate will bring about many advantages to the central stations, and protect them from loss, unprofitable patronage, and, I believe, will also protect them from undesirable legislation.

I recognize the fact that any change in methods of charging will cause trouble, if enforced suddenly on those consumers whose bills it will increase, but this system can be used in place of horizontal reductions in the rate now charged, and can reasonably be exacted from new consumers, and eventually made universal. Evolution, not revolution, must be the policy of all quasi-public corporations. In view of the fact that it will be inadvisable to enforce this system on old consumers who will be injured by its adoption, I propose to adopt it first as a substitute for all special-rate consumers, and also for new consumers. Instead of dividing my expenses as they exist to-day and apportioning them amongst the consumers on this basis, I expect to adopt such charges as will benefit long-hour, and therefore profitable consumers to such an extent as can be readily compensated for by the additional business which can be secured with a lower rate per kilowatt-hour. I will continue the rate cutting by small steps, so long as I can protect the company's net earnings from marked shrinkage.

In one station where we have been experimenting, we are convinced that it is more profitable to supply consumers on this rate system, making a fixed charge of $6 per consumer per year, plus $1.80 per lamp demanded per year, to which is added four cents per kilowatt-hour for current used, than to sell at a straight rate of 10 cents per kilowatt-hour. It is needless to call attention to the fact that consumers will be much more liberal in the use of current when supplied at four cents than at 10 cents per kilowatt-hour. My plan is to make all contracts for a year or more, allowing the consumer to contract for any capacity he may choose; the capacity to be increased whenever he desires, but not to be decreased except at the expiration of the period contracted for; the capacity to be limited by a suitable maximum demand cut out to prevent him from demanding more capacity than he contracts and pays for, and one-twelfth of the fixed charge to be included in each monthly bill.

This system, I believe, can be rendered absolutely uniform, both for light and power, and will

1. Read before the Northwestern Electrical Association at Milwaukee on January 16, 1901.

prove more equitable than any other system. A reduction of the kilowatt rate should be made for current supplied for power purposes, to compensate for higher costs of lighting service, owing to the exact degree of regulation necessary, and the cost of lamp renewals, which is a more important item than is generally believed.

I have no patents or copyrights on this system, or the appliances its use demands. Anybody can use it as described, or as they care to modify it. The system is already in use in one central station with which I am connected, and we are about to put it in use in two others. It has also been partially adopted by other central stations with which I have no connection, and for which I have no authority to speak.

Practical Line Construction.[1]

By Loren W. Burch.

This is a subject that should have been given a more fluent writer. How to construct a pole line correctly has undoubtedly agitated many minds before now. In the early stages of construction a great amount of groping and feeling in the dark was indulged in, and when we see some of the work that is done to-day it looks as though daylight had not yet come for some of us. Pole-line construction has permitted a vast amount of fanciful ideas emanating from the minds of those therein engaged, because no specifications have as yet been produced to form a standard which could be followed with success.

The importance of good line construction is made apparent by the increased expenditures caused by a poorly constructed line. It may be that a line-repair account is not kept; under such circumstances it is possible that the line itself is not kept in proper repair. Keeping the line in good condition and keeping a strict account of same should go hand in hand. A line poorly constructed means a waste in dividends; money spent for repairs on work originally badly done, that should have entered into the first cost, is worse than money thrown away. To construct a first-class pole line at the start is to save money and give character and stability to the line and increased value to your property. It will also inspire confidence in your customers and bring forth words of praise that mean business for the plant.

There are three great evils which are always at work doing their best to defy success in almost all kinds of construction. In pole-line work we find, first, ignorance; second, false economy; third, dishonest contractors. No matter how good a standard you might have, any of these elements is enough to work sad ruin to an investment of this nature.

As regards pole-line construction, where will we begin? I would suggest, with the pole. We experience little or no trouble in getting good, dry, live-cedar poles, that are graded to a standard set up by the pole dealers. The pole should be well peeled, dressed up, housed and gained. One, two, or even more extra gains should be cut while the pole is down, as it is much easier and more cheaply done on the ground. We will not go into details of setting poles, in this paper, but suffice it to say that a pole well set and tamped is half guyed. No matter how good your poles may be or how straight the line in which they are set, if they are not properly guyed you will have a poor piece of work on your hands when through. It is safe to say that a properly guyed pole line will enhance its value fully 50 per cent.

I do not advocate the use of the so-called hand-made guys, as to make a stranded guy is a difficult task for men to perform and get each strand of equal tension. Machine-twisted guys are cheaper, stronger and more easily handled. Guy clamps should be used in all cases, as it permits of coming up with the end and taking the slack out of a guy, if necessary, without cutting it. Guy rods are better than ungainly looking posts, and should be used wherever possible. All guy wires should be fitted with circuit-breakers, placed at a distance of six to eight feet from the pole end to prevent accidents and grounding from live guy wires. Guying to trees, buildings, etc., should be avoided entirely, as other people's property is not yours, and you cannot make it so by making fast to it in this manner. In the construction of the ordinary plant the subject of guying is an after consideration, and if a guy is put up one end is made fast to the pole and the other to some man's house, barn or tree. This is bad practice, even if the permission of the owner is granted, as the ownership of these buildings may be changed at any time. Special attention should be paid to all corner, junction and end poles, or there will be no end of trouble when you commence to pull up your wire.

In digging holes, it is immaterial whether you commence at the top and work down or at the bottom and work up. To dig the hole in the shortest possible time is the object in view, and the nature of soil will always dictate the mode of procedure and tools to be used. The important part of the hole is the filling of it. Dry, loose dirt and rock, well, exceedingly well, tamped, will always hold a pole in place.

Cross-arms are made in standard sizes, and spacings of not less than 18-inch centers and 17 inches between pins should be used on all lines carrying 1,000 or 2,000 volts. Cross-arms should be doubled on all corner, junction or end poles. On six and eight-pin arms nine-sixteenths by nine-inch lag screws should be used, and not less than one-fourth by 1¼ by 26-inch cross-arm braces. Some superintendents insist upon having galvanized-iron throughout; this is undoubtedly all right, but it is not absolutely necessary in all cases. It depends upon the color the poles are painted. Cross-arm braces should be used on all cross-arms over three feet long, and I would recommend their use on two-pin arms if a heavy wire is carried upon them.

Good live-oak pins are all right to use on straight runs or light wires, but on corner or junction poles locust pins should be used. On wires from No. 8 to No. 0000 it would be better construction to use iron pins to support the heavy strains put upon them.

The height of poles is a matter that should receive considerable attention. The matter of trimming trees has caused a great amount of trouble and annoyance to both property owners and station managers. We who are engaged in the business can see little or no reason why persons should protest at having their trees trimmed to allow the stringing of wires without coming in contact with the limbs, but how would it be if we owned the trees and were interested in the building of other people's property? Undoubtedly, we would object to having our trees trimmed or poles set in front of our premises as much as they. In order to avoid trouble of this nature, I would recommend the erection of poles high enough to bring the bottom wires well above the trees. This would, in a measure, remove the necessity of cutting trees, and would at the same time insure a clear line free from grounds caused by wires cutting into the limbs which are left in the way.

Recent orders received by our local company in Madison compelled it to remove all poles and wires from the four streets bounding the Capitol Square. In order to do this, the streets one block from the square were used for the new pole line. The trees on these streets were numerous and extremely large and tall, and in order to get above them it became necessary to purchase some unusually tall poles. Consequently, poles were brought from Idaho, ranging from 55 feet to 75 feet long, with seven-inch to 10-inch tops. These poles are very straight, and when painted make a pole line that is worth going to see, and will undoubtedly stand the aging tests for years to come. Of course, these poles cost money; it also costs money to trim trees and keep them trimmed; so it is possible that in the end the long poles will cost no more than the shorter ones, and when it becomes necessary to string an extra circuit your men will not have their attention diverted from their work by a man or woman with a shotgun.

Stringing wires over buildings is bad practice, as you are liable to damage the roofs over which they pass. For instance, it is customary to build a horse to support a circuit which will be placed upon the roof, and in time the water collects and rusts the tin under the legs. Leaks result and water causes damage to building and merchandise, and the owner brings suit. This would not happen if all wires are carried on poles owned by the company. A few weeks ago the writer had occasion to visit the roofs of some of our stores and the sight was amazing. Some of the roofs were crossed and re-crossed by a score or more of telephone wires. On account of the electric-light circuit being entirely new in the district visited, its wires were found to be in excellent condition. The poles being tall and new made it a good, substantial piece of property. However, in some instances, service wires are run too low, and would thus interfere with the firemen in discharge of their duty. In course of time these wires will have to be removed, and this will cost money. When a service wire is to be run it would be well for the superintendent to visit the building and determine where and how it should be strung, and thus be sure that it would not have to be removed on account of misjudgment.

Cross-arming poles is a very particular part of the construction of a good pole line. Great care should be taken to see that the gains are not cut too large in the poles, thus allowing the cross-arm to wabble. The lag screws should not only be driven in enough to give it a start, but turned in the remainder of the way. Cross-arms should be put on the side of the pole opposite the strain, so that it will not be pulled off. In double cross-arming, holes should be bored through the spacing blocks, which should not vary in length from the thickness of the pole at the gain, so as to prevent bending the cross-arm.

Arc-lamp poles should be 40 feet long and at least seven-inch tops. These should be set with a six-foot plank, running edgewise under the top of the ground just far enough to be covered and square with the face of the pole, looking to the center of the square. This plank will greatly strengthen the pole and prevent its top coming over, by the constant strain of the arc lamp. When an order is given to put up an arc lamp in the outlying districts, it is customary to rush the work and get the lamp to burning. The quicker it burns the sooner it becomes a revenue. But how about the rush work? After the work is done it is found that the poles were not set in proper position. They are in or out of the proper line. It may not happen at the time the line is built, but a year or so afterward, when it is brought to your attention by the mayor or aldermen.

It will then be found necessary to do a part of the work over again, which proves the old adage that "Haste makes waste." In order to avoid this transplanting process, I would suggest that the proper authority, the city engineer, for instance, be made to stake out where poles could be properly set. It is reasonable to infer that, if a city gives a company a franchise to use its streets to set poles in, they will furnish someone clothed with authority to designate the proper location for them, or, at least define curb lines, corners, gutters, etc. It is also better in laying out new lines to run them with a view to getting future business, and not always by the shortest and quickest route. Often it is possible to run into a neighborhood that will give you a few customers that you were not anticipating. An electric line running past a man's house sets him thinking, when nothing else would. We have been able to secure business after the line was up from parties who were not anxious for the light, but could not offer the absence of a pole line as an excuse for not wanting it. Whenever possible it is undoubtedly best to set poles on lot lines or run in alleys and feed to the rear of the stores and houses. The neatest service wires you can put up do not improve the looks of a good piece of architecture, and a bad-looking pole line makes a bad-looking street. Too much construction work is done simply for the time being, and not with the demands of the future in view.

Discussion.

George Cutter, Chicago: I agree with Mr. Burch that there is too much of our construction work done on a temporary basis, and, of course, we all understand how marvelously permanent temporary work becomes, and it is the work that is done in a hurry, "temporarily," that causes the greatest amount of trouble. We Americans are proud of having pushed our electrical industries so rapidly forward, and therefore we are not ashamed of our wires hanging around our streets like clotheslines, with shreds hanging from them, and all that sort of work. We are not ashamed of it—naturally—because our American practice has been to rush out work and then improve and beautify it afterward. The day for that has gone by in electrical construction. Central-station men owe it to themselves to pay strict and personal attention to their line construction. There is not a central-station manager here that would think for a moment of having his steam pipes leaking steam all over the plant, shoveling coal under the boiler and wasting the steam. He can see that, and would not have it for a minute. But he will go outside, where there is 10 to 20 per cent. more loss in leakage over his lines, and will pay no attention to it.

One or two points occurred to me during the reading of the paper, and one is on the question of grounding your guy wires. I have served as an expert for an electric-light company, and two instances have come under my observation where men have been killed by contact with guy wires; these men were doing work that they had a right to do in each case, and if the guy wire had been perfectly grounded no harm could have resulted. I, therefore, believe that every guy wire that is within the reach of the public should be perfectly and absolutely grounded.

Mr. Burch: We sit here and talk about boilers, engines, dynamos, taxation and all that line of subjects, so interesting to the owners of plants, while we forget matters of practical interest to superintendents. You do not know anything about the "bum" line on the back street, and when your superintendent asks you for a trifle to fix up that line, you say, "Isn't Brown getting current? Yes? Well, then, let the line go." One reason why I wrote and read the paper was because I thought it would open up some kind of discussion on pole-line construction, and that would bring in one division of our central-station plants. Management would be another, and wiring of houses another. Following along this line, after a while, the Northwestern Electrical association would have a series of different subjects upon which a standard could be placed, called the Northwestern Electrical association standard, just the same as the Master Car Builders put their standard stamp on a bumper or casting.

1. Read before the Northwestern Electrical Association at Milwaukee, on January 16, 1901.

Marconi System for Belgian Packets.

A final official test has been made of the Marconi system of space telegraphy, with a view to deciding whether it should be adopted for use on the Belgian channel steamers. The test was made in the presence of Belgian officials on a trip of the Belgian packet Princess Clementine recently, during a severe storm of wind and snow. Although the steamer was rolling heavily, and was frequently swept by big seas, no difficulty was experienced in sending and receiving messages between the vessel and Ostend, throughout the entire trip, the last message being sent just as she was nearing the dock at Dover. The trial was so satisfactory under these severe conditions that the system will be adopted for the Belgian packets, and it is said that stations will be erected along the British coast. The English authorities are reported to have prohibited the use of the Marconi system on English boats.

CORRESPONDENCE.

New York Notes.

New York, January 12.—The last section of the subway to be contracted for has been assigned to Benczette Williams, a Chicago engineer and contractor. It is the section extending from Forty-first street and Park avenue to Forty-seventh street and Broadway, and is one of the most difficult on the whole line, owing to the great number of underground obstructions to be avoided and the character of the soil. The letting of the contract has been deferred on account of the negotiations with the New York Central officials for a route leading under the Grand Central station. This has finally been refused on account of the New York Central's plan for a suburban loop at the subway level, and work will probably commence in February.

The Rapid Transit commissioners have estimated that the cost of supervision of the work on the subway can be kept down to 3½ or four per cent. of the cost of construction. In the case of the Boston subway this cost was about 10 per cent.

The Brooklyn Rapid Transit company is to make a large addition to the power house at Third avenue and Second street in South Brooklyn. The building will be of brick and stone, and six engines of 4,000 horsepower will be installed. It is also proposed to enlarge the Kent avenue power house about 30 per cent. The company has decided not to use vestibuled cars, stating that on the Montague street line, where the vestibuled cars were tried, they had to be replaced with open-front cars, as the motormen prefer the latter.

The value of the property of the Brooklyn Rapid Transit company taxable in the state of New York has been fixed at $34,997,561, and the tax thereon at $53,499.

The State Board of Railroad Commissioners has granted to the Larchmont Horse Railway company authority to operate its road by the overhead-trolley system, and to increase its capital stock from $25,000 to $200,000.

Citizens of Tarrytown will shortly be called upon to decide the question of bonding the town for $35,000 for an electric-lighting plant. The trustees claim that they can light the town for $6,000 a year, as against $10,000 a year that is now paid for lighting service to the Hudson River Gas and Electric company.

The United Traction company of Albany has declared the regular quarterly dividend of 1¼ per cent., payable February 1st.

The Board of Aldermen of Waterbury, Conn., is authorized to issue $100,000 bonds for a municipal electric-lighting plant.

A mortgage for $50,000,000 was recently given by the Third Avenue Railroad company to the Morton Trust company of New York. It bore $17,500 in revenue stamps. The transaction is the carrying out of the financial plan by which the floating debt and the old mortgages of the Third Avenue Railroad company are provided for in a lump sum. The Metropolitan Street Railway company, which now controls the Third Avenue, guarantees this mortgage, principal and interest.

A 40-ton electric traveling crane, the largest in New York, and costing about $12,000, was recently installed in the machine shop of the Brooklyn navy yard. Two 10-ton cranes will also operate in the same shop, their track being on a lower level. Still another crane of 25 tons' capacity is on hand at the navy yard, ready to be erected.

An automobile-bus line is to be put in operation at Plainfield, N. J., by the Plainfield Automobile company. The New York Motor Vehicle company has become interested in the project and will furnish the carriages for the service. M. L. G.

Canadian Intelligence.

Ottawa, Ont., January 12.—The ratepayers of the town of Annapolis, N. S., have decided to take over the O'Dell electric-light plant of the town and operate it under municipal ownership and control.

The council for the town of Dartmouth, N. S., will apply to the local Legislature for authority to borrow $40,000 for electric-lighting purposes.

Engineers are at work preparing plans for developing additional waterpower at Bonnington Falls, B. C., for the West Kootenay Power and Light company, and contracts are about to be let for additional machinery.

Messrs. Robertson & Robertson of Victoria, B. C., will apply to the Dominion Parliament for the incorporation of a company for the transmission of electric power and the construction and operation of telephone lines within the districts of Esquimalt, Victoria City and North and South Victoria.

Information has been received that the Alaska Exploration company, a syndicate capitalized in Great Britain, has laid plans before the council for the Yukon district for the building of a line of street railways through the main street of Dawson City, and out to the creeks.

The movement in favor of municipal ownership and operation of electric-light plants is gaining in popularity throughout the province of Ontario. The town of Blenheim has just carried a by-law for the town to take over its electric-light system; Parry Sound has also carried a by-law for $29,500 to purchase the electric-light plant of the town and improve the waterworks, and the electors of the town of Lindsay have voted in favor of the municipal ownership of an electric-light plant.

Probably the largest industrial combine ever attempted in the city of Montreal is now in process of organization. A new company, to be known as the Lighting and Power company of Montreal, is to be formed, with a capitalization of $25,000,000, to take over all the light and power companies of the city. The companies which will, it is said, be absorbed are the Chambly Manufacturing company, the Royal Electric company, the Montreal Gas company and the Lachine Rapids and Hydraulic company. It is stated that if this combine is consummated, it is not likely there will be any change in the rates so far as the consumption of gas is concerned, but that there will probably be an advance in the rates for electric light and power. The reason for the latter is that Montreal, at present, enjoys the cheapest electric rates, practically, in America, due to the keen competition between the two power companies operating waterpowers.

A. V. W.

From the Buckeye State.

Columbus, January 12.—The Cleveland, Elyria and Western Electric Railway company has an extension from Elyria to Medina and Wooster planned, and grading on an extension from Oberlin to Norwalk is being done. The line from Oberlin to Wellington has just been opened for business. The new power house at Elyria has been almost completed and a new generator will shortly be installed in the one at Cleveland.

Fred N. Hait and Ulysses J. Smith of Cleveland have asked the council of East Liverpool to grant a franchise for building a road in that town, this to be a portion of a road to connect Salem, Lisbon, East Liverpool and other places, and to be known as the Salem, Lisbon and East Liverpool Electric Railway company.

Carl H. Oliver of New York has been in different towns along the line of the proposed new road from Columbus through the state to Toledo. He says that there is ample capital to back the new company and that a double-track road will be built. Mr. Oliver is a member of the Pratt & Oliver company of New York.

Because of the injunction suit brought against the company building the Youngstown-Sharon road, by the village of Hubbard, that town may be left in the cold. There is a plan on foot to build around it altogether.

General Manager Fisher says that the cars of the Columbus, London and Springfield road will be running on the loop in Columbus within 60 days.

A special election will be held at Barberton, Ohio, on January 24th to vote on the acceptance of C. O. Barber's offer to build a light plant, to cost $150,000. The town has been without street lights, but a temporary arrangement has been made to have it lighted by the Rapid Transit company.

Thomas L. Childs, who has been arranging plans to connect Canton and Akron with an electric-railway line, now proposes to have the line extend on into Cleveland. Mr. Childs says that this is not a new plan at all, but that he has had it in mind all the time. He says that work on the Akron-Canton line will be commenced within a few days. It is said that a Chicago trust company will finance the road.

The Camden Interstate Railway company has been organized at Huntington, W. Va., to succeed the Ohio Valley Electric Railway company. The officers are as follows: President, J. M. Camden, Jr.; secretary, Sprigg Camden; treasurer, Mr. Caldwell. The directors are John Means, John Russell, L. R. Putnam, Jr., Charles Shaddock, Colonel H. A. Marting, E. T. Vincent and F. Ensign. The capital stock of the company is $1,000,000.

The Buckeye Traction company of Bucyrus has been incorporated, with a capital stock of $10,000. It is proposed to construct an electric line from Bucyrus to Norwalk, through Annapolis, Chicago Junction and New Washington. The incorporators are H. V. Flickinger, A. J. Scott, R. V. Sears, C. Feirling, S. J. Kibler and W. A. Blicke.

John P. Martin of Xenia, who is at the head of the new company incorporated some weeks ago, for the purpose of building an electric line from Xenia to Cincinnati, says that the line will be of the three-phase system, and that the passenger runs will be at the rate of 60 miles an hour. The road will carry freight at night. He thinks the road will be in operation the entire distance by August next.

The Northern Ohio Electric Railway company of Defiance was incorporated the past week, with a capital stock of $25,000, by Charles H. Adkins, Charles H. Hubbard, Gilbert A. Bartholomew, Hubert C. Warren, James N. Merwin, Edwin F. Frink and G. L. McKibbin. This company proposes to construct an electric line from Defiance to Bryan, with branches to other places in the northern part of the state.

The Geneva Automobile company, Geneva, Ohio, has been incorporated, with a capital stock of $100,000, to manufacture automobiles and vehicles driven by steam, electricity, gasoline, compressed air or other gaseous products; also to do a general manufacturing business. The incorporators are J. A. Carter, C. I. Chamberlin, A. W. Chamberlin, A. F. Dickenson, Charles Craine and C. H. Munger.

The Electric Metal Heating company, Columbus, has been incorporated, with a capital stock of $10,000, for the purpose of purchasing the Mulford patents on electric metal-heating machines and manufacturing the machines, buying and selling patents and conducting a general business in that kind of machinery. The incorporators are Joe H. Earnshaw, Henry L. Gilbert, Francis C. Caldwell, William W. Mulford and John G. Mitchell.

The Central Market Street Railway company, Columbus, has been incorporated, with a capital stock of $10,000, by Dr. S. B. Hartman, O. A. Schenk, Louis Seidensticker, William H. Luchtenberg and Benjamin Monnett. Dr. Hartman is the well-known manufacturer of proprietary medicines, and Mr. Luchtenberg is an electric-railway contractor, now engaged in building the line of the Columbus, London and Springfield Electric Railway company. The new company proposes to build a line from Columbus to Portsmouth, by way of Lancaster.

The first annual meeting of the Little Miami Traction company was held in Xenia a few days ago and the following-named officers were chosen: President, John P. Martin, Xenia; vice-president, William H. Marlatt, Cleveland; secretary, Sherman J. Fitzsimmons, Detroit; treasurer, Charles Orr, Cleveland. W. D. Riddell of Xenia was made chief engineer. The stockholders voted to increase the capital stock from $50,000 to $550,000. It is said that work on the line between Xenia and Springfield will begin at once.

The Steubenville, Carrollton and Canton Electric Railway company has asked for a franchise through Stark County. The promoter of the road is James M. Ferguson of Steubenville.

The City Council of Lima has awarded the contract of lighting the city for 10 years to the Lima Electric Railway and Light company, made up of Buffalo men, at $85 a light yearly. It is said the local light company offered to take the contract at $75 a light.

The Scioto Traction company has filed with the secretary of state an amendment of charter which will enable it to build branch lines from Circleville to Washington Court House, another from Circleville to Lancaster, and another from Lancaster to Columbus.

W. H. Sharp and John J. Chester are interested in getting a new lighting plant for what is known as the North End of Columbus.

It is said that the Dayton, Troy and Tippecanoe electric road will be equipped with compressed-air motors. It is about 20 miles in length. A company of Ohio capitalists has been formed to control the sale of apparatus for using compressed air on street railways and railroad cars in this state. M. E. Ingalls, Myron T. Herrick, Perry S. Heath, J. D. Allison, W. D. Brickell and some others are interested.

It is estimated that many of the electric roads in this state are operating on 50 per cent. of their gross receipts, all from passenger and express business. This fact is a marvel to railroad men, who always consider the passenger departments of their roads an accommodation to the public rather than a money-maker.

Negotiations have been in progress for some time between the Southern Ohio Traction company and the Cincinnati Street Railway company for an entrance to Cincinnati from College Hill, the terminus. M. J. Mendelbaum, vice-president of the Southern Ohio, met the Cincinnati officials Thursday, but no conclusion was arrived at.

At the annual meeting of the directors of the Columbus Railway company, held Thursday, steps were taken to provide for the entrance to the city over the company's tracks of the cars of four interurban railroads, the Columbus, Winchester and Lancaster, the Columbus and Lancaster, the Worthington, Clintonville and Columbus and the New Albany and Johnstown Traction company, the interurbans to pay three cents each for passengers landed within the city limits.

Edward Mott of Paducah, Ky., has been chosen general manager of the Lancaster electric-light plant and the Lancaster Gas Light and Coke company, Lancaster.

The work on the Columbus, Buckeye Lake and Newark electric line is progressing very satisfactorily. At the present time the force is engaged on a deep cut which will be finished soon. A contract has been closed with the Westinghouse company for the machinery for the power station.

The Newcastle and Youngstown Street Railway company was incorporated in Pennsylvania a few days ago, to build a line from Newcastle to Robison on the Ohio state line, where it will likely connect with the Mahoning Valley Railway company, with a terminus only two miles away.

J. A. Erner & Co., electrical contractors of Columbus, tendered their employes an elaborate dinner at the Chittenden Hotel on January 9th.

It is announced that the Northern Ohio Traction company has purchased the property of the Akron and Cuyahoga Falls Traction company, which was purchased a few weeks ago by Andrew Radel and other eastern men. The idea given out is that the road was purchased by the Northern Ohio to prevent the competition which the new owners showed signs of making. The Northern Ohio already has a line to Cuyahoga Falls, and the other company has one from Akron to Barberton, where the Northern Ohio is building.

The Conneaut and Eastern Railroad company, Conneaut, Ohio, has been incorporated, with a capital stock of $10,000, to build an electric line from a point on the Pennsylvania line, near where the

New York, Chicago and St. Louis railroad crosses, to Conneaut, with two short branches from the main line. E. S. Templeton, J. H. Clark, W. E. Cushing, Frank Leisenheimer and F. B. Carpenter are interested.

The Motor Truck and Vehicle company of Columbus has been incorporated, with a capital stock of $25,000, to manufacture motor trucks and vehicles. J. M. Clark, W. A. Hopkins, Jr., T. M. Livesay, M. S. Hopkins and Walter B. Beebe are interested.

The promoters of the Akron-Canton Electric Railway company are ready to organize. T. L. Childs is the leading spirit.

The Dayton Electrical Manufacturing company, Dayton, has increased its capital stock from $20,000 to $50,000. H. G. Catrow is president and C. C. Hooven, secretary.

The Dayton and Northwestern Traction company, Dayton, has been incorporated, with a capital stock of $10,000, by Allen C. McDonald, H. G. Cresy, Charles J. Hall, William Hurmon and David S. Baker. The company proposes to build a line of electric road from Dayton to the Indiana line, where the National Pike crosses it.

The Anness Freeman Manufacturing company, Hamilton, has been incorporated, with a capital stock of $25,000, to manufacture and deal in electrical and mechanical appliances.

The Cleveland, Ashland and Mansfield Traction company, Cleveland, was incorporated this week, with a capital stock of $10,000, by C. V. Hurd, T. K. Dissette, S. T. Everett, Richard M. Parmely and E. J. Kennedy. The intention is to build an electric line from Cleveland to Mansfield through the counties of Cuyahoga, Lorain, Medina, Huron, Ashland and Richland.

The East Liverpool and Youngstown Railroad company, Salem, was incorporated January 11th, with a capital stock of $15,000, to build an electric line from Youngstown to East Liverpool. The incorporators are T. M. Latimer, Timothy Dwight, Harry G. Fotts, Robert C. Cridler and E. E. Hanna.

Thomas N. Fordyce has ordered the equipment for his canalboat scheme on the Miami and Erie Canal. The Westinghouse company furnished the motors, which are slow-speed machines. A standard track will be laid along the canal and the boats will be towed by the motors. O. M. C.

Information from Indiana.

Indianapolis, January 14.—Governor Mount recommended in his message the amending of the tax law so as to give the State Board of Tax Commissioners original jurisdiction in matters of assessment over all electric railroads extending into different counties; also power to tax franchises.

The Indianapolis council will be asked to pass an ordinance to prevent incompetent wiremen from securing positions involving responsibility.

The Big Four Railroad company will soon make a move toward competing with the electric lines of the Union Traction company, which parallel its tracks. The company's manager says it is a matter of no little importance and will have to be met. It is thought a one-cent-a-mile rate will be established between competing points.

The commissioners of Decatur County have ordered an election for February 19th, to vote an $80,000 subsidy to help build an electric road from Greensburg to Versailles. If this subsidy is voted the promoters say they will extend the line to Madison on the south and to Shelbyvilie on the west, and ultimately reach Indianapolis.

The city of Churubusco has a $25,000 electric-light plant, which the people do not patronize sufficiently to pay operating expenses. The plant was put in a year ago and turned over to the town authorities, who were to pay for it on the installment plan. The authorities find they cannot run the plant unless they increase the taxes to meet the payments, and it is the intention to turn the plant over to the contractors next month. The first bond of $1,000 is due, and there is no money with which to meet it.

The Plymouth Electric Light company has been incorporated, with a capital of $10,000. The directors are: M. W. Simmons, E. B. Simmons and F. C. Simmons, all of Plymouth.

The Connersville Traction company has been incorporated, with a capital of $25,000. The directors are J. C. McFarlan, Mart. Meyer, J. P. Lomel, R. N. Elliott and J. L. Ashworth, all of Connersville.

The Greensburg and Versailles Electric Railway company, with a capital of $100,000, has been incorporated at Greensburg, with the following-named directors: G. S. Little, W. H. Robbins, S. B. Edward, E. T. Riley, Grant Johnson and N. O. Comert of Greensburg, and W. A. Burton, J. M. Gore and G. W. Bryson of Indianapolis.

Louis Schneck and others have obtained a franchise for an electric railroad between New Albany and Jeffersonville, Ind., and extending as far as Speeds. Work will begin in the spring.

The commissioners of Rush County have refused to grant a right-of-way over the Indianapolis pike to the Morristown and Rushville Traction company. The road will now be built on a private right-of-way along the Cincinnati, Hamilton and Dayton tracks.

The managers of the Indianapolis and Greenfield Rapid Transit company announce that they will be able to declare a dividend on its stock at the end of the first year. The announcement has caused much interest, inasmuch as it is taken as an example of the great profits from the interurban lines running into Indianapolis.

The Grant County commissioners have given a franchise to the Indiana and Ohio Traction company through the county. The promoters announce that the work will begin at once on the line, as the right-of-way has been obtained from Hicksville, Ohio, to Marion, Ind. The work of building will be carried on simultaneously at five different points.

The Board of Public Works is about to issue an order prohibiting the interurban companies from hauling trailers for freight through the principal streets of Indianapolis. The companies have no such rights under the proposed franchise.

T. C. McReynolds succeeds W. O. Finch in the management of the Kokomo electric-light plant and the Kokomo Street Railway company, the latter owned by Detroit capitalists. The street-railway company proposes extending its lines, and will build a rural line to Greentown.

The Union Traction company, which, at present, is using the streets of Indianapolis by sufferance, has refused to carry passengers at the same rate as the local company, and on several instances has put citizens off its cars. This act, it is thought, will militate against securing a franchise privilege of charging a straight five-cent fare. The citizens and the press are insisting on a four-cent fare with transfers.

Charles Zeublin of Chicago, in a recent series of lectures in this city, spoke of transportation, and said that the dweller in a city spends too much time in being transported. He placed emphasis on the danger to human life that was occasioned by grade crossings, and said elevated tracks and subways would be the future mode of transportation in cities. F.

Northwestern Notations.

Minneapolis, January 12.—The International Electric company of Minneapolis has passed into the hands of P. F. Crafts as receiver. The company recently changed hands, the General Electric company securing control.

The Chippewa Falls (Wis.) Lighting company is enlarging its plant to double its capacity. The enlargement is to supply power for the Chippewa Valley Electric Railway company's road.

The Duluth (Minn.) branch of the Association of Stationary Engineers will oppose the enlargement of the scope of the law requiring licensed electricians. It bases its opposition on the ground that many buildings have an electric plant in connection with the steam plant. Under the law, unless the engineer is licensed as an electrician, he is unable even to replace a burned-out fuse, but must call in an electrician.

The Twin City Rapid Transit company has won its case, wherein the city of Stillwater, Minn., sought to annul its franchise in that city for failure to build and operate a line to South Stillwater. The franchise granted by the city of Stillwater stipulated that the company should apply to the village of South Stillwater for a franchise in that place. The company made application, as required, and secured a franchise. But the company never accepted the franchise from South Stillwater, nor constructed the branch line. The court holds that the Legislature has never empowered villages of less than 3,000 population to grant franchises for street railways, and therefore a village is unable to do so. The same company is taking active steps toward the construction of a power dam across the Mississippi River at Coon Creek, nine miles north of Minneapolis. It is expected that construction will be started in a few months. The company proposes to retail power to manufacturing concerns in Minneapolis, and also in Anoka, a few miles above. Columbia Heights, a suburb of Minneapolis, in which Mr. Lowry of the company is interested, will be especially favored. It is between the site of the dam and Minneapolis proper, and has a number of manufacturing interests which can utilize electric power.

The council of Marshalltown, Iowa, is considering plans for an electric power plant for the new sewage-disposal system.

Faulty registration for the special election at which the Street Railway and Electric Light company was recently granted a franchise at Oskaloosa, Iowa, may nullify the election.

The Electric Light company of Pipestone, Minn., will install a steam-heating system in connection with its lighting station.

The Beresford (S. D.) Mill company will establish an electric-lighting plant for furnishing light to the town in the spring.

A private lighting plant will be installed for the new county jail at Aberdeen, S. D. It will be of sufficient capacity to light the courthouse, when erected.

The capitalists interested in the electric railway at Mason City, Iowa, will form a company and put in an electric-light, gaslight and steam-heating plant for that city. The new company will expend $150,000 in the new system.

The council of New Ulm, Minn., has appointed a committee to investigate electric-light plants in cities of the size of New Ulm and report the advisability of a municipal plant.

The council of West Superior, Wis., will appeal to the state Legislature to be empowered to construct a municipal light and power plant for city and commercial use.

Charles F. Gay of Spokane, Wash., has invented a switch for electric cars, whereby it is not necessary to stop to throw a switch. The device consists of a shifting foot operated by the motorman. It resembles an inverted U, and fits over a wedge on the slide rail of the switch. The street-railway company of Spokane will test the appliance.

The street-railway company of Des Moines, Iowa, promises better service and the extension of the line to Waveland as soon as North street is properly graded. The company asks that it be allowed to stop the cars on the extension only every four blocks, and wants an ordinance compelling wagons to yield the right-of-way on the tracks to cars.

The contractors who installed the electric-light plant for the city of Austin, Minn., are now whistling for their money. They have been given warrants on the treasury, but there are no funds. These companies took the work in the face of statements that it was illegal. Now they seek to have the plant turned back to them until the bill is paid, or offer to take the plant in full payment of their claims. The council does not seem inclined to do either.

It is proposed to install a new and larger incandescent-light machine at Luverne, Minn., and to make other changes in the city-lighting plant.

The new electric-motor car of the Rapid Transit company of Waterloo, Iowa, has been completed and put in operation. It was built at the company's shops in Waterloo. It will be used for extra work and for transferring freight, mostly in Cedar Falls.

John Haug of Faribault, Minn., has been appointed receiver by the United States District Court for the Faribault Consolidated Gas and Electric company. The action is brought by Howard C. Levis of Schenectady, N. Y., who holds a trust deed given to secure $75,000 worth of bonds issued in 1889.

The Diamond Light and Power company will expend $1,000 at once improving its plant at Sheldon, Iowa.

The Brush Electric Light company of La Crosse, Wis., has offered to furnish street lights at $70 each per annum. This is a reduction of $15 a light a year from the prices now prevailing. The council demanded that the company accept the reduction and threatened to put in a municipal plant.

The power house of the State Electric Railway company at Clinton, Iowa, was recently damaged by fire to the amount of $5,000.

The North Coast Electric company has been incorporated at Tacoma, Wash., with $5,000 capital stock, and proposes to introduce a general district messenger service.

The electric-light, gas and heating plant at Mason City, Iowa, has been sold by S. Clarke to W. E. Brice and associates in the electric railway for $100,000 cash.

The Tacoma Railway and Power company of Tacoma, Wash., is laying a second track on Puyallup avenue, for the purpose, it says, of improving its service. There are some who suspect that the real object is to prevent the construction of a line on that street by Fred Sander, who is an applicant for a franchise for an interurban line between Seattle and Tacoma, and would have to use that street.

The Seattle (Wash.) Electric company has offered to furnish arc street lights for $84 each per annum. This is a reduction of $12 from the present figure. The council has decided to change gas and substitute 30-candlepower electric lamps. There will be 140 gas lamps replaced by incandescents.

The Minnesota Water company, operating the waterworks system at Brainerd, Minn., finds the cost of fuel for the plant steadily advancing. The company would like, therefore, to substitute electricity for steam power, using the waterpower to develop the electric. But the change would be an expensive one, and the company will seek to ascertain how much power could be sold to small manufacturers, in case the change is made.

A man is canvassing Missoula, Mont., with a view to establishing small electric-light plants in each block of the city, to furnish light for all the buildings on the block. The reason that he does not seek a general franchise, covering the town, is that the present company's franchise is such that no other company can cross the streets on which its wires run without infringing on the old company's rights.

The county treasurer at Des Moines, Iowa, will fight the injunction secured by the street-railway company to prevent the sale of its property for taxes. He says that the bondholders are supposed to protect themselves in the matter of seeing that property in which they are interested is not sold for taxes.

Surveys are being pushed for the development of the waterpower of the Walla Walla River at Athena, Ore., as rapidly as the high water will permit. R.

PERSONAL.

Philip Dawson, a well-known English electrical engineer, is in this country on a short business trip and is stopping in New York city.

Roger W. Conant, who has been electrical engineer of the Boston Elevated Railway company of Boston for many years, has resigned his position, to accept the managership of the New York office of the Gold Car Heating company.

The Franklin Institute of Philadelphia, through its committee on science and the arts, has recommended the award of the John Scott legacy medal and premium to Thomas Wilkinson Blakey of

Keene, N. H., and William Courtenay of New York city, for their invention of a reconstructed granite as an insulating material for electrical uses.

Elmer E. Sperry, formerly electrical engineer of the Cleveland Machine Screw company of Cleveland, Ohio, has accepted a similar position with the American Bicycle company, which has taken over the business of the former company.

H. P. Broughton, well known in engineering circles in the West and Southwest, has associated himself with the Central Electric company, Chicago. Mr. Broughton was for many years a consulting engineer, with offices in St. Louis, and his wide experience and ability in his profession should prove a valuable addition to the Central Electric company's staff.

William W. Thweatt, one of the oldest telegraphers in the service of the Western Union company, died in Baltimore on January 12th. Mr. Thweatt was born near Petersburg, W. Va., more than 60 years ago. He served as a telegrapher during the war and afterward with the United States Telegraph company, as manager of the Richmond office of the Norfolk and Petersburg railroad, with the Signal Service Bureau in Washington, and finally with the Western Union Telegraph company. Since 1877 he had been connected with the Baltimore office of the Western Union company.

George H. Rae, oldest son of Frank B. Rae, the well-known consulting electrical and mechanical engineer of New York city, formerly of Detroit and Chicago, was killed in action at Kuion, Luzon, P. I., on December 30th last, while serving in Company A of the Battalion of Engineers. "Bert," as the patriotic young man was familiarly known, was for a time with the Crane Elevator company in Chicago, and later with the Helena Power and Lighting company at Helena, Mont. He went to Manila as engineer and electrician on the transport Port Albert and enlisted in the Battalion of Engineers in December, 1899. He was 27 years and six months of age. The sympathy of many electrical friends will go out to the bereaved family in their affliction.

ELECTRIC LIGHTING.

The electric-light plant at Atlantic, Iowa, is to be improved.

The electric-light plant at Atlantic, Iowa, is to be extensively improved.

The Dublin (Ga.) Electric Light and Waterworks company will make improvements to its plants.

The citizens of Greenville, Ill., have subscribed $10,000 and will erect a new electric-light plant.

The Norfolk Light, Heat and Power company will erect a $22,000 electric-light plant at Norfolk, Va.

The Laclede Power company of St. Louis, Mo., will erect a large power house in that city, to cost $55,000.

The Morris Run (Pa.) Coal Mining company proposes putting in an electric-light plant for commercial lighting.

C. H. Barry of Huntsville, Ala., has received a franchise for the erection of an electric-light plant in Tuscumbia, Ala.

The Independent Gas and Power company of San Francisco, Cal., has been incorporated for $5,000,000, by C. Spreckels, J. D. Spreckels and F. Tillman.

The Northern Ohio Electric company of Defiance, Ohio, has been incorporated for $25,000, by W. D. Sherwood, E. Bartholomew, H. C. Warren and J. U. Merwin.

E. Craig and others of New Orleans, La., have incorporated the New Orleans Power House company, with $50,000 capital stock, to build and operate electric power plants.

The Baltimore (Md.) and Ellicott City Electric Light and Power company has been incorporated for $15,000, by G. L. Mowen, H. L. Stewart, J. H. B. Jefferson and J. Shaw.

Business men of Fond du Lac, Wis., have organized a stock company for the purpose of installing an electric-light plant. The company will be incorporated with $10,000 capital stock.

At a recent council meeting at Canfield, Ohio, a franchise was granted to C. C. and J. R. Fowler, D. F. Anderson and H. A. Ernst of Youngstown to establish and maintain an electric-light plant.

The Sullivan Electric company of Sullivan, Ill., has been incorporated, for $50,000, to operate lighting, heating and power plants. The incorporators are John H. Baker, W. A. Steele and A. J. Petterson.

The Capital County Light, Heat and Power company of Watervliet, Albany county, N. Y., has been incorporated for $25,000, by D. S. Johnston and J. E. MacLean of Cohoes and Robert Williams of Watervliet.

Dr. George G. Hopkins of Brooklyn, N. Y., says that he has nearly cured two patients of consumption with "decomposed light" from an arc light of 22,000 candlepower, the light being thrown upon the patient through a blue glass in front of the arc. He says he has also used the system with success for the cure of cancer.

The International Light and Power company of El Paso, Tex., will place orders within 60 days for a 200-horsepower, tandem-compound engine and a 125-kilowatt, direct-connected, two-phase generator.

A contract for the city lighting of Shreveport, La., has been let for five years to the Shreveport Gas, Electric Light and Power company on a bid of $95 an arc light of 2,000 candlepower per annum. The competition for the contract was very close.

The present oil headlights on the Chicago, Burlington and Quincy railroad are to be replaced by electric headlights. Experiments recently made on western parts of the road have convinced the management of the efficacy of lighting by electricity, and it is the purpose gradually to replace the lights on all passenger and freight locomotives, numbering more than 750, with the electric ones.

Stockholders of the Missouri-Edison Electric company of St. Louis have re-elected S. M. Dodd, James Campbell, J. C. Van Blarcom, Thomas H. West, James W. Bell, R. C. Kerens and Edwards Whitaker as directors, and at a meeting of the board S. M. Dodd was re-elected president, James Campbell vice-president, S. B. Pike secretary, C. L. Horton assistant secretary, and J. G. Kelley treasurer.

The Hagerstown Electric Railway company, which for several years had the contract for lighting the streets of Hagerstown, Md., at $7,000 a year, has filed suit in equity to force the city to renew its contract for a period of five years, beginning January 1, 1901. The city has nearly completed installing its own $50,000 plant, and expects to light the streets shortly by electricity from its own power plant.

Congress has been asked for an appropriation of $21,000, to be expended under the charge of the superintendent of public buildings and grounds, for the purpose of providing electrical displays on the exterior of the various public buildings in Washington during the coming presidential inaugural ceremonies, including the Capitol and its approaches, White House, Postoffice, Treasury and State, War and Navy buildings.

ELECTRIC RAILWAYS.

A strike of motormen and conductors tied up the entire system of the United Traction company of Reading, Pa., on January 8th.

The Connersville (Ind.) Traction company has been incorporated, with $25,000 capital stock, by A. E. McFarlan, M. Meyer and R. N. Elliott.

C. H. Barry has secured a franchise from the city authorities of Tuscumbia, Ala., to build an electric railway, which is to be completed December 31, 1901.

F. E. Sander has been granted a 50-year franchise by the commissioners of Pierce County, Wash., to construct an electric railway across the Puyallup reservation.

The Muncie-Hartford City Electric Railroad company promoters have been granted a 30-year franchise for the use of the streets of Eaton, Ind., 12 miles north of Muncie.

Plans for extending the Terre Haute (Ind.) Electric Street Railway company's lines to West Terre Haute are being formulated. C. B. Kidder is the manager of the company.

The Greenville Street Railway company has been incorporated, with $50,000 capital stock, to build a trolley line in Greenville, Pa. J. H. McCafferty is president of the company.

The Worcester and Blackstone Valley Street Railway company's directors have voted to build a new power station of 1,000-horsepower capacity in Millbury, Mass., to cost $50,000.

The Board of Supervisors of Los Angeles, Cal., has passed an ordinance granting to D. H. Thomas and his assigns the right to construct the proposed electric street railway from Santa Ana to Los Angeles.

The City Council of Chicago has ordered the draft of the proposed street-railway bill forwarded to the Legislature, and the Street Railway Commission has been directed to use its influence to secure the passage of the act.

W. H. McDoel and B. Taylor of Chicago and business men of Crawfordsville, Ind., have incorporated a company with a capital stock of $100,000 for the purpose of building an electric line 30 miles long, to connect Crawfordsville with several nearby towns.

Negotiations are still under way for the consolidation of the Chicago Electric Traction company, the South Chicago City Railway company and the Calumet Electric Street Railway company and the roads are said to be in better condition for merging than when the project was first taken up.

In his inaugural message to the Michigan Legislature, Governor Bliss, among other suggestions, recommended that, inasmuch as the suburban and interurban street railways of the state are assuming full railroad functions, they should be brought under the full jurisdiction of the State Railroad Commission.

The Queenston, Niagara and Port Dalhousie Electric Railway company has been incorporated, with $40,000 capital stock, to build an electric railway from Queenston, Ont., to St. Catharines, by way of Niagara and Port Dalhousie. G. J. Gibson and W. H. J. Evans of Niagara and R. B. Hamilton, J. Kyles and others of Toronto are interested.

The Quakertown Traction company, at its annual meeting, changed its title to the Philadelphia, Doylestown and Allentown Railway company, and elected C. Taylor Leland, president. The extension from Richlandtown to Allentown will be built at once and the extension of the line from Perkasie to Doylestown will be built as soon as the weather permits. A power house is to be built at Perkasie, Pa., the headquarters of the company.

G. F. Harding of Chicago has made a proposition to give the city $1,000,000 for the right to operate street railways in the city after the expiration of the franchises of the present companies. Mr. Harding proposes to buy the rolling stock of the companies if he gets the franchise from the City Council. He makes a provision that the lines can be surrendered to the city at any time. He says he would either make a four-cent fare general or give 20 per cent. of the gross receipts to the city every year. He reserves the right to bond the lines. The City Council at its last meeting sent the offer to the Street Railway Commission for consideration.

ELECTRICAL SECURITIES.

The Electric Company of America has declared a semi-annual dividend of 50 cents a share, payable January 31st.

The Columbus Railway company has declared a dividend of 1¼ per cent, on its preferred stock, payable February 1st.

The directors of the Edison Illuminating company of Boston have declared a dividend of two per cent., the regular quarterly rate, and an extra of one per cent., which rate, if continued, puts the stock upon a 12 per cent. basis, or better terms than were offered by the Morgan least of which the terms were only 11 per cent. The dividends are payable February 1st.

The Birmingham (Ala.) Railway, Light and Power company has given a first mortgage for $3,500,000 to the Old Colony Trust company of Boston to cover an issue to that amount of 50-year five per cent. gold bonds. The mortgagor owns and operates all the electric car lines in Birmingham, and forms a consolidation of all other local car interests. Half the proceeds of the bond issue will be used to pay bondholders of the absorbed companies, and the rest will be turned into the treasury of the company for operating the consolidated system.

CALENDARS.

N. W. Ayer & Son of Philadelphia, the well-known newspaper and magazine advertising firm, is sending to its friends and customers a large display wall calendar for 1901.

The Philip Carey Manufacturing company, Lockland, Ohio, manufacturer of Carey's magnesia flexible cement roofing, has issued a wall calendar which bears a highly colored design, illustrating the use of the company's products.

A unique subject has been chosen by Kurz & Root, consulting electrical engineers of Appleton, Wis., to illustrate a neat calendar which they are sending to their friends. It represents the lighting plant installed at Appleton in October, 1882, which was the first incandescent-light central station in the world. The equipment included a 250-light, 16-candlepower, Edison K dynamo, and the first superintendent and electrician was William D. Kurz of Appleton.

PUBLICATIONS.

The Western Electric company has recently issued a bulletin describing in detail its new series alternating enclosed-arc lighting system.

Beginning with the new year, Cassier's Magazine has commenced the issue of a "library edition," the magazine being bound in substantial and attractive cloth covers. This edition will hereafter be a regular monthly feature and is especially designed for the use of libraries, reading rooms, etc.

Part I. of a paper on electric furnaces has been issued in pamphlet form by the author, Professor Luigi Belloc, inspector of industries, of Rome, Italy. The treatise, which is printed in Italian, gives a historical treatise of the development of electric furnaces up to 1886, several of the different types described being illustrated.

Emile Mertz, manufacturer of machinery of Basle, Switzerland, has issued a comprehensive catalogue, in French, describing and illustrating his direct-connected, upright, electrical generating sets for continuous current, moisteners for textile factories, high-pressure and centrifugal pumps, ventilators and the Mertz gas-lighting system.

The report of the Street Railway Commission to the Chicago City Council, which was submitted in December last, has been issued in pamphlet form.

It makes a book of 136 pages, and besides the actual report of the commission and the street-railway bill recommended contains in an appendix several letters, addresses, editorials, etc., bearing on different phases of the street-railway question in Chicago and other cities.

The English Electric Manufacturing company of Preston, Lancashire, England, has published, in pamphlet form, a reprint from the Tramway and Railway World of an article describing the corporation's large new factory at Preston. The article is quite extensive and is very well illustrated by views of the new plant. The contractors for the works and the present sole selling agents for the company are Dick, Kerr & Co. of London.

SOCIETIES AND SCHOOLS.

The twenty-second annual convention of the Michigan Engineering society was held at Ann Arbor, Mich., on January 8th, 9th and 10th. Among the papers read was one by W. W. Brigden of Battle Creek, Mich., on "Electrolysis."

The November bulletin of Purdue University, Lafayette, Ind., contains the annual reports of the president and other officers of the institution for the school year 1899-1900. In his report on the year's work in scientific and technical research President Stone speaks of the extensive tests relating to arc-light photometry conducted in the electrical-engineering department by a committee of the National Electric Light association, of which Professor Goldsborough is a member.

MISCELLANEOUS.

The Anheuser-Busch Brewing association of St. Louis is planning to equip its brewery with a complete outfit of electric motors and a new power plant will be put in. The engineering contract has been awarded to Ruebel & Humphrey, electrical engineers of St. Louis.

TRADE NEWS.

The Advance Electric company has been incorporated at Indianapolis, Ind., with a capital stock of $5,000.

The Standard Electric company of Cincinnati, dealer in electrical supplies, has removed to more modern and commodious warerooms at 113 West Third street, in order to handle its increased business.

The Edison Electric company of Chicago has been incorporated, to do a general electrical supply, construction and manufacturing business, by John J. Edison, William M. Mecham and G. A. Harter. The capital is $2,500.

Jos. H. Williamson, business manager of the Viennot Advertising Agency of Philadelphia, has found it necessary for the better convenience of his clients and friends to be more centrally located, and has removed his New York office from 127 Duane street to room 719 Temple court, where he will be pleased to meet his acquaintances.

After six months' negotiations the Pratt & Whitney company of Hartford, Conn., has passed into the hands of the Niles-Bement-Pond company of New York, which has plants in Ohio, Pennsylvania and New Jersey. The Pratt & Whitney company will continue as a distinct and separate organization. That company manufactures a line of small machinery, while the specialty of the Niles-Bement-Pond company is heavy machinery.

The American Bridge company announces the following appointments: E. W. Stearns has been appointed manager of the East Berlin (Conn.) plant. Frank S. Moore has been appointed manager of the Lafayette (Ind.) plant. All the Pittsburg plants have been consolidated into one, with J. W. Walker as manager. C. A. Billings has been appointed assistant treasurer for the New York district and H. W. Post has been made manager of the Post & McCord plant.

With the beginning of the new century, the Sprague Electric company opened another branch office, to facilitate the handling of its constantly increasing business in the South. The new office is located in Baltimore, in the Guardian Trust building, on the corner of Calvert and German streets. The Baltimore office will enable the company to keep in closer touch with the large amount of government work constantly being done and also to handle more conveniently the increasing demand for its various products throughout the South. The manager of the new office is W. H. A. Davidson, who goes there from the New York office, where he has been for many years. The products of the Sprague Electric company have long stood the test of actual service under exacting conditions and have taken a front rank in their respective classes. The personnel of the company, in its executive departments, guarantees fair dealing and reasonable prices.

BUSINESS.

In the January issue of Graphite, published by the Joseph Dixon Crucible company of Jersey City, N. J., is given a short account of the growth of the graphite industry.

Daily trains to St. Paul, Minneapolis, Ashland, Duluth and the Northwest leave Chicago from the Central station, Twelfth street and Park Row (Lake Front), via the Wisconsin Central railway. The nearest ticket agent or James C. Pond, general passenger agent of the company, Milwaukee, Wis., can furnish complete information in regard to the trains.

The Incandescent Electric Light Manipulator company of Boston says that since the announcement was made that it had been awarded a medal at the Paris Exposition it has received so many inquiries about its manipulators and adjusters from all over the country that steps are now being taken to secure agents to represent the company in every large city in the United States.

The Central Electric company, Chicago, announces a constantly increasing business in its popular I X L brand weatherproof wire. The company states that one of its largest customers recently tested four of the leading weatherproof wires, the I X L brand standing at the head of the list, and the customer selected it as his standard. The Central Electric company is also prepared to furnish weatherproof aluminum wire and solicits inquiries relating to the same. While aluminum cables have been used in western waterpower plants for several years, it is said they did not give entire satisfaction until recently, owing to the fact that several years ago alloy was employed in the manufacture of aluminum wire, which proved unsatisfactory. The Central company states that it is not only prepared to furnish anything in the line of aluminum wire, which is thoroughly tested before shipped, but it also guarantees it to be entirely satisfactory. The company has sold aluminum wire to some of the largest street-railway companies.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 8, 1901.

665,404. Electromagnetic Brake. Edwin P. Carpenter, Pawtucket, R. I. Application filed September 9, 1899.

A vertically disposed bar of soft iron has a slotted upper end, with a pin passing through the slot and securing the bar to a bracket carried by the truck. A brakeshoe is swiveled to the lower end, and a spring exerts an upward tension on the bar which carries a magnet coil.

665,421. Machine for Restoring Insulated Wire. James B. Fleming, Detroit, Mich. Application filed January 15, 1900.

The stripping device consists of a pair of scrapers, one arranged to receive the wire on its upper edge and the other on its lower edge. For winding the tape the driving means are operated by the running wire. Means are provided for moving the winding device independent of the driving means.

565,422. Globe Holder for Arc Lamps. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed September 25, 1899.

A globe support has a socket for the negative electrode provided with an air-tight joint for the bottom of the globe, with an adjusting nut on the periphery of the support. Symmetrically arranged clamping toes are carried by the nut hanging in lines to clear the globe when the nut is raised. An inclined wall on the globe holder deflects the clamping toes into engagement with the globe when the nut is lowered.

665,423. Electromagnetic Cut-out. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed November 24, 1899.

The fixed and movable members are formed of sheet metal, one being provided with a number of punched tongues engaging corresponding slots in the other so as to form a loose hinge joint. A spring connects the parts and has its connecting points symmetrically related with respect to the pivotal connections.

665,426. Art of Obtaining Chlorates by Electrolysis. William T. Gibbs, Buckingham, Canada, assignor to the National Electrolytic company of New York. Application filed September 9, 1895.

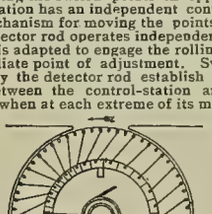
This patent covers the process of obtaining chlorates from the chlorides of alkaline or alkaline-earth metals which consists in subjecting the chloride in solution while flowing continuously through a cell to the action of an electric current between two electrodes in close proximity and insulated from each other, but otherwise separated only by the liquid, the density of the current used being such as to maintain the solution in the cell at a temperature suitable for decomposing hypochlorites.

665,427. Electrolytic Apparatus. William T. Gibbs, Buckingham, Canada, assignor to the National Electrolytic company of New York. Original application filed September 9, 1895. Divided and this application filed October 8, 1900.

This is an electrolytic cell in which one of the cell walls is of metal subject to disruption in the presence of chlorine, interiorly faced with a substance substantially resistant to the action of chlorine. This constitutes one electrode and is connected with the positive pole of a source of electricity. The other electrode consists of vertical wires or rods of suitable metal properly supported in the cell.

665,428. Railway Switch and Signal-controlling Mechanism. John E. Gillmor, Jersey City, N. J. Application filed August 20, 1900.

In this switch-point operating device there is mechanism for moving the switch points in opposite directions. A control station has an independent connection between it and a mechanism for moving the points in each direction. A detector rod operates independently of the switch points and is adapted to engage the rolling stock when at an intermediate point of adjustment. Switching devices controlled by the detector rod establish one of the connections between the control-station and point-moving mechanism when at each extreme of its movement.



No. 665,486.

665,437. Fluid Pressure Regulator. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed November 22, 1899.

The claims describe a pressure governor comprising an electric motor for raising the pressure, a pressure-operated circuit-closer in the motor circuit, a by-pass of low resistance around the circuit-closer contacts when closed, and means for opening the two branches through the circuit-closer and by-pass in sequence to prevent arcing.

665,449. Brush Carrier. Carl W. Larson, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed October 23, 1899.

The brush carrier is provided with slots concentric with the armature, with supports secured in a fixed portion of the machine and engaging in the concentric slots. Brushes are carried in continuous engagement with the commutator, and means are provided whereby the reversal of the armature causes the brush carrier to be moved in a direction opposite to the reversed direction of the movement of the armature, to reverse the lead of the brushes.

665,450. Electric Brake for Vehicles. Joseph N. Mahoney, New York, N. Y., assignor to Price, Darling & Co., New York, N. Y. Application filed February 12, 1900.

The electromagnetic brake-operating apparatus has multiple windings. Means are provided for opening the circuit between the motor and the source of power, including the windings of the brake-operating apparatus in the circuit of the source, and exciting the field of the motor so that it will operate as a generator. An electrically actuated relay in the motor circuit then runs as a generator, operating to transfer the windings of the brake-operating apparatus from the circuit of the source to the motor circuit.

665,459. Lamp Terminal. George B. Painter, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 20, 1898.

A center contact for lamp bases is described, which consists of a sheet-metal strip doubled upon itself, one end of the contact being closed and having an inward depression for the reception of solder and a perforation through the depressed portion for the reception of the lead-in wire, and the other end of the contact being open and the adjacent parts flared outwardly, whereby the contact can be anchored in the insulating material of a lamp base.

665,486. Dynamo-electric Machine. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed October 25, 1900.

This generator comprises two relatively rotating members, one of which is provided with commutator brushes, the other member having a commutator co-operating with the brushes, and a winding connected to the commutator the segments of which are so spaced with reference to the points of connection to the winding as to cause a periodic shifting of the diameter of commutation. (See cut.)

665,492. Electric Switch. Charles L. White and Frank W. Cole, Chicago, Ill. Application filed March 30, 1899.

The switch arm is adapted to make and break an electric circuit. A linear break spring is adapted to move the switch arm to an inoperative position, and a linear return spring to return the switch arm to its operative position, the springs being placed substantially side by side. A movable part when actuated renders the return spring inoperative, and a holding device retains the switch arm, the parts being so disposed that the holding device is released after the return spring is rendered inoperative.

665,494. Lamp Socket. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 9, 1898.

A metallic strip secured at its outer end to the base is adapted to receive a binding screw, and to engage with its inner end a lamp terminal. Portions of the strip are partially cut away and bent to an angle with the strip to form lugs adjacent to the binding screw, which prevent the lead-wires from being twisted or squeezed from beneath the binding screw and into contact with other conductors secured to the base, when the binding screw compresses the wire.

665,514. Electric Switch. William Ely, Providence, R. I. Application filed August 13, 1898.

A disk is secured upon a holding shaft and provided with the engaging shoulders located at about a quadrant with each other, and also provided with means adapted to receive the impact of the actuating member when the latter is moved in the direction to withdraw the contact blade from the contact brushes. The actuating member is provided with a pawl-disengaging device, with the opposite spring-controlled pawls projecting outward from the base plate, and with the extensions adapted for the engagement therewith of the disengaging means of the actuating member. The connecting spring is secured at

one end to the actuating member and at the other to the disk at a point located at the opposite side of the axis of the shaft from that of the shoulder of the disk, which by its engagement with the shoulder of the pawl serves to hold the contact blade in its disengaged position.

665,539. Means for Generating Electricity from Axles of Locomotive Trucks. Morris Moskowitz, New York, N. Y. Application filed March 13, 1900.

A fixed platform is placed at the front of the locomotive and above a swing truck. A generator is arranged on the platform and has a lateral circular motion controlled by the corresponding motion of the truck about its center bearing. The generator is belted to the truck axle.

665,540. Means for Generating Electricity from Car-wheel Axles. Morris Moskowitz, New York, N. Y. Application filed March 13, 1900.

A pivoted or swing truck of a railway car carries a fixed platform suspended on brackets from the body of the car. A second platform is movably arranged upon it. A pair of arc-shaped channels are cut in each platform concentric with the pivotal center of the truck, and ball bearings or travelers are placed in the channels. A dynamo is carried on the movable platform and is driven from the axle. (See cut.)

665,541. Electric-lighting System. Morris Moskowitz, New York, N. Y. Application filed April 13, 1900.

In this system a battery is installed in connection with a dynamo subject to reversal of armature rotation. A relay is in circuit with the battery. An automatic pole-changing device is in circuit with the brush terminals of the dynamo or generator, comprising a solenoid coil in circuit with the relay, a plunger extending into the coil, and movable upwardly therein, when the solenoid coil is energized from the relay, but movable downwardly by gravity when the solenoid coil is thrown out of circuit by the action of the relay. Contact devices are connected with the plunger, the contact devices being of constant polarity, and arranged in circuit with the main circuit.

665,548. Telephonic System. Leon W. Pullen, Camden, N. J. Application filed May 23, 1899.

Two or more stations have a signal wire and a line wire extending between them with means for supplying current to the talking and signal wire. A signal bell of low resistance is permanently in circuit between the signal wire and line wire at each of the stations, and a receiver and a transmitter of relatively high resistance are in series with the bell between the talking or line wire and the signal wire at each of the stations. Suitable means are provided for independently short-circuiting the transmitter and receiver at each station while maintaining them in series with the bell whereby the resistance of these instruments shall be eliminated from the wire when signaling.

No. 665,540.

665,573. Transformer. Walter S. Moody and William L. R. Emmet, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed October 26, 1900.

The windings are placed in a heat-conducting casing containing a fluid for conveying heat. There is an aqueduct for absorbing heat direct by conduction from the windings extending out into the coil for absorbing the heat that the latter conveys from the core and the parts of the windings extending outside the core, and another aqueduct is provided surrounded by the cooling fluid and co-operating with the heat-conducting casing to absorb the heat conveyed by the fluid from the core and from the parts of the windings which extend into the oil. (See cut.)

665,582. Lamp Socket. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 14, 1900.

A metallic cap covers the end of the insulating base and has an opening for the circuit wires in its crown. An annular yoke is secured in the crown of the cap beneath the opening, and provided with arms extending within the interior of the cap. An insulating lining protects the cap from live contacts and is retained by the arms within the cap and provided with a hole for the circuit wires.

665,586. Direct-current Dynamo-electric Machine. Wilhelm V. Siemens and August Rotth, Berlin, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed January 6, 1900.

A drum armature has longitudinally extending slots containing the armature coils. A core has an auxiliary field winding adapted to decrease the effects of armature reaction, the core having two legs separated from one another a distance equal to a multiple of the distance between the individual teeth of the armature.

665,609. Electrical Battery. Charles B. de Lamarre, Biloxi, Miss. Application filed August 15, 1900.

This battery comprises a jar containing a positive and negative electrode, a porous cup and a hollow carbon electrode in the cup. The negative electrode is porous and has an opening extending longitudinally of its side with a closing cover. The jar, cup and carbon electrode have chemical solutions or compounds therein for setting up an electrolytical diffusion and reaction.

665,625. Primary Battery. Harry S. Amwake, Camden, N. J., assignor of one-half to Joseph H. Wilson and Abraham M. Geisinger, Philadelphia, Pa. Application filed March 2, 1900.

A case has copper connecting strips on two opposite walls and a number of porous carbon cups within it. The cups are adapted to be readily removed from the case, and provided with proper insulation and means for making contact with one of the copper strips. The carbon cups contain zinc plates and an electrolyte, the zinc plates being properly insulated and adapted to be readily removed from the cups, and provided with means for making contact with the other of the copper strips. The porous carbon cups are surrounded on their outsides with an electrolyte dissimilar to the one within the cups.

665,636. Electric Cable. Robert K. Gray, London, England. Application filed May 23, 1900.

Longitudinal ribs are formed upon the insulating coating around the conductor, and another insulating coating of plastic or semiplastic material provided, which is prevented from displacement by means of the ribs.

665,639. Telephone Transmitter. Takeo Iwata, Tokio, Japan. Application filed October 25, 1899.

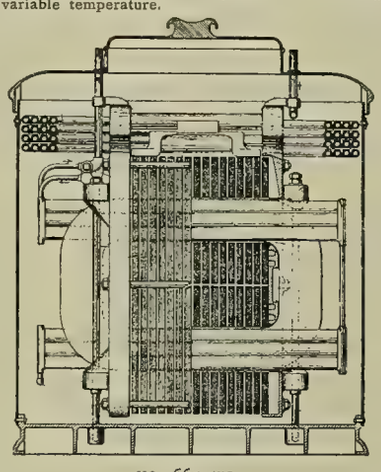
A set of microphones are arranged, one on each side of the principal diaphragm, and each consists of a carbon cup containing a loose mass of granular carbon, with its open end opposite to the respective sides of the diaphragm, on which the mass of carbon exerts a pressure. A membrane is interposed between the mouthpiece and the front end of the microphones.

665,664. System for Heating Conductors of the Second Class. Carl D. Raab, Kaiserslautern, Germany. Application filed April 30, 1900.

Connections for the heater with the conductors of the first and second classes and a neutral conductor of the supply circuit are such that the potential at the heater terminals decreases as the resistance of the second-class conductor decreases.

665,667. Electrical Measuring Instrument. Llewelyn B. Atkinson, Cardiff, England. Application filed June 8, 1900.

This device consists of a hydrometer float in a transparent tube, adapted to indicate by its point of flotation the current passing in a surrounding coil. A metal tube protects the transparent tube, having a slot and a scale attached for reading the height of flotation of the hydrometer. An adjusting set screw is set in the bottom of the metal tube. A flange on the metal tube is attached to a bracket adapted to be secured to a vertical board. A metal shell on the bracket surrounds the current coil. Swivel connections are made from the ends of the coil to its terminals. A cap fits in the top of the shell to cover and protect the top of the coil and the top of the inner glass tube. Means are provided for compensation of readings for variable temperature.



NO. 665,573.

665,676. Junction Box for Electrical Conductors. Edwin T. Greenfield, New York, N. Y. Application filed July 9, 1900.

This is a two-part junction box, one part of which is provided with a number of openings and a series of half-necks, the other with a neck for supporting the fixture canopy and a corresponding series of half-necks. A thin false bottom is placed adjacent to the first-named part and a number of detachable disks or cups are adapted to close the ends of the necks.

665,679. Electric Battery. Robert E. Hall, Bridgeport, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed December 15, 1899.

The cell comprises a box holding oxide of copper in the form of copper scale, the box having two opposite sides made of solid glass and the other two opposite sides made of a pervious material.

665,704. Electric Furnace. George S. Strong, New York, N. Y. Application filed April 4, 1896.

The construction is such as to exclude air from the furnace when in operation. The furnace is heated internally by the electric arc. Means are provided for heating an air muffle independently, and a conduit leads from the interior to the enveloping muffle whereby gases generated in the electrically heated furnace are led to the enveloping furnace and used for heating it. (See cut.)

665,717. Apparatus for Melting Iridium. Gyulo Armeny, New York, N. Y., and William C. Marion, Arlington, N. J. Application filed November 15, 1900.

A metallic plate is attached to the top of a supporting table, a second metallic plate being attached to the under side of the table and connected with the first. One of the plates is connected with one pole of a source of electricity. A metallic clamp is attached to the top plate and provided with a clamping screw and holds a carbon plate provided with a number of depressions for receiving iridium in small quantities. A movable electrode is provided with a handle and connected with the opposite pole, and adapted to be passed over the carbon plate for melting the iridium in the depressions.

665,734. Type-printing Telegraph. Adolf Franke, Berlin, Germany. Application filed January 18, 1899.

A shaft carries a type wheel and an escapement wheel. Electromagnetic means operate the escapement wheel to rotate it. A circuit includes the electromagnetic means and the contact device. A resilient flexible coupling device is placed intermediate the shaft and the contact device, whereby the escapement wheel and the type wheel may have a movement relative to the contact device after the latter is stopped, and the contact device when released will be returned to its normal position relative to the shaft and type wheel.

665,782. Primary Battery. Henry K. Hess, Philadelphia, Pa., assignor to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed January 11, 1899.

The cell contains a series of porous partition plates forming two sets of compartments. A molded non-conducting cup is mounted under the partitions, and grooved non-conducting end pieces in alternate spaces, with zinc plates adapted to the grooved end pieces and a conductor mounted in the non-conducting cup on which the several zinc plates rest.

665,783. Process of Regenerating Spent Elements of Primary Batteries. Henry K. Hess, Philadelphia, Pa., assignor to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed July 13, 1899.

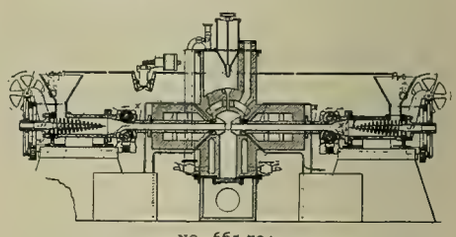
The process consists in simultaneously regenerating acid solutions of zinc sulphate and of chromium sulphate by separating the two liquids by means of a porous partition in such a way that the zinc sulphate remains in the cathode compartment and the chromium sulphate in the anode compartment, the anode being insoluble in the anode solution and subjecting the two solutions to the action of an electric current which enters the chromium sulphate and passes out of the zinc sulphate, whereby the zinc is precipitated from the zinc sulphate upon a cathode which will protect it from chemical action with the solutions present and the chromium sulphate is reoxidized to chromic acid and sulphuric acid.

665,784. Apparatus for Regenerating Spent Elements of Primary Batteries. Henry K. Hess, Philadelphia, Pa., assignor to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed August 9, 1899.

A series of containers each holds a porous vessel which contains a lead anode. Mercury is held in trays within the containers, and makes contact with electrical conductors. Inlet pipes communicate with the porous vessels and with the containers. Feed and discharge pipes are placed at the side of the series of containers, one pipe connecting with the several containers, the other pipe connecting with the several porous vessels, the pipes being insulated in such a manner that there will be no electrical connection between the several containers through the pipes.

665,788. Attachment for Telephones. David Laing and George M. Ferry, Duquesne, Pa. Application filed May 2, 1900.

A clip has a knuckle projecting outwardly and an arm hinged to the knuckle. A socket has telescopic connection with the arm and a yoke projects outwardly from a sleeve located parallel with the socket and is adapted to be connected to a telephone transmitter. A receiver support adjustably secured in the sleeve is adapted to rest upon one side or the other of the yoke, the support carrying a receiver thereon.



NO. 665,704.

665,798. Electrical Measuring Instrument. Camillo Olivetti, Ivrea, Italy. Application filed August 9, 1900.

A core wound by the line wire and provided with a cylindrical channel formed eccentrically to the axis of the core surrounds a rotatable shaft arranged centrally within the channel and having fixed upon it two radial magnetic wings that project at their outer edges into close proximity to the cylindrical wall of the channel. A semicircular plug is disposed in the channel to one side of the shaft, and provided at one end with a disk fitted airtight in one end of the channel and at its other end with an annular enlargement fitted airtight to the end of the core and provided with a semicircular aperture, a semicircular washer closing the aperture. A pointer or index is fitted to rotate with the shaft, and means are provided for returning the pointer or index to normal position.

665,810. Apparatus for Generating Electricity. Joseph Stretch, East Orange, N. J. Application filed May 21, 1900.

An endless platform is mounted upon an endless track and carries generators mounted upon it which are geared to the axles of the platform.

665,827. Manufacture of Storage-battery Plates. John L. Creveling, New York, N. Y. Application filed May 23, 1900.

This patent covers the process of producing a porous plate, which consists in spraying molten metal through an oxidizing flame against a collector, thereby oxidizing the surface of the metal wherever exposed, and in regulating the degree of the oxidation.

665,848. Telephone Switch. Nathan Bassett, Philadelphia, Pa., assignor to the Globe Telephone Manufacturing company, Philadelphia, Pa. Application filed May 3, 1900.

A combined circuit maker and breaker carries a series of spring contacts. The spring contacts normally move in line with circuit-wire contacts and stand initially out of engagement therewith. The subsequent engagement of the spring contacts with the circuit-wire contacts is effected.

665,856. Electric Burglar-alarm System. Emil Biedermann and Leopold A. Heine, Chicago, Ill. Application filed April 23, 1900.

A circuit-closer is made up of a door lock having a lock and latch bolt, a casing having openings to receive the bolts, and an opening between the openings for the bolts. Two spring contacts located within the casing are formed so as to cross each other without contacting. A button located in the opening between the openings for the bolts extends into the casing, and posts extend into the casing but are insulated therefrom.

DESIGN.

33,871. Electric-vehicle Body. Charles G. Burrows, Windsor, Conn., assignor to the Eddy Electric Manufacturing company, Windsor Conn. Application filed June 27, 1900.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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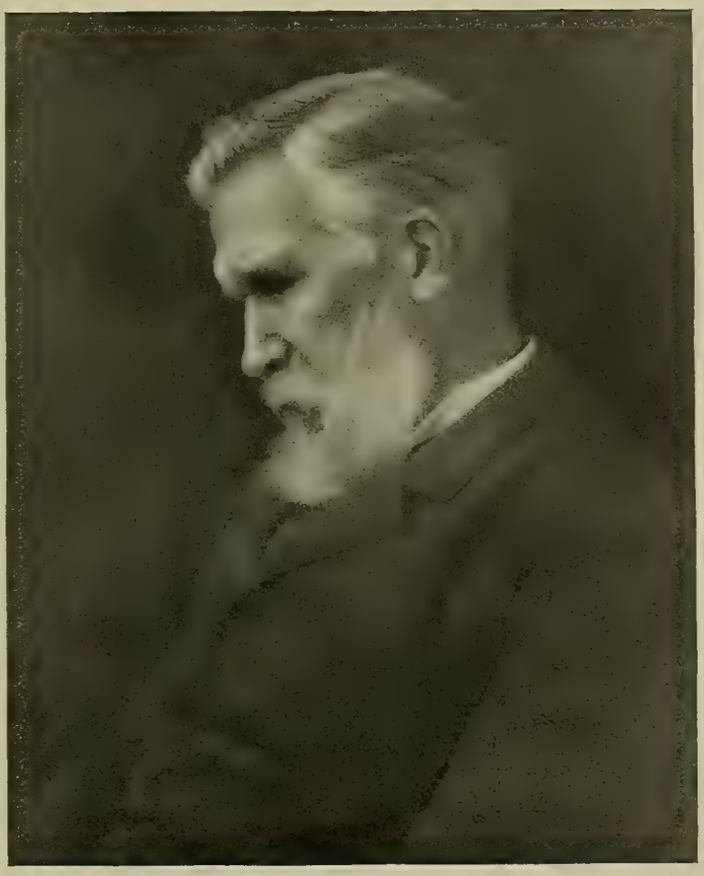
Death of Elisha Gray.

Electrical men throughout the country were shocked on Monday of this week by the news that Professor Elisha Gray, the distinguished electrical inventor, had died suddenly in Newtonville, Mass., a suburb of Boston, on Sunday night, January 20th. The following special dispatch to the Western Electrician from its Boston correspondent gives some particulars of the sudden taking-off of Dr. Gray:

Boston, January 21.—Professor Elisha Gray, the famous electrician, telephone and telautograph inventor, and lately prominent in perfecting a system of submarine signaling, was picked up unconscious in Newtonville Square at 9:45 o'clock on Sunday night, and died at a house nearby at 11:30 p. m. Death was due to heart failure. Professor Gray was 65 years old, and a resident of Chicago, but had for the last year and a half been living at 82 Huntington avenue, Boston, busied with Arthur J. Mundy in perfecting submarine signaling. He was returning through Newton from a visit to Mr. Mundy.

By the death of Professor Gray the field of electrical invention is deprived of one of its most eminent and valuable workers. Professor Gray devoted himself almost entirely to the development of systems of electrical communication, and in this work he achieved success and distinction. He improved the telegraph, and he ranks with Bell and Edison as one of the great trio of American inventors who brought into existence the electric speaking telephone. In later years the deceased electrician invented the telautograph, a most ingenious device for electrically transmitting in facsimile the written message or drawing of the sender. This was a very original and interesting invention, and upon it Professor Gray lavished years of time and a large share of his private fortune. Within the last year the indefatigable inventor, in collaboration with Mr. Mundy, had devised apparatus to accomplish practical results in submarine signaling or detecting sounds proceeding from a distance under water. In private life Professor Gray was a kindly, unostentatious gentleman, with a reflective turn of mind and a reverent, religious temperament. He was a man who inspired thorough respect for his unblemished moral character no less than for well-balanced mental attainments. He was gifted with the inventive faculty and employed the talents he had industriously and worthily for the betterment of existing conditions.



Elisha Gray

Elisha Gray was born in Barnesville, Belmont County, Ohio, on August 2, 1835. He was of Quaker extraction, the son of David Gray, a native Pennsylvanian of Scotch descent. When 12 years of age the boy Elisha was left to shift for himself by the death of his father, and was apprenticed to a blacksmith. The trade, however, proved too severe for him, and he became a carpenter's apprentice, following this pursuit for about two years. At the age of 21 he entered Oberlin College, where he remained for five years as a student, paying his expenses by doing carpenter work. While in college he devoted his time mainly to the study of physics; but it was not until his thirtieth year that he took up, specifically, the investigation of electricity. Once entered upon it, however, he became greatly interested. He was appointed instructor in physics and electricity at Oberlin and also taught these branches for a time at Ripon College. He was given the degree of A. M. by Oberlin College and of Ph. D. by Ripon. Later degrees of Sc. D. and LL. D. were also conferred upon the great inventor.

Professor Gray's first invention of importance (patented in 1867) was a self-adjusting telegraph relay, and, indeed, nearly all of his earlier patents were on improvements in telegraphic apparatus. About 1869 Mr. Gray removed from Oberlin to Cleveland and bought out the partner of Enos M. Barton, who was then engaged in manufacturing and dealing in electrical supplies. The firm of Gray & Barton continued to do business in Cleveland and later in Chicago for about three years, when it was merged into what was then the Western Electric Manufacturing company, now the Western Electric company, of which Mr. Barton is still president. Professor Gray's residence in or near Chicago thus dates from about 1870. For many years his home was in Highland Park, Ill., a North Shore suburb of Chicago. Here he had a very completely equipped laboratory, and at one time employed a considerable force of men in perfecting his inventions. Dr. Gray was distinctively a western man, although for the last year or so he had lived in Massachusetts, near the scene of his submarine-signaling experiments. In his most successful days, with his fine suburban home and laboratory, he sustained a somewhat similar relation to Chicago and the West that Edison does to New York and the East.

Dr. Gray's inventions during these business connections with Mr. Barton formed the basis of a large part of the manufacturing business of the concerns mentioned. His relay, while possessing much originality, never had a large use because it was not seriously needed. His first invention to have large commercial success was his printing telegraph, which was in demand for short private lines, and enabled anyone who could read to transmit messages by the manipulation of a keyboard somewhat similar to that of a typewriter. The instruments for this system were manufactured by the Western Electric Manufacturing company, of which Mr. Gray was mechanician and superintendent. Before the invention of the telephone Professor Gray perfected his harmonic-telegraph system, which was the first of its kind, and made extensive use of vibratory currents in telegraph lines.

He recognized, soon after 1870, that the speaking telephone was possible, and after perfecting the harmonic telegraph, which led up to his invention of the telephone, he said that he was "going to make it talk." There is no doubt that Professor Gray independently invented the speaking telephone, and, in fact, his caveat, filed February 14, 1876, the same day on which Alexander Graham Bell filed his application for a patent, described the invention as an "art of transmitting vocal sounds telegraphically," while Professor Bell's application spoke of "new and useful improvements in telegraphy." The document filed by Professor Gray contained the following statement: "It is the object of my invention to transmit the tones of the human voice through a telegraphic circuit and reproduce them at the receiving end of the line, so that actual conversation can be carried on by persons long distances apart." About 1878 Professor Gray left the Western Electric Manufacturing company to devote his time to the prosecution of his telephone patent rights. He made experiments on a line between Milwaukee and Chicago in 1877, at which the music of an organ in Milwaukee was plainly heard throughout a large hall in Chicago. After years of litigation priority of invention was awarded to Bell, Dr. Gray being considerably hampered in securing recognition of his rights by the contract between the Western Union Telegraph company and the American Bell Telephone company, his patents being controlled by the former company. Professor Gray secured a considerable sum of money for his telephone patents, but probably went down to his grave with the conviction that the full value of his invention of the telephone had never been realized.

Some of Dr. Gray's other important inventions which may be mentioned are the annunciator systems used in hotels and elsewhere, and his improvements on magneto call-boxes for telephone systems, which were largely manufactured by the Western Electric Manufacturing company after he severed his connection with the company.

The telautograph, which was first publicly exhibited at the World's Fair in Chicago in 1893, although Professor Gray had been working on it for at least six years previously, was, next to the telephone, his greatest work. It was invented and perfected by Professor Gray, and under his direction developed to a point where it was a working success. The telautograph, as its name implies, is an instrument for reproducing at the receiving end of a telegraph line the handwriting of the sender. By its means autograph signatures and drawings may be transmitted and recorded by the receiver simultaneously with their production in the sending office. At the time of the invention of the telephone, and even before, when the telegraph was not very extensively used for business purposes, the commonly expressed opinion was that neither could come into commercial use on a large scale because of the liability to error in the messages transmitted, and that business transactions must always be in black and white. This criticism was undoubtedly what suggested the telautograph to Professor Gray. When the speaking telephone was perfected, it was found that its mechanism could be made quite simple and yet be successful in operation. If the telautograph could have been simplified to the extent possible with the telephone, without impairing its working, it would have proved a powerful rival not only of the speaking telephone, but even of the common telegraph system in some of its branches.

For the last year or two Professor Gray devoted his time principally to the development of a system of submarine signaling, which embodies the detection of sounds produced under water several miles from the receiver. This system is intended not only for the actual transmission of signals, but also, as applied to ships of war, to give warning of the proximity of submarine vessels,

which would be made to announce their approach through the vibrations caused by their driving machinery.

Perhaps Dr. Gray's greatest honor came in 1893, when he was made chairman of the World's Electrical Congress which met in Chicago during the World's Fair. He was a member of the American Institute of Electrical Engineers, the American Philosophical Society, the Institution of Electrical Engineers of England and the Society of Telegraph Engineers of London. Besides writing a number of pamphlets and papers and contributions to the press, he was the author of "Telegraphy and Telephony," "Experimental Researches in Electroharmonic Telegraphy and Telephony" and "Nature's Miracles." At the Paris Exposition of 1878 he was awarded the grand prize and made chevalier in the Legion of Honor by the French government.

When connected with the Western Electric Manufacturing company as superintendent he generally had one or two men working on the details of his inventions, and after leaving this company he employed a number of mechanics in his shops on this kind of work. He once said: "It has been my habit all through my career as an inventor to put my ideas into the hands of my experts and to watch their construction until they have reached a point of perfection that satisfied me, and then to leave them for others to put on the market. I then go at something else, relying upon the statements of others in regard to their future exploitation." This is characteristic of the man, and in a measure explains why he did not realize more from his inventions. Perhaps his most striking trait as an inventor was his originality, which extended through his modes of reasoning to the results which he obtained.

Professor Gray belonged pre-eminently to that class of men whose type he characterized in his opening address to the World's Electrical Congress as "that other much-abused but necessary citizen, the inventor, the man who is, in some degree, a combination of all the rest, and is the product of daylight toil and midnight oil." In the same address he said: "The individual cannot be great in his vocation or profession if he always lives and works within narrow lines. Every science is more or less related to every other science, so that to know any one thoroughly it is necessary to know something of all. In other words, to be a good specialist one must begin by being a good generalist. * * * The pure scientist cannot carry on his work without the aid of the man who applies scientific discovery to useful machines and instruments of research, and the great world cannot be benefited by the discoveries of scientists and the applications of inventors without the man of practice, who is the medium between the inventor and the user." Professor Gray not only realized these truths, but was enabled by his early training as blacksmith, carpenter and joiner, student and teacher of natural philosophy, and manufacturer, to combine the three elements which he considered necessary to success in the field which he entered. His perseverance, breadth and independent manner of thought and absolute integrity in all his dealings commanded the respect of the world, and his death will be felt as a personal loss by many who knew him only by reputation, but who have been benefited to a greater or less degree by his achievements.

On January 1, 1862, Elisha Gray married Miss Delia M. Shepard of Oberlin, Ohio. His widow, two daughters and two sons—Mrs. W. C. Stubbs of Cleveland, Mrs. Charles S. Everett of Highland Park, Ill., Edward E. Gray of Hinsdale, Ill., and David E. Gray of Boston—survive him. Dr. Gray was an earnest worker in his church as in everything else, and was an elder in the Highland Park Presbyterian Church, where the funeral services were held on January 23d. He was buried at Rosehill Cemetery, Chicago.

Enos M. Barton, president of the Western Electric company, Chicago, the former partner of Professor Gray, spoke of him as follows: "He was a man of sterling character and a deep thinker along scientific lines. Genial, kindly and of a charitable disposition, he was loved by the workmen under his direction as a superintendent and was a general favorite among his large circle of friends. He had a thorough grasp of fundamental principles, and, what is equally important, the ability to apply them. It was largely to these two qualities that he owed his success as an inventor."

Col. R. C. Clowry, vice-president and general superintendent of the Western Union Telegraph company, said: "I knew Professor Gray well and found much pleasure as well as profit in his society. He was a great inventor and a delightful man. He had the inventive faculty to a marked degree. In addition, he was a man of deep and original thought. He was modest, quiet and self-contained, but nevertheless impressed the most casual observer as one possessing much intellectual strength in reserve. His death is a loss to the electrical industries."

Woods of the Philippines for Electrical Purposes.

By R. G. Mayse.

Although the forests of America furnish excellent woods for the manufacture of poles, arms, battery boxes, distributing boards, pole houses, desk telephone stands, pins and brackets for use in telegraph and telephone service, they are surpassed by the woods of the Philippines. There is no country in the world of the same size in which there are so many varieties of commercial woods available for electrical and kindred purposes. The writer has

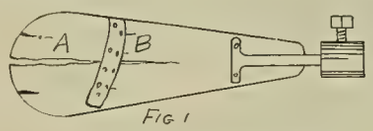


FIG 1

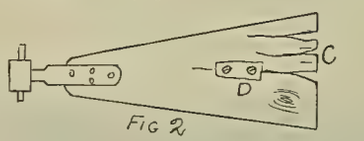


FIG 2

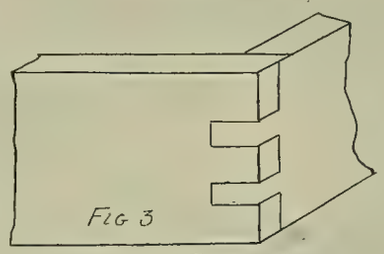


FIG 3

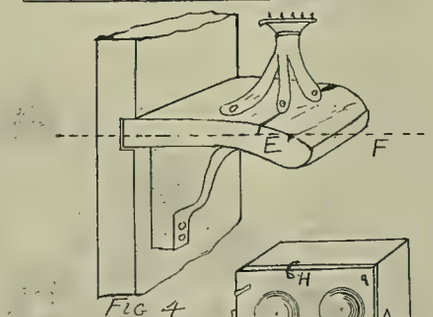


FIG 4

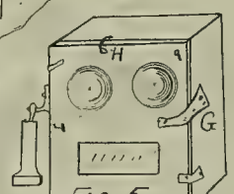


FIG 5

WOODS OF THE PHILIPPINES FOR ELECTRICAL PURPOSES. —CRUDE FAN AND TELEPHONE WORK.

visited the Forestry Bureau at Manila, a new establishment organized by the United States government and in charge of army officers. At this office they have plans of all of the important wood lands of the islands, and some of these lands are exceedingly rich. Most of them are unworked, and the field for the future operations in timber promises to be very profitable, for these wood lands contain extensive growths of mahogany, cedar, oak, ash, black walnut, rosewood and the like. Pine does not appear to be so liberally grown, although there are some pine forests in Mindanao. On Luzon one finds all sorts of hardwoods, and some of the trees are of such dimension that tables are cut from them 10 feet in diameter. One often eats his lunch from a table on the Isle of Panay made of one piece of mahogany, large enough to accommodate a dozen persons. The writer traveled through the leading southern islands and was surprised at the large supplies of hardwoods available and which no one appeared to own. The miners and others who want wood simply go out and cut it, and there is no one to make any claim for pay. Manufacturers of wood supplies for electrical purposes could find an abundance of cheap stock here. The wood can be had for the cutting, as the lands are mostly in the possession of the government, while the cost of labor for the cutting would be about 10 cents a day per man. The cost of hauling the lumber to the seacoast for shipment would not be much, as the natives own draft cattle, which can be hired for about eight cents each. The only trouble is that there are no saw mills and the wood has to be cut up by hand, a slow and tedious process, yet inexpensive, as the native sawyers also work very cheaply.

The demand for hard and other types of woods locally is now good, as the electrical and other concerns of the islands have lately put in thousands of fans for cooling the air. These fans are, of course, operated by electrical power in and about Manila and other places where they have an electrical power station in operation. In other places the fans are operated in any way that is practicable. As to the wood portion of the fan, this is often abused, and the native electricians are not to be trusted. They do considerable patchwork, and in Fig. 1 is shown a fan, illustrating the native mode of piecing up an article. The fan is split at (A) and a piece of metal is riveted on at (B). Of course, the weight of the metal throws the fan out of balance, and trouble ensues. Then I have seen fan blades cut off square, as at (C), Fig. 2, and

WOODS OF THE PHILIPPINES FOR ELECTRICAL PURPOSES. —NATIVE CARPENTERS MAKING PINS AND CROSS-ARMS.

the ends in bad shape, as shown. Perhaps a patch is put on at (D), and this adds to the trouble.

Although the average Filipino workman uses a surplus of nails, screws and bits of wire in the repairing of split-wood fans and the like, when it comes to making a new wood article, such as a telephone box, he tries to do without nails, for he has been taught that nails are expensive. Fig. 3 shows how the Filipino puts boxes up without nails. The dovetailing has to be accurate and fit very tightly. Sometimes little wedges are driven in to aid in tightening the edges, but no nails or screws are employed. Probably this system of put-

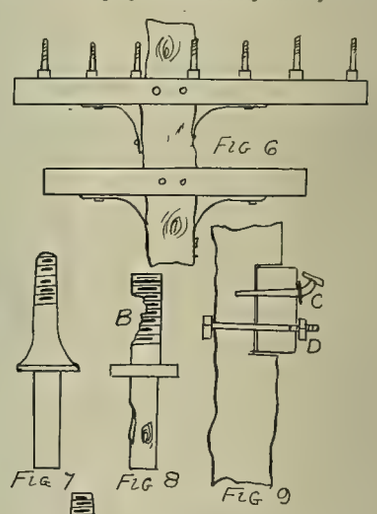


FIG 6

FIG 7 FIG 8 FIG 9

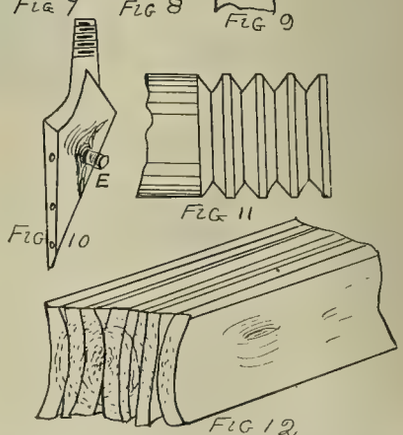


FIG 10 FIG 11

FIG 12

WOODS OF THE PHILIPPINES FOR ELECTRICAL PURPOSES. —POLES, PINS AND CROSS-ARMS.

ting up cases and boxes will cease, now that the American hardware and electrical-supply stores of the islands are carrying lines of screws, nails and brads, which they sell at reasonable prices. The prices at the old Spanish hardware stores were so excessive that only the rich could afford to buy nails and screws.

In the making of brackets for stands for fans, motors and other small devices for use in houses, stores, offices, shops and other buildings, the native carpenter makes the mistake of utilizing the good lumber of the islands without allowing it to season properly. The result is that one who looks over

the work of the Filipino carpenter will see that some of the shelves for the little machines are badly warped out of shape, as shown by the dotted lines (E) and (F) in Fig. 4. There are no means for mechanical seasoning of woods in this country, and the natives have always been accustomed to use the wood green or to permit it to dry out and season under the influence of the rays of the hot sun, which causes considerable warping and cracking. The Americans have established seasoning plants in Manila and near Iloilo, but the work is not extensive enough to meet the demand. There is plenty of room for money to be made from a first-class, wood-seasoning plant in the vicinity of Manila, Iloilo, and, in fact, any of the leading cities of the largest islands of the Philippine group.

There are in service in the Philippines at the present time several thousand telephone instruments, some of which but lately arrived from America, while others, which came over here about 18 months ago, are already in bad repair, due to the rough handling to which they are subjected by the native linemen and others. There are not nearly as many Americans here as are needed by the Signal Corps service, and the result is that the officers are obliged to hire hundreds of Filipinos to do work among the instruments, on the line and for general service. Some of these natives are employed to go from station to station with a slim outfit of native tools on their back to look out for and repair defects in the telephones in the interior, or wherever the lines may run. I have seen these native workmen put a good instrument out of service in a very short while in attempting to make a repair of some minor part. They will overhaul the whole affair to get at some little imperfection which a skilled hand could rectify in five minutes. During one period there was a shortage of instruments and battery boxes, and, in fact, all parts of the needed outfits. Boxes were made by the local native carpenters, one of which is shown in Fig. 5. The woods were good, but the means for manufacture defective, and these boxes are being thrown out of service as fast as new ones arrive from America. In the home-made box I observed that instead of using hinges, the native nailed on pieces of leather, as at (G), while the mode of driving in the few wire nails he had available is illustrated at (H), they being bent and doubled over, as shown. Still, the wood employed in all of these boxes and other parts of the electrical equipments is superior in character and suitable for making of nicely finished articles.

The linemen of the Philippine service have in recent months been able to get a great many cedar poles from the forests of the archipelago, there being unlimited growths on Panay, Luzon and two or three of the southern islands of the group. These cedar poles are superior to the cocoanut poles, which have been utilized extensively in the first lines which were put up. The cedar is also used to good advantage for cross-arms. In Fig. 6 is shown a typical pole, with cross-arms, as put up by some of the Filipino linemen. The pins are made in this country by natives, but, like most other supplies, are always short. There are two shops in Manila and one in Iloilo trying to supply the market with pins made from a species of wood that ranges between hard and soft and is about right for the purpose wanted. But the natives have no effective means for turning the pins. They rig up turning lathes which must be operated by hand-power, a boy turning the wheel. The belt from the turning wheel encircles a little wood wheel on the shaft, to which the article to be turned is attached, and this belt is always slipping, so that the workman cannot apply enough pressure to take off much of the wood, and he must keep digging away at it until the pin is gradually worked down to the desired size. This takes time and also results in the production of an inferior pin. As to the cutting of the thread on the ends of the pins, this is a problem which was beyond the Filipino workmen for a long time. Even now, in some of the shops, they work out the threads by means of a hand knife, but as the cost per day for this sort of labor is but 10 or 12 cents a man, it can be seen that the labor expense is not high. In Fig. 7 is shown the type of native pin usually made. In Fig. 8 is another form of pin used. Often the workmen are very negligent about the assorting of the pins, and I have seen specimens with pieces broken out, as at (B).

The mode of attaching cross-arms, as employed by the average native, is shown in Fig. 9, which illustrates the need of watchfulness over these fellows. They cannot seem to drive an American spike correctly, and will manage to bend it over in some way, as at (C). Some of them use the long-bolt-and-nut method, as at (D). The bracket in Fig. 10 shows a weak spot where the knotted place at (C) is breaking out. The native makers of brackets and pins do not use the proper judgment in the making of these brackets and will let an article go through, even if it is weakened by a knot. In Fig. 11 is a sample of one of the finished threaded pieces in which the thread is worked out by hand. This is quite a trick of the natives, and an American would not be so foolish as to idle his time at it, for it requires a day or more to get the article finished. There is great need for machinery here for the making of threads on wood pins and brackets for telegraph and telephone service.

In Fig. 12 is a sample of the way much of the wood warps as soon as it is split by the native carpenters. They are trying to make cable distributing boards, panel boards, etc., by the wholesale, and even with the excellent assortments of woods, they fail to get proper results. The tendency, of course, is for the fiber of the wood to expand in such way as to cause the exterior sections to turn outward, as in the cut. If the natives possessed the proper apparatus for seasoning the wood, this would not occur to any serious degree, as it does now. One can see great piles of cut lumber in the yards, and all of it is warped and twisted, as shown. The birch found in the islands is being used for telephone work, and is very like American growths. The hard pine grows in the sandy sections of the islands in the south and is extensively used. The rosewood is an exceedingly good variety and suitable for use in the making of nearly all classes of electrical devices in which wood is employed. A type of locust is grown here which is used by some of the carpenters, but this wood is subject to the inroads of the white ants, which pests destroy even large timbers in course of time by eating through them.

French Cables Proposed.

A bill has been proposed in France for the construction of an extensive network of submarine telegraph cables and overland connecting lines. Included in the provisions of the bill are lines in the Atlantic from Rochefort to Dakar, 2,224 miles; Dakar to Buenos Ayres, 3,874 miles; Dakar to Kotonou and Libreville, 2,168 miles; Libreville to Mossamedes, 1,074 miles. Other cables are proposed as follows: In the Indian Ocean, a line from Tamatave to St. Denis, 381 miles; in the Chinese Seas, from Saigon to Shanghai, Port Arthur and Taku, 2,865 miles, and from Saigon to Batavia, 1,291 miles; in the Levant, from Bizerta to Sebastopol and Bayrouth, 2,173 miles. The land lines comprise lines from Macao to Canton, Taku to Tientsin, and Ergasteria to Athens, the total cost of all lines being estimated at 129,728,591 francs ($24,837,618). Other systems, to cost an additional 106,000,000 francs ($20,458,000), are foreshadowed in the bill.

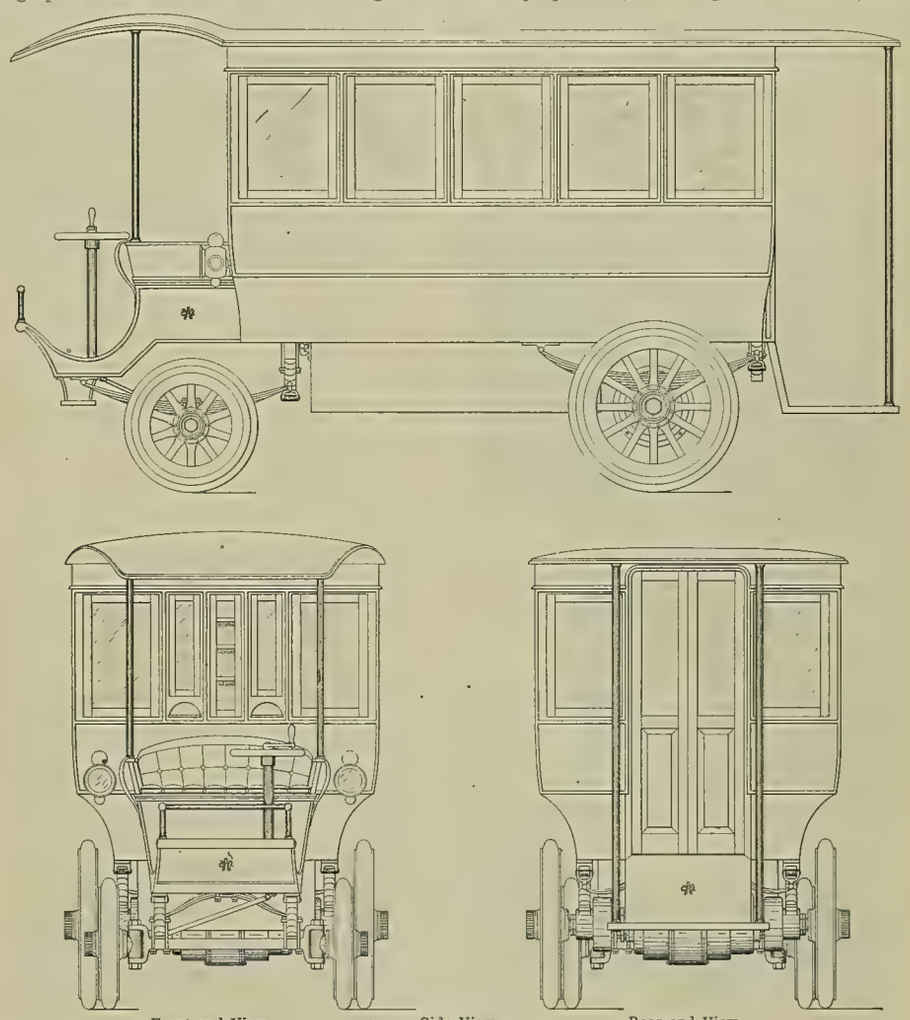
Emperor William is interesting himself in the subject of electric propulsion for heavy railways, and is using his influence in aid of some high-speed trials, which are soon to be made between Berlin and Zossen. Single cars carrying about 50 people are to be used, and it is hoped that a speed of from 125 to 150 miles an hour will be demonstrated as feasible.

New Electric-vehicle Service Proposed for Chicago.

A new corporation, to be known as the Chicago Automobile Transportation company, is being organized in Chicago by Clinton E. Woods, the well-known automobile designer. It is asserted that certain Chicago capitalists have associated themselves with Mr. Woods for the purpose of developing the proposition as rapidly as possible. Mr. Woods is now busy, not only preparing plans for the building of the new vehicles, but also in preparing schedules for the various routes on which they will run and the arrangement of a general system of operation, which is to include a cab service, running in conjunction with the electric buses, and which is proposed to be on the following plan: Bus fare to any point will be five cents; cab rates within the district bounded by Twenty-second street, the lake and the main and south branches of the river, including the Chicago and Northwestern depot, will be 25 cents, which price will include a transfer on any of the buses to any point to which they may run. Transfers on the buses will also be made from one line to any other line running in the same direction.

The proposition, according to Mr. Woods, is for the installation of 348 buses and 160 cabs at first to be run as follows: Starting at the Northwestern depot, 12 buses will be commissioned to run between the depots exclusively for the purpose of transferring passengers, hand baggage, etc. This will be supplemented during the heavy suburban traffic morning and evening by 26 additional buses running directly from the depots to the large department stores and office buildings. Arrangements are also being made by Mr. Woods to commence a special service to the department stores for the transportation not only of their patrons to and from their homes, but of their help to and from their homes, and he says he is also arranging a service for the large office buildings, which, at a moderate rate, will convey their occupants from door to door between home and office.

These special services will be extended south as far as Fifty-first street, between Michigan avenue and Lake avenue, north to Lincoln Park between the lake and Clark street, and west as far as Garfield Park, extending north to Chicago avenue and



Front-end View. Side View. Rear-end View.

NEW ELECTRIC-VEHICLE SERVICE PROPOSED FOR CHICAGO.—BUS TO BE USED.

south to Twenty-second street. A regular bus line will be run from Fifty-first street. It will give transfers to the North Side line of buses running to Lincoln Park, the buses going up one street and coming back another, which, to some extent, will be the arrangement on the South Side line. Cab rates extending beyond the downtown district will be at the rate of 25 cents a mile for four passengers, or 6¼ cents a mile for one, each cab seating four people.

The Chicago Automobile Transportation company will build all of its own vehicles after Mr. Woods' designs. As it would in any event have to build a plant to maintain its own vehicles, it has concluded to increase it somewhat and do its own manufacturing. However, the manufacturing will consist chiefly in building the vehicle bodies and assembling the parts, as it is planned to use motors, batteries, controllers and other parts made for the company by different manufacturing concerns.

Four stations will be provided. One will be near the Union depot and one as near as possible to the terminus of each regular route. These stations will be used as stables and for charging purposes.

In the accompanying illustrations are shown side, front and rear-end views of the bus which the company proposes to use. Each bus will have a seating capacity for 24 people, and in the summertime will have smokers' seats on top that will carry eight more. Each bus will be equipped with a specially designed nine-horsepower motor, having an overload rating of 130 per cent. The battery will consist of 40 cells, with a 222-ampere-hour capacity, working on a five-hour discharge rate.

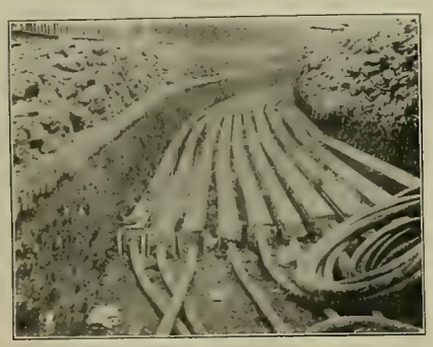


FIG. 5 GLASGOW MUNICIPAL ELECTRIC PLANT.—FEEDER AND DISTRIBUTING MAINS.

The controller will be arranged for four speeds, the maximum being 10 miles an hour. Wood wheels, with 3½-inch solid-rubber tires, will be used, and the axles, as well as the motor, will have ball bearings. Three separate brakes will be provided, one electrical and two of a mechanical nature. The vehicle itself will weigh 3,600 pounds, exclusive of the battery, which will have a weight of 1,800 pounds.

Later it is the company's intention to take up the question of parcel delivery by automobiles and to put on several hundred vehicles of this class to make delivery of merchandise for both the large and small stores, for carrying mail, distributing newspapers, and general express business.

New Turbines for the Niagara Power Plant.

The Niagara Falls Power company has awarded the contract for six new 5,000-horsepower turbines, which are to be installed in the new wheel-pit now in course of construction. This is one of the most important contracts connected with the new installation, and as there have been rumors that the style of turbine is to be changed as compared with those at present in use, the award of the contract has been awaited with much interest. The I. P. Morris company of Philadelphia, Pa., has captured the order. This company built the turbines now in operation in the present wheel-pit. The new waterwheels are to be built after designs made by Escher, Wyss & Co. of Zurich, Switzerland. The turbines in the old pit were designed by Piccard, Pictet & Co. of Geneva, Switzerland, and the new ones will differ from them principally by the guides and buckets being enclosed in the wheel-case and having draft tubes which will allow of the full head available. The adoption of the designs of Escher, Wyss & Co. is the result of a competition invited after the return of Dr. Coleman Sellers and William A. Brackenridge from Europe last spring. The new turbines will be delivered sometime in August next, and they will be used to drive the six 5,000-horsepower generators ordered in November last from the General Electric company of Schenectady. The consulting hydraulic engineer of the Niagara Falls Power company is Clemens Herschel.

Lighting Features of Pan-American Exposition.

When the lighting of the Pan-American Exposition is considered, it should be remembered that arc lights will be used for the interior lighting of the large buildings and for lighting the alleyway, 20 feet wide, that will surround the grounds, in order that a proper patrol system may be maintained during the period of the exposition. Incandescent lamps will be used throughout the grounds in great numbers for lighting and decorative purposes, also for outlining the buildings and portraying the beauty of flower-beds in certain of the basins. In other words, arc lighting will be used for the principal interior illumination, while incandescent lighting will be the system employed for exterior lighting. Thus the arc lighting will be only for patrol and service purposes. In the incandescent lighting, utility, as well as decorative features and usefulness, will be considered. It is intended that the lighting throughout the Esplanade, while maintaining at all points the unit essential for the public accommodation, shall increase in brilliancy and decorative effect until the surroundings of the Electric Tower are reached. The light unit per square foot will be greater than at any previous exposition.

The incandescent lamps about the grounds will be grouped on poles, each of which will have from 26 to 100 lamps. In all there will be about 1,500 of these poles, the majority of them being about nine feet high. These poles are of wood and have an artistic staff covering to develop them in column form. The wiring will be concealed.

The climax of spectacular effects in water and lighting will be reached in the basin in front of the Electric Tower and in the niche of the tower. On each side of the central axes of the structure will be located two groups of jets of water, with 26 large pillar jets, which will throw water columns to a height of 50 feet. On the arc of a circle, whose center is the niche, there will be located some 42 large jets, throwing water in parabolic curves toward the cascades in front of the niche. These jets will be so arranged as to make a very ragged stream. It will not be a solid stream, but it will not be so broken as the water of the spray jets. From the niche itself water will be thrown by means of a deflector into an immense water screen. This deflector will break the entire volume of water, consisting of 13,000 gallons, so that it will form the magnificent stream referred to. At this point there will be arrangements of color disks, which will blend the prismatic colors of light thrown on the water effects in front of the Electric Tower so as to produce a constant change of color, the effect of which will be very fine. It is worthy of note that the water displays on the exposition grounds will be operated continuously, but only under electric illumination at night.

One of the fine lighting features of the exposition will be about a bed of flowers in a semicircle around the Fountain of Abundance. By deftly concealed lamps the beauty of the bloom and foliage will be portrayed at night to the delight of all. There was a bed of this kind at the Omaha Exposition, and it commanded much admiration.

The Goddess of Light, which is to have position on the apex of the Electric Tower, will be a winged figure having a height of 18 feet and well proportioned. It will be made of staff, the entire weight resting on the toes of the right foot, while in her right hand she will hold aloft a torch significant of her creation. This figure will bring the full height of the tower up to 391 feet. It is evident that the placing of the goddess on her position is destined to be a task of no small proportions. In fact, it will be one of the remarkable feats of the exposition construction. O. E. D.

Thirty-eight new boxes were added to the Chicago fire-alarm telegraph system during 1900.

Glasgow Municipal Electric Plant.

By Frank C. Perkins.

The recent installations in the municipal lighting plant of the city of Glasgow, Scotland, are particularly interesting, giving a fair idea of recent direct-current practice in Great Britain.

The attractive exterior of the Port Dundas station is seen in the accompanying illustration (Fig. 1), while the sectional drawing shown in Fig. 2 gives the details of construction and general arrangement of the boiler, engine and dynamo rooms of this station, which is located on Edington street.

The municipality took possession of the electric-lighting plant of Glasgow in 1892, and, acting on the advice of Lord Kelvin, a three-wire, direct-current system was adopted. Mr. W. A. Chamen has been resident engineer for a number of years, and the construction of the new central stations has been pushed forward to completion under his direction.

FIG. 1. GLASGOW MUNICIPAL ELECTRIC PLANT —PORT DUNDAS STATION.

The new works for the north side of the river are situated near Garscube road, on the Glasgow branch of the Forth and Clyde Canal. The new works for the south side of the city are situated near St. Andrews Cross and the Eglinton street-railway station of the Caledonian railway. The engine and boiler rooms of this station are sufficient in size to accommodate 15,000 horsepower of boilers, engines and generators.

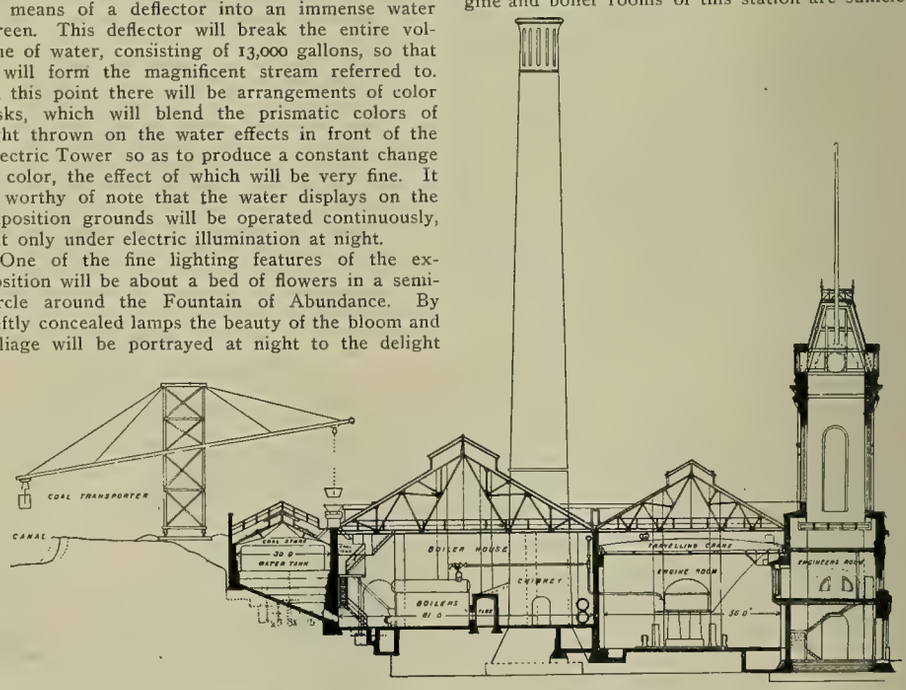


FIG. 2. GLASGOW MUNICIPAL ELECTRIC PLANT.—PORT DUNDAS STATION.

The Port Dundas power station is to be 560 feet long when completed, but at present only the central portion has been finished, having a length of 220 feet. The boiler house is equipped with 10 1,100-horsepower boilers, built by Babcock & Wilcox of Renfrew. These boilers are supplied with chain-grate stokers and superheaters, and have a total capacity of 11,000 horsepower, working under a pressure of 200 pounds to the square inch. The engine room, illustrated in Fig. 3, is equipped with English, German and American apparatus, showing the uncertainty of English central-station work. The English representatives of American and German firms are placing large orders, to the exclusion, largely, of English apparatus. The American ap-

paratus already installed was supplied by Laing, Wharton & Down of London, and consists of a Ball & Wood engine, having a capacity of from 750 to 1,000 horsepower, operating at 150 revolutions per minute, the American generator being of the Walker type. Preparations are being made to install two large American generators of the Westinghouse type, each of which will be driven by a 3,000-horsepower Willans engine, operating at a speed of 180 revolutions per minute.

The German unit consists of a Schuckert dynamo, operated by a Paul 900-horsepower engine, supplied by Mavor & Coulson. This engine was built at Dumbarton, and is of the three-crank, triple-expansion type, operated at 150 revolutions per minute. The English dynamos, built by Crompton & Co., are operated by 200-horsepower and 400-horsepower engines, installed by the Mirrles, Watson & Yaryan company. Two direct-connected generators were also supplied by the British Thomson-Houston company, each directly coupled to a Belliss engine of 1,500-horsepower capacity. The normal speed of these machines is 230 revolutions per minute. In addition to the above machines, there is a large Crompton generator, operated at 230 revolutions per minute, by a 1,500-horsepower Willans engine.

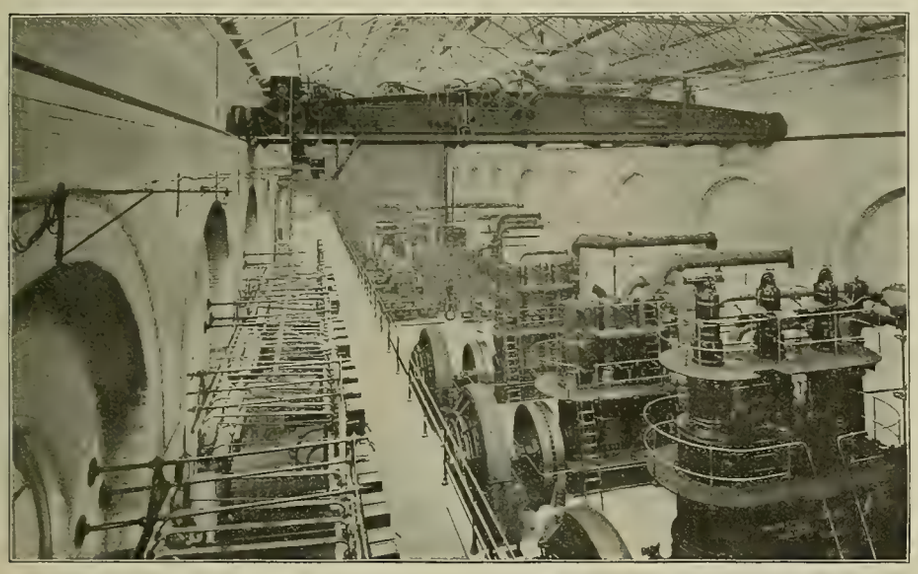


FIG. 3. GLASGOW MUNICIPAL ELECTRIC PLANT.—GENERATOR ROOM IN PORT DUNDAS STATION.

Besides the equipment mentioned there are in regular use two sets of motor-driven boosters, used for providing the necessary extra pressure required for charging the accumulator plant. This storage-battery plant consists of two sets of 167 cells each, shown in accompanying illustration (Fig. 4). One set is connected on each side of the three-wire system, making a total of 334 cells. The cells are mounted on steel stands and are supplied with lead covers, supported on insulators—a practice not in general use in this country. The normal capacity of the accumulator plant is 1,100 ampere-hours. The normal rate of charge is 180 amperes and the normal rate of discharge 150 amperes for seven hours. The cells are capable of being discharged without damage, should necessity require it, at a rate of 300 amperes. It is therefore possible to supply 600 lamps from the battery for seven hours or double that number for about three hours.

The switchboard apparatus was supplied by James White of Glasgow and Messrs. Gowans of Manchester. On account of the excessive output to be dealt with (more than 40,000 amperes), special switchboard apparatus was found necessary. The voltmeters were of the Kelvin type, and the Kelvin recording and indicating ammeters were also used, reading to 2,000 amperes.

Triple concentric cables are used for the feeders and large distributing mains, four of the former and six of the latter being shown in Fig. 5. These cables are lead sheathed and are built up of stranded-copper conductors, the outside of the cables measuring 3⅛ inches in diameter. These cables are among the largest in the world, and each cable is capable of conveying electric energy to the extent of 700 horsepower a distance of two miles.

The Phœnixville (Pa.) and Bridgeport Electric Railway company will build an electric street railway 12 miles long, to connect with the Norristown and Philadelphia electric railway at Bridgeport. A 300-horsepower station will be built at Valley Forge, and work on the new road will be commenced about March 1st.

Electric Printing.[1]

By H. B. Wren.

A London photographer Mr. Friese Greene, has succeeded in producing electrographic paper, which promises to revolutionize the "art preservative of all arts." Using the new, patent paper, the Electrical Inkless Printing syndicate has recently perfected a process of printing without ink. Instead of saturating the paper with the sensitizing materials, as has hitherto been done, it has been found best to mix them with the pulp in the process of manufacture; and so a radical departure has been made and a new machine-made paper has been invented that has rare properties.

As the chemicals used are abundant and cheap, the new medium can be produced as cheaply as common paper. The prepared paper is stable and colorless; is unaffected by any other agent than the electric current; may be kept indefinitely and sent to the press directly from the roll as manufactured, with no preliminary treatment whatever; yields instantly a dense, black, permanent print; requires no subsequent "fixing" or developing; indeed, is ready for distribution immediately, as there is nothing like ink to smirch or require drying; in short, meets all the requirements of a perfect medium for electric printing.

Given such a suitable paper, and the mechanical problems incident to a practical system of electric printing are comparatively simple.

The London syndicate, having satisfactorily completed the experimental part of its undertaking, is now engaged in demonstrating the workings of the new process and overcoming the objections of printers.

The machine for electric printing is simply an ordinary press divested of all its inking mechanism and having the cylinder or paper-bearing surface covered with a suitable conducting metal. The work of "make ready" is the same as for ordinary printing; and line blocks, electrotypes, woodcuts, halftones, engravings, all kinds of designs in relief, may be used at will.

The "form" is connected with one pole of the dynamo or battery—for most purposes the current may be taken from an ordinary incandescent-light wire; the paper-carrying cylinder or surface is connected with the opposite pole. Thus, the metal surfaces of both cylinders are the electrodes, while the paper is in reality a very thin cell in which the pulp is an inert medium and the contained chemicals are the electrolyte. As the cylinders approach each other to press the paper as it is fed between them, the current is switched on automatically and flows from one cylinder through the paper at the points of contact to the other cylinder, the impression being produced instantly by electrochemical action. A governor, or variable "resist," permits an operator to control the quantity and intensity of the current, which must be continuous. The paper possesses magnetic electric properties, and consequently the amount of current required is surprisingly small. The voltage used may be from 10 to 100, and four amperes are ample for the largest machines. All inking mechanism being dispensed with, the power necessary to drive the press is greatly diminished. For a given piece of work the cost of current for the actual printing is said to be only one-half that of ink, while a saving of at least one-third in the original cost of presses is assured.

The new process lends itself readily to all speeds, even to the fastest web presses. At an exhibition at Blackpool, England, witnessed by a large company of printers and scientists, a rotary press was run at the rate of 6,000 impressions per hour, and the work was declared perfect in every particular.

Thus far the efforts of the syndicate have been almost exclusively given to black print, but incidentally there have been some promising developments in the line of color work.

Relative to the appearance of electric printing, The Journal of Printing and Kindred Industries of the British Empire says it greatly resembles lithographic work. The Inland Printer states that samples furnished that paper "are remarkable in their clearness of outline and solidity of color."

At last accounts several of the great London dailies had placed their plants at the disposal of the syndicate for an exhaustive test of the process.

So far as known, there have been no attempts as yet to utilize this electrographic paper for any other purpose than presswork; but evidently its field is far wider than this, and not unlikely it will soon be made use of in other fields of graphic art.

1. From the Scientific American.

The Brussels Conference.

Walter H. Chamberlain, assistant United States commissioner of patents, has returned from the conference for the protection of industrial property at Brussels, to which he was a delegate. The convention at Paris in 1880 provided for periodical conferences for revision of the regulations adopted at that time. The conference just held is the third under this provision.

The members of the Brussels conference proposed some important additions to the patent regulations, and this conference will probably take rank with the original convention. Under the regime suggested, there will be no more lapsing of a patent in one country because it has lapsed in another for non-payment of fees. A uniform period of three years from the date of application has been decided upon as the limit to the time in which the patent need not be worked. The convention has also proposed to extend the time of filing applications from six or seven months to a uniform period of one year. The provisions of the convention against false indications of origin were extended to agricultural products, thus protecting American fruits, and a new article was inserted granting the same protection against unfair competition to citizens of the United States as is granted to citizens or subjects of any other of the countries of the union.

The delegates, of whom 45 were in attendance at one time were the ministers of the several countries interested; supported by the heads of the offices of the different countries which are concerned with industrial property, professors of universities, members of legislative bodies, and lawyers of recognized standing as authorities on the subjects discussed. It is said that every first-class power except Russia has now adhered to the convention or given notice of such intention.

FIG. 4. GLASGOW MUNICIPAL ELECTRIC PLANT.—ACCUMULATOR ROOM.

The mayor of Oshkosh, Wis., advocates a municipal electric-lighting plant.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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We are sure that we voice the general sentiment when we say that the electrical men of the United States extend a sympathy that is real and earnest to their co-workers in the British empire on the occasion of the death of Victoria, the great queen, the good woman.

We publish this week, almost entire, the report of the committee of the Northwestern Electrical association on the relation of central-station employes to correspondence schools. With the discussion, the report occupies over seven columns of the Western Electrician, but we consider that the importance of the subject justifies the amount of space given to it. Correspondence schools have become an important factor in American industrial life, and it is well to consider carefully their advantages and limitations. The situation is canvassed fully and impartially in the report, and there are few readers of the Western Electrician who will not receive benefit from an attentive perusal of the paper.

Few persons realize the rapidity with which the primary battery is disappearing as a source of current in telegraphy. For 50 years this useful type of apparatus was relied upon to operate the telegraphs of the world, but within the last few years the dynamo has demonstrated its superiority for this work and is now rapidly superseding the battery. The work of reconstructing the generating plants is proceeding in all the considerable centers of telegraphic work in this country, having been already accomplished in the cities of the first class, such as New York, Chicago and St. Louis.

Take the western division of the Western Union Telegraph company, for instance. In Chicago and St. Louis the machines have been installed for some time, but in a number of smaller cities the change has been but recently made or is now under way. In Cincinnati 13,000 gravity cells have just been replaced by 18 motor-dynamos. These machines are wound for 220 volts on the motor side and for voltages ranging in different generators from seven to 340 volts on the dynamo side. The machines of higher voltage are used for supplying the long quadruplex lines. Current is supplied from central-station mains, care being taken to have other sources of supply in reserve in case of necessity. This is the practice followed in all the newer plants, which are installed under the direction of J. C. Barclay of Chicago, the electrician for the company.

Among other cities where the motor-dynamos have just been, or are now being, installed, are Cleveland, where 11,000 cells were replaced; San Francisco, 10,000; Denver, 9,000; Toledo, 5,000; Minneapolis, 5,000; Houston, 5,000, and Duluth, 3,000. Here, in eight cities, is a total of 61,000 cells of primary battery replaced by motor-dynamos within the last few months.

Germany seems to have succeeded Great Britain, for the moment, as the country terrorized by American competition. Recently a Hamburg paper of importance, discoursing warningly of "The American Danger," basing its article on the annual report of the secretary of the United States Treasury, proposed these remedial measures: "We must fight Americanism with its own methods; the battle must be fought with their weapons, and wherever possible their weapons must be bettered and improved by us. Or, to speak with other and more practical words, Germany—Europe—must adopt improved and progressive methods in every department of industry; must use more, and more effective, machinery. Manufacturers as well as merchants must go to America, send thither their assistants and workingmen, not merely to superficially observe the methods there employed, but to study them thoroughly, to adopt them, and wherever possible to improve upon them, just as the Americans have done and are still doing in Europe." No one in the United States surely can take exception to this advice. Let our German friends come over on their sharp-eyed tours of observation; they will be cordially received, unless the traditions of American industrial establishments are suddenly abandoned. But let them beware of the subtle atmosphere of Americanism; it is very infectious, and unless the visitors stoutly set themselves against it they are likely to become imbued with it to the extent of remaining here as a component part of the republic. But there is another danger in going back to the Fatherland, for by the time the investigators have landed on German soil the inconsiderate Americans will have invented some new machinery or devised some new methods that will demand renewed attention on the part of the champions of German trade There seems to be only one way out of the difficulty, and that is the establishment of relays of Teutonic pupils in the art of being up-to-date, crossing and recrossing the Atlantic in endless succession. There would thus be a constant circulation of open-eyed and open-eared Germans among us, to the great benefit of transportation lines and the inn-keeping trade.

The death of Elisha Gray takes away a man who contributed much to the development of the electrical transmission of intelligence in the last third of the nineteenth century. Professor Gray was essentially an inventor, and it may truthfully be said that he was a great one, although it is equally true that he failed to reach the greatest success through a certain indifference to final details of improvement and an apparent lack of business foresight. He liked to plan out and develop an invention on broad lines until it gave promise of practicability, and then leave to his assistants the final touches necessary to make a workable piece of apparatus for everyday use. He obviously possessed inventive talent of the highest order, but there seemed to be in his character an element of irresolution or indecision that prevented him from reaping the full benefits of his own conceptions and demonstrations.

Professor Gray certainly conceived the idea and method of making an electric speaking telephone independently of anyone else, and he filed a caveat for the prospective invention on the very day that Bell filed an application for a patent on his magneto telephone. "Gray embodied in his apparatus the main principle upon which all successful battery transmitters are based," says Mr. K. B. Miller, in his book on "American Telephone Practice." Bell, however, applied for a patent; Gray simply filed a caveat, and the priority of invention was awarded to Bell, after years of litigation. If Professor Gray, who was incontestably more of an electrician than Professor Bell (although the latter had the better knowledge of acoustics), had worked out the details of his idea with more promptness and foreknowledge, it is very possible that the greater honors and emoluments that came to Professor Bell would have been his.

In the telautograph Professor Gray displayed great originality. He devoted years of time and a large amount of money to the perfection of this ingenious invention, and he made a machine that accurately transmitted the sender's written message in facsimile to distances as great as from London to Paris, as was actually done. As originally invented, the telautograph was a complicated and expensive instrument, requiring four wires for the transmission line, and it could not compete with the simpler telephone system, even with its advantage of a facsimile record. Lately it has been much simplified, and it now gives promise of greater usefulness. But in its original form, as exhibited at the Chicago World's Fair of 1893, it was a wonderfully ingenious device and was in itself an eloquent demonstration of the ability of its inventor.

Gray's printing telegraph was a valuable invention in its day, and at one time a number of the instruments were in use on short lines. Among his other work, an improved telegraph relay, hotel annunciators and telephone signaling systems may be mentioned, not forgetting the harmonic telegraph nor his recent valuable experiments to demonstrate the practicability of detecting sounds under water, by suitable apparatus, for distances up to 12 miles. Thus a partial list of Professor Gray's inventions shows that he is entitled to a high and honorable place in the select fraternity of American inventors. As a man he was simple and unassuming, reserved but unpretentious. Morally and socially, his life was on the highest plane of American citizenship; he could look the world in the face without fear and without reproach.

Trade Education of Central-station Employes.[1]

By D. C. Jackson, F. A. Copeland and H. L. Doherty.

The investigations of this committee have shown them that they have a big subject to deal with and one which is rapidly changing in aspect. This report may therefore be characterized as preliminary, and it is our belief that the committee may be advantageously continued for the purpose of further investigations into the working of correspondence schools of various types, with a view to making a more complete comparison of the results obtained by these schools.

For the present the committee has felt that it is desirable to divide the subject and discuss it under three heads:

1. Can correspondence instruction be relied upon to increase the usefulness of electric central-station employes to their employers?

2. Are existing courses of the correspondence schools properly adapted to be of the greatest use to electric central-station employes and through them to their employers?

3. What provisions may central-station owners reasonably supply for the purpose of encouraging their employes to study the requirements of their business, and how may those provisions be executed?

Your committee finds that for the purpose of this report only four correspondence schools need be considered, since these are the only ones which present courses for electric central stations at large. These four schools are given in alphabetical order as follows:

American School of Correspondence, Boston, Mass.

Electrical Engineer Institute of Correspondence Instruction, New York city.

International Correspondence Schools, Scranton, Pa.

United Correspondence Schools, New York city.

Each of these schools has an enrollment in all of its courses which aggregates thousands. One school, the International, advertises an aggregate total enrollment of 200,000, or thereabouts. This aggregate, however, must be understood as representing the total enrollments which the school has enjoyed since its organization, but even thus considered, the number is big enough to be amazing. The enrollments of the other schools are smaller than this, but they are in each case large enough to provoke consideration for their work.

The capital invested in the different schools is large. The International Schools, which is an incorporated concern in Pennsylvania, has a capital of a million and a half of dollars, and the character of its buildings and equipment make it clearly evident that several hundred thousand dollars are invested in fixed property, while the cost of operating the school must absorb a considerable proportion of the remainder of the capital.

The United Correspondence Schools, which is incorporated in New York, has a capital stock of $250,000. An inspection of the headquarters of this school also makes it evident that a considerable sum is invested in fixed equipment or is required in handling the business of the school.

The American School of Correspondence is incorporated under the laws of the state of Massachusetts, and the Electrical Engineer Institute of Correspondence Instruction is incorporated under the laws of the state of New York. Neither of the latter two institutions advertises its capital stock, but it appears from an inspection made by your committee that the money invested in these schools is not so extensive as that invested in the others. This must not be understood to be necessarily an unfavorable criticism. Your committee is not prepared to say that the moneys invested in the buildings or equipment in the other schools are essential to the best success of their efforts to teach, though they must be contributory thereto.

In the effort to get information with respect to the correspondence schools, your committee was dependent to a considerable extent upon the schools themselves. The chairman of your committee expended considerable time and some money in interviewing the managers at headquarters of the several schools and making personal examinations of the arrangements for dispatching business. An unfortunate conflict of engagements made it impossible for him to interview the manager of the International Correspondence Schools at Scranton, but he has had correspondence with him and his western superintendent, and has interviewed the principal of one of the important departments of the school and also the western superintendent of the school.

All the schools have courteously responded to requests for information, and all of them, with one exception, have given fairly complete information upon points inquired about—two schools have, in fact, offered more than the committee specifically asked for. The exception is the Electrical Engineer Institute of Correspondence Instruction, which courteously declined to lay bare its methods of business management and the results attained by its school. This refusal was made notwithstanding the fact that the committee only desired and requested the information needed for the purpose of arriving at a just conclusion with respect to the merits of the school.

The United Schools gave full information, but were unwilling to allow correspondence to be carried on with their scholars except through the home office.

First Head.

1. Can Correspondence Instruction Be Relied Upon to Increase the Usefulness of Electric Central-station Employes to Their Employers?

For the purpose of aiding the committee in making its judgment upon this matter, we sent out letters to from 50 to 75 of the scholars of each of three correspondence schools.

These letters were accompanied by a list of questions which read as follows:

1. What is your employment?
2. What regular schooling have you had?
3. How long have you been enrolled as a scholar in the —— correspondence school?
4. What course are you taking, and how far along in your course are you now?
5. How much practical advantage have you thus far found from your correspondence-school lessons?
6. How far do you feel that you can ultimately increase your value to your employer by taking the instruction in the correspondence school?
7. Do you now intend to complete the full course you have entered upon?
8. How long do you think it will require you to do this?
9. Would it have been impracticable for you to have taken a full course in a manual-training school or a high school?
10. Do you anticipate ever preparing to enter a regular engineering course in a college?

In the space below please enter any farther remarks which you think may be useful.

One of the schools (the American School of Correspondence) courteously furnished us with a list of about 75 of its scholars, to whom letters were sent, and from whom replies were received—each of the replies being more or less full. Two of the schools (the International and the United Correspondence Schools) preferred to send out the letters for us rather than to give the names and addresses of their scholars, which might perhaps be a violation of the confidential agreement with their scholars. The answers to these letters were then forwarded to the chairman of the committee. One school (the Electrical Engineer Institute of Correspondence Instruction) refused either to furnish a list of names of its scholars or to send out letters of inquiry furnished by the committee for the purpose.

The chairman of your committee received, approximately, 250 replies from the scholars of the three schools named above. The answers were enthusiastically affirmative regarding the advantages derived from the courses of the schools. This was true to a unit. As the schools each had the opportunity to pick some 50 to 100 scholars, to which the letters were sent, from perhaps some thousands or even tens of thousands, we may very properly credit them with furnishing the addresses or forwarding our request letters to scholars who were recognized as being satisfied. Notwithstanding this advantage on the side of the schools, your committee was surprised at the extreme unanimity with which the courses of the schools are approved by the scholars.

The subject of this division of this report is dealt with from the scholars' point of view in their answers to the fifth and sixth questions. Some thoroughly concrete information might perhaps have been obtained through correspondence with the employers of these various scholars, but your committee did not feel privileged to undertake this without first invoking the permission of the schools and then individually requesting permission from the scholars themselves, since there appears to be some sensitiveness in respect to making known the names of individuals who are enrolled in correspondence-school courses.

Your committee will endeavor to take this matter up for more careful examination during the coming year if you consider it desirable to continue the committee for farther investigation.

The answers to question 5 may doubtless be properly regarded as representing the personal opinions of the individual scholars upon the value of the courses. The replies, on the whole, show a feeling of added power and a confidence in future promotion as a result of properly directed study, which certainly evidences a satisfactory amount of inspiration as the result of the correspondence-school courses.

The answers to the sixth question, as a rule, are reasonably modest. A goodly number of the scholars who have been carrying on their correspondence work for over a year, however, claim to have received promotions and that these promotions are the immediate result of a greater value to their employers which came directly through pursuing correspondence courses. The replies to our inquiries are from men of all ages and widely different conditions in life, but most of them had completed or are pursuing electrical courses. Comparatively few of them are employed in or about electric generating plants. All of those who had not completed their courses expressed their intention of doing so. Nearly all replied that it would have been impracticable for them to have attended a day school instead of enrolling in the correspondence school.

On the whole, these answers fulfill the expectations which may be reasonably gained through abstract reasoning on the advantages of a special practical education to employes who hold positions which require such careful service as work in electric central stations. The character of the work pertaining to an electric generating station is of such a nature that inefficient employes may cause wastes of greater or less magnitude in almost every operation, from the stoking of the furnaces to the testing of the meters. Not the least proportion of the losses in a central station is to be laid to inferior work in the boiler room. A fireman who has been well informed in regard to the combustion of fuel and the relation between fuel consumption and admission of air to the furnaces may every week save a sum comparable to his wages, as compared with an uninformed or careless fireman. Each fireman, with his hand shovel, will handle coal which has a value in this western country exceeding may times his wages. The difference between judicious and injudicious handling of this coal makes a marked difference in the earnings of a station.

A properly planned correspondence course may put the fireman upon a proper footing with respect to his handling of the coal. The engine runner, the dynamo tender and the wiper may all likewise be made more efficient, through a proper understanding of their business, with a resulting considerable increase in the net earnings of a station. It is particularly important that the chief operating engineer of a station and the superintendent of the company shall be well trained in matters relating to the economical combustion of fuel for the raising of steam, the economical operation of steam engines and auxiliaries, as well as the economical handling of electric machinery and devices, and that they shall be competent to instruct properly all of the station employes.

The central-station company whose superintendent and chief operating engineer are not acquainted with methods of analyzing flue gases, testing the quality of steam, the use of the indicator for the purpose of checking the valve-setting of the engines, and various other special tests about the station, loses through the chimney, through radiation, defective engine-running and other defects large sums of money every year. Sums which are lost by many stations on account of the defective knowledge of the employes would, in fact, if saved, be sufficient to pay for the entire cost of correspondence courses for the more important men in the station and still leave a handsome margin over.

That advantages may be gained through a proper training of the employes is shown through the experience of many central stations, and it is also illustrated by the answers which your committee has received to its various letters of inquiry from the employes themselves. We may set it down as a fact that the average central station may in large measure improve its economy as the result of the proper trade education of its employes.

We assert, as a deduction from the experience of the gas-light companies, as a deduction from the conditions which are known to exist in central stations, and as a deduction from the experience of the managers of progressive central stations who have tried it, that proper instruction may be relied upon to increase the usefulness of central-station employes to their employers, and that this increase of usefulness will be of a character that will enable employes to receive promotion, and it will also be of a character which will result in direct savings in the operation of the plant. The magnitude of these savings will depend upon the character of the plant and the character of its management. In the average station they are likely to equal a considerable proportion of the operating expenses.

There is a demand for this proper instruction of central-station employes, and your committee believes that it can be reasonably well filled by correspondence courses, provided they are well planned. The interrogatory of the first head is thus answered in the affirmative.

Second Head.

2. Are Existing Courses of the Correspondence Schools Properly Adapted to Be of the Greatest Use to Electric Central-station Employes and Through Them to Their Employers?

Each of the four schools referred to in the earlier part of this report describes one or more courses which are apparently intended for the training of electrical artisans. These courses are called by various names, and are held out by the schools as having value for central-station employes. It is readily understood that the value of these courses to such employes must depend upon the subjects treated in them and upon the way in which those subjects are treated. [The subjects treated in the various courses which the several schools claim to be adapted to the needs of central-station employes are presented at length in the report, but must be here omitted for lack of space.]

[*Continued on page 70.*]

1. Abstract of report (presented January 17 1901) of a committee of the Northwestern Electrical association appointed to consider the advisability of central-station managements encouraging their employes to enroll themselves in courses of correspondence schools. Suggestions relating to industrial education in general are to be found in the report made in 1900 by a committee of the Society for the Promotion of Engineering Education, which is entitled "American Industrial Education: What Shall It Be?" Copies of this report may be obtained from the chairman of the committee that made it, Prof. J. B. Johnson, dean of the College of Engineering, Madison, Wis.

DEVELOPMENT OF THE TELEPHONE FIELD.

Mr. Glidden Resigns as President of the Erie Company.

At a special meeting of the directors of the Erie Telegraph and Telephone company held in Boston on January 16th the new management, representing the bankers' syndicate, took charge of the company's affairs. Charles J. Glidden resigned his office as president, and Charles A. Grant resigned the treasurership. Mr. Glidden's successor was not elected, but Walker Abbott was chosen treasurer, and Mr. Grant was elected auditor. An executive committee will direct the affairs of the company for the present. It is made up as follows: Philip Dexter, chairman; William Endicott, Jr., Reginald Foster, Francis R. Hart and W. J. Latta. The failure of the board to elect a successor to President Glidden is considered to be significant as part of a broad scheme, which it is believed will ultimately result in the absorption of the Erie system by the American (Bell) Telephone and Telegraph company. None of the officials, however, will openly admit that a deal of this sort is pending. Mr. Glidden will still continue for a time as a director, but he purposes, according to a daily newspaper statement, eventually to retire from active business.

CHARLES J. GLIDDEN.

The retirement of Mr. Glidden will be a distinct loss to the Erie company, as it will thereby be deprived of the direct supervision of one of the very ablest and most energetic of the telephone men of to-day. Mr. Glidden knows how to make keen competition, but even his opponents recognize his great capacity and untiring activity. He is but 43 years of age, so that the talk of his permanent retirement from active business seems curious. It is to be remembered that no permanent successor of Mr. Hudson as president of the American Telephone and Telegraph company has been appointed, and gossip has persistently connected Mr. Glidden's name with the position; but this, of course, may be merely the idle conjecture of well-meaning friends. Mr. Glidden has been engaged in the telephone business since 1877, beginning as a canvasser for the original telephone company in Lowell, Mass. Later he became secretary and treasurer of the Erie company, and he has progressed through all the grades of promotion to the presidency. The Erie company now controls the largest system of telephone exchanges in the country, with something like 145,000 subscribers.

There seems to be little doubt that the Erie Telegraph and Telephone company is now under the control of the Bell telephone interests. Less than two months ago the company removed its offices and the entire clerical force from Lowell, Mass., to Boston and New York. In New York, where the principal offices were located, the company had quarters in the building at 100 Broadway, in contiguity to the offices of the Telephone, Telegraph and Cable company, which owned a controlling interest in the Erie stock. Now it is officially announced that the offices of the company "have been removed from 100 Broadway, New York, to Lowell, Mass." Coming so soon after the previous removal, this announcement can mean nothing less than that the T. T. C. men are out of the Erie management and that the Bell people are in.

Extensions Near Dubuque.

The Bellevue Telephone company of Bellevue, Iowa, has the poles erected for its new line to Andrew, Springbrook and Lamotte. The work of stringing the wire will begin at once, and the line be completed as soon as possible. In the early spring a line will be built to Maquoketa, to connect with the Miller system of Clinton, which will give the new company connection with Clinton County towns. Another line will be built to Dubuque, to connect with the Dubuque system, which will provide connections to the northward. The new company will make a reduction in the telephone rates

Telephone News from the Northwest.

The stockholders of the Marshfield (Wis.) Telephone company have received a four per cent. dividend.

The People's Telephone company of West Superior, Wis., recently answered 9,296 calls in its exchanges at the West End in one day. The company has 750 subscribers.

Telephone connection is being made between Rushville and Lakeside, Neb., 60 miles south. A good share of the distance will be covered by the use of the two upper wires of ranch fences.

The Nebraska Telephone company expended about $200,000 on new lines and exchanges in 1900. Nearly 3,000 miles of new copper wire was strung and over 300 miles of new toll lines constructed.

The Bellevue Telephone company of Bellevue, Iowa, has increased its capital stock by $10,000 and will build toll lines to a number of points.

The Johnson County Telephone company of Iowa City, Iowa, will connect with the toll line of David Stewart at North Liberty, which will be made a metallic-circuit line.

The Fox River Valley Telephone company has applied to Neenah and Menasha, Wis., for franchises for local exchanges. The company offers to bury its wires on the principal streets.

The Dane County Telephone company has a line of wires on West Washington avenue in Madison, Wis. The Wisconsin Telephone company was preparing to string wires down the same street recently. The former found its wires too low and feared that it would not be able to raise its wires if the Wisconsin company built its line. To prevent this, the Dane County company put a large force of men at work one night and placed extensions on its poles, raising its wires 15 feet higher by morning. The Wisconsin company will now go still higher.

The Iowa Telephone company will construct a copper metallic-circuit line from Sioux City to Des Moines by June 1st.

A line will be built between Corydon and Humeston, Iowa.

Musson Bros. of Atlantic, Iowa, propose to establish a local exchange at Anita, Iowa.

The recent increase of capital stock by the Iowa Telephone company means an extension of its facilities. It is believed that a direct toll line will be constructed from Dubuque, Iowa, to Sioux City and another to Council Bluffs and Omaha from Sioux City.

The Iowa Telephone company in Des Moines has filed a demurrer to the case against it brought by the city to secure the removal of its poles and wires from the streets. The company contends that its system was constructed under the old statute, and that the company operates under a franchise from the state.

The Farmers' Mutual Telephone company of Adair, Iowa, has completed a line to Linwood.

The Northwestern Telephone Exchange company plans to extend a line to Devils Lake, N. D., next season and connect with the entire western part of North Dakota. A line from Crookston, Minn., to St. Vincent, Minn., which was projected last year, will be completed the coming season.

Creditors have asked for a receiver for the Mississippi Valley Telephone company in Minneapolis. The complaint alleges that the company has no ready money and that its plants in Minneapolis and St. Paul are mortgaged for several hundred thousand dollars. The plaintiffs claim that these mortgages were given without consideration, and that the company's business has been poorly handled, so that where it should have been making money, it has been steadily running behind. Edward E. Webster has been appointed as the receiver, and the system will continue to operate.

The Sheboygan County Telephone company will build a line from Sheboygan, Wis., to Plymouth, Random Lake, and other nearby towns. In the sping the company will have connection with the Eastern Wisconsin Telephone company, which will extend a wire from Fond du Lac.

The Marquette County Telephone company recently held its annual meeting at Ishpeming, Mich., and declared its usual 10 per cent. dividend. The company has about 1,000 instruments connected.

The Zenith Telephone company of Duluth, Minn., will connect its system with the long-distance system being constructed by the Duluth and Iron Range railway, which will cover the Mesaba range.

The Martin Telephone company of Webster City, Iowa, is installing telephones in private residences, with meters for registering outward calls. The company claims to be the only Independent company in the country which has such a system.

The Little Wolf River Telephone company is arranging to fit up an entire building in Fond du Lac, Wis., for its exchange and general office use.

The Harlan and Avoca Telephone company has bought the line from Portsmouth to Panama, Earling, Westphalia and Harlan, Iowa, from the Woodbine Telephone company.

The Pacific States Telephone and Telegraph company has completed a copper-circuit line between Wenatchee and Leavenworth, Wash. This leaves a gap of but 45 miles to fill to complete a line from Spokane to Seattle, Wash., direct. Connection is now made via Portland, Ore.

The Mutual Telephone company at Des Moines, Iowa, contemplates putting in the selective system for residence connections. The company now has no party lines. The annual meeting of the stockholders resulted in the adoption of a resolution removing the purchase preference for preferred stock from the holders of common stock and authorized the directors to sell preferred stock to any and all persons in any quantity.

The Mutual telephone exchange of Bloomfield, Iowa, has been sold to the Southwestern Iowa Mutual Telephone association. The sale includes the company's toll lines in southeastern Iowa and northwestern Missouri. The new owner will extend several lines to complete circuits. Lines will be built to Moravia from Ottumwa, and to Eldon, Belknap and Bloomfield; also to Lancaster and Unionville, Mo.

The Keokuk Telephone company of Keokuk, Iowa, has been incorporated, by J. C. Hubinger, with $75,000 capital stock.

The Citizens' Telephone company of Mankato, Minn., will increase its capital stock to $100,000, in order to make some outside extensions. A line is proposed to Kasota. C. K. Willard is manager of the company.

O. A. Buckland of Madison, Minn., has purchased the franchise of Lewis Dueland for a local exchange at Dawson, Minn. Mr. Buckland will canvass the town and install an exchange, if sufficient business can be secured.

The Hutchinson (Minn.) Telephone company has notified patrons of a 10 per cent. increase in rates, owing to the addition of Sunday service.

A resolution has been introduced in the Board of Aldermen of St. Paul looking to the municipal ownership of the Mississippi Valley Telephone company's system in that city.

The Zenith City Telephone company of Duluth, Minn., reports its gross earnings for the first nine months' business to be $24,263.

The Northern Minnesota Telephone company of Wadena, Minn., will make a number of improvements to its line in the spring. The company received an offer of $18,000 for all the stock of the concern, but refused it.

Charles E. Wisard of Howard, S. D., is arranging to establish a local exchange for Woonsocket, S. D. A local company is being formed and will have a capital stock of $2,500.

The Marathon County Telephone company held its annual meeting at Wausau, Wis., recently. The company has 80 miles of poles and 160 miles of wires. The cost of the completed system is $11,514.

The District Court in Duluth, Minn., has decided in favor of the Duluth Telephone company in the case brought by the city of Duluth to evict the company from the streets. The court holds that streets are highways, within the meaning of the state law giving telephone companies rights on highways, and says that the company has rights which cannot be taken from it, even though its franchise has expired. But the decision does not determine the right of the city to require the company to remove its poles and wires from any limited district.

The local telephone exchange at Albert Lea, Minn., has been sold to S. H. Cady of Albert Lea for $10,000. He will probably abandon the automatic-switch system and put in a switchboard, with operators.

A bill is before the Minnesota Legislature which provides that telephone companies may place their poles in the public highways of any town they wish to traverse, on the written consent of the supervisors, without compensation for the privilege. A bill is also reported to give private concerns and individuals the same rights on public highways that telephone and telegraph corporations have. R.

Ohio Telephone Notes.

The Toledo Telephone, Telegraph and Messenger company, Toledo, was incorporated recently, with a capital stock of $25,000, by J. H. Bellows, Lem P. Harris, C. F. Watts, A. M. Hough and H. A. Merrill. It is the intention of the new company to build a telephone plant in Toledo and establish a messenger service. Later on the business will be extended to Lucas County, Ottawa, Sandusky, Erie, Lorain, Cuyahoga, Geaugua and Ashtabula counties. The termini of the lines are fixed at the Indiana and Pennsylvania lines. H. A. Merrill, one of the incorporators, said there is plenty of capital behind the enterprise and that the promoters are men of experience in the telephone business, but he could not give all the names at this time. The Toledo City Council will be asked to grant the company a franchise at an early date, and it is thought there will be no trouble in securing it.

The work of building the Independent telephone plant at Xenia has been begun. C. D. Juvenal is looking after the construction.

The Columbiana County Telephone company has completed arrangements for installing 27 toll stations in Columbiana County. A solid copper circuit has been completed to Cleveland.

The Sayers Telephone company is preparing plans to connect Salem and Adelaide.

The Independent telephone lines have been completed from Columbiana County to New Brighton,

Pa. The Pittsburg lines have been built to within a short distance of that place.

A movement has been started to build a telephone line from Portsmouth to California, Pike County, by way of New Boston, Sciotoville and Harrisonville. It will be largely patronized by farmers along the line.

Mansfield people are just now exercised over the probable disposition of the franchise of the Citizens' Telephone company, which was organized about two years ago, but never did anything beyond contracting with a few subscribers. Lewis Brucker, an attorney, has the controlling interest in the Independent company, it seems, and, therefore, has a valuable franchise, which was granted by the Mansfield council. He once negotiated with the Star Telephone company of Ashland, for the consolidation of the two, but it seems that nothing came of that. Then it was reported that the franchise was sold to the United States Telephone company, but if that is so, no steps have been taken to put in an exchange.

The gang of workmen engaged in putting up the east and west line of the United States Telephone company has been moved from Mansfield to Crestline.

City Solicitor Griffiths of Zanesville has filed injunction proceedings against the United States Telephone company, the Zanesville Telegraph and Telephone company, James G. England, J. B. Rhodes and A. T. Brennen, to prevent them from using wires and poles which have been erected in the town without the permission of the City Council. A temporary injunction is asked to prevent the use of these poles and wires until the court decides upon the permanent injunction asked for. The specific charge is made that the wires have been attached to the market house without permission, but the ultimate object is to get the companies out of business in the town.

The Ironton office of the Central Union Telephone company reports a good increase in business the last year. There are over 400 telephones in use in the city and 50 new ones have lately been added.

The annual report of Manager Druckemiller of the Central Union office at Akron shows some very interesting figures. The total mileage of wire in the town is 4,448, and of this amount 1,253 miles are underground. The increase in the number of subscribers last year was 164. The average number of calls last week was 16,167 a day. The total number of subscribers is 1,428.

The Warren and Niles Telephone company, Warren, held its annual stockholders' meeting last week, and a few evenings ago the directors met and elected the following-named officers: President, Washington Hyde; vice-president, Jules Vautrot; secretary and treasurer, J. J. McLean; manager, E. G. Miller.

The People's Telephone company of Sardinia, Ohio, was incorporated recently, with a capital stock of $2,500, by W. J. Marshall, G. A. Kennedy, George A. Stephen, C. T. McIntire and O. H. Shotwell. The company will build a plant in Sardinia, and has the privilege of extending its lines into the vicinity about there.

The Liberty Center Telephone company, Liberty Center, Ohio, has been incorporated, with a capital stock of $10,000. The charter issued to the company will allow it to build a plant in the town and operate toll lines in the county. M. Donnelly, F. D. Printis, M. Weakley, C. B. Kushner and Robert V. Shuey are the incorporators. O. M. C.

Indiana Telephone Items.

The arrangements which have been quietly taking shape for some time at Corydon, between Louisville and Cleveland men, for a telephone service throughout this county, are said to be consummated. This service will have long-distance connections through the Kinloch Telephone company at St. Louis, the new Indianapolis Telephone company, the United States Telephone company of Cleveland and the Feilnie Telephone company of Pennsylvania.

The Central Union Telephone company is soliciting among the farmers in Cass County with a view of extending the service through the prosperous rural districts near Logansport. The local situation is but little changed. The City Council is still holding the matter of renewing the Central Union's franchise in abeyance, having refused to suspend the rules and vote on it. A sentiment in favor of granting an exclusive franchise at reasonable rates developed, and conferences are now being held with the companies to secure propositions. The citizens want but one system, but at reasonable prices, and have demanded $12 and $18 rates. The Central Union says it cannot furnish the service for that money. The new Indianapolis company will apply for a franchise, but its rates have not been made known.

An aerial right-of-way controversy has arisen between the Whitestown Rural Telephone company and the Big Four railway officials which is likely to result in litigation. Work progressed well on the telephone lines until an attempt was made to cross the Big Four's right-of-way. Then the employes and officials of the latter absolutely refused to permit the work of constructing the line over its tracks to proceed. The outcome is a bill introduced in the Legislature to provide for such a contingency.

Competition has greatly stimulated the telephone business in Kokomo. Last fall, before the new company started business, only 225 telephones were in use. After a three months' fight, 1,300 telephones are in business houses and residences. The war is still on, and the struggle is extending into the country. The Bell company has cut the residence rate to 50 cents a month, but the new company continues to collect $1.25 for houses and $2 for business houses. The new system has 850 subscribers and the old one 451. F.

In Missouri.

The Boonville Telephone company of Boonville, Mo., is preparing to supply the farmers in Cooper County with telephone service. It has now over 100 farmers subscribed and the list is expected to double by spring. This is a new departure in this section of the state, as with the exception of the Bunerton exchange, no others have ever catered to the farmers for patronage.

The Independent exchange at Jefferson City is holding its own with the Bell company. It is increasing as rapidly as the force can construct, and expects to list 500 telephones in its new directory.

Sedalia will be a battleground between the Independent and Bell interests. The latter have reduced rates on residence telephones from $1.50 a month for party lines to $1 for a separate line, and further reductions are expected, if necessary to hold business.

The most severe sleet storm that has been experienced in this country for years visited central Missouri on January 12th, completely cutting off all communication for 24 hours and damaging exchanges more or less throughout the state. Sedalia, Jefferson City and California were in darkness for two nights on account of the condition of wires. Everything is now in good condition again. A. B. M.

Experiments in Wireless Telephony.

Cable dispatches from Paris announce that M. Maiche, a French inventor, has been making successful experiments in wireless telephony in the forest of St. Germain. The account reads as follows:

"The transmitter was in a house on the outskirts of the forest. It was connected with the earth in the manner in which lightning rods are connected. Two iron posts, 90 feet apart, connected by a wire, were planted in the ground about 1,000 yards distant. Voices and other sounds at the transmitter were clearly heard at an ordinary telephone receiver attached to one of the posts. M. Maiche will not divulge the secret of his discovery, but says that communication is in a straight line, not like the Marconi system of wireless telegraphy by a wave current, but by a circuit current, virtually enabling a given spot to be aimed at. If the receiver is not placed exactly in the direction given to the current there will be no transmission, and receivers on either side of the line of transmission will not be affected."

The above information is of interest in connection with the accounts published about a month ago referring to a series of experiments in wireless telephony conducted by James Kelsey, near Minneapolis, and also in connection with a recent dispatch from Ottawa, Ont., in which it is stated that Professor Stone Wiggins, a "weather prophet" of that city, is developing electric currents so as to produce a wireless telephone. Professor Wiggins says that the discovery will enable ships to talk to each other though separated by long distances at sea and will also do away with the necessity for wires on railways. Professor Wiggins asserts that Marconi appropriated his ideas in regard to wireless telegraphy.

According to the daily papers, Forest Hawkins and Frank Hartley, young electricians of Greenport, L. I., have been experimenting with apparatus which they have devised for wireless telephony, and have recently given a public test at which, it is said, they were able to transmit messages three miles.

Southern Ohio Independent Telephone Association.

At a meeting held at Washington Court House, Ohio, on January 16th, the Southern Ohio Independent Telephone association was organized, for the mutual advantage of the local Independent telephone companies in Ohio south of a line east and west through Columbus. G. P. Thorpe, secretary of the Clinton Telephone company of Wilmington, Ohio, was chosen president, and I. S. Henkle, secretary of the Mount Sterling Telephone company of Mount Sterling, Ohio, was made secretary. An executive committee of three was elected, consisting of the following-named gentlemen: Charles D. Duncan, secretary of the Home Telephone company, Chillicothe, Ohio; F. W. Peirce, secretary of the London Telephone company, London, Ohio, and Jerome Penn, vice-president of the Citizens' Telephone company of Washington Court House, Ohio. The next meeting of the association will be upon call of the executive committee.

EXTENSIONS AND IMPROVEMENTS.

It is said that the New York Telephone company added 14,000 new stations to its plant in 1900.

The Keystone Telephone company, which is backed by a number of Philadelphia capitalists, has increased its capital stock from $2,000,000 to $10,000,000.

The Cecil Telephone and Telegraph company, whose lines now traverse all parts of Cecil County, Md., and which is a branch of the Diamond State Telephone company, is building a line from Providence, Md., to Lewisville, Pa.

The Citizens' Telephone company's exchange at Traverse City, Mich., has been changed to new and better-arranged quarters. The company will soon have a direct line from Traverse City to Grand Rapids, and will also extend its connections to Frankfort and from there to Manistee.

The "Yards" exchange of the Chicago Telephone company has been moved into its new building at 4122 Union street. The cables were cut and the change made from the old building, six blocks away, without interruption to business. The exchange has 1,000 connections and employs 25 operators.

At a meeting of the directors of the Mankato (Minn.) Citizens' Telephone company, January 11th, it was decided to increase the capital stock from $25,000 to $100,000. The company contemplates extensions and improvements in the spring. There are 500 telephones now installed in the company's exchange and a number of applications are on file.

The Mexican Telephone company has recently completed the extension of its metallic system in the City of Mexico. The entire business section now has a metallic telephone system, whereas previously but a small area was thus supplied. The work upon the extension was commenced in the early spring of 1900, and has cost about $22,000, all of which has been paid from the earnings of the

GENERAL TELEPHONE NEWS.

The Pittsboro (N. C.) Telegraph and Telephone company has been incorporated by Gen. W. C. London and others.

The Central Union Telephone company has recently installed a line from Oregon, Ill., to Byron, Ill., a distance of 10 miles.

Seventeen telephones have been set up in the different buildings of the University of Chicago for the use of professors and officers of the institution.

A bill has been introduced in Congress to allow the Paris, Choctaw and Little Rock Railway company to construct a telegraph and telephone line across the Indian Territory.

The Cattaraugus Telephone company of Cattaraugus, N. Y., with capital amounting to $1,000, has been incorporated by S. F. Burger, Frank Crawford and H. B. Easton.

W. B. Thompson of Chicago asserts that he has a prior invention to Professor Pupin's, relating to telephony at great distances. He says that his invention consists of a system of inserted relays 200 miles apart, whereby one can, by the use of ordinary telegraphic wires now in use, communicate to any distance articulate speech.

At the annual meeting of the Greene and Western Telephone company of Mason City, Iowa, the following-named directors were elected: A. Kime, W. I. McAllister and Charles Weber. The officers chosen were: President and general manager, A. Kime; vice-president and treasurer, H. E. Soesbe; secretary, W. I. McAllister. A large amount of new toll line and several new exchanges were provided for and will be installed during the coming season. The list of subscribers increased from 400 to 600 during last year.

MANUFACTURERS AND DEALERS.

On January 11th the Central Telephone and Electric company of St. Louis, Mo., had the misfortune to suffer from a severe fire in its factory. The company, however, saved all its patterns and dies, so that, though its stock was practically entirely destroyed, it is now ready, in its temporary headquarters, 907 Market street, to ship all styles of complete telephones, switchboards and parts. The construction-material and supply department was saved with only a small loss, so that on this class of goods shipments are being made without any delay.

The Sterling Electric company of Lafayette, Ind., has issued an artistic booklet descriptive of its new line of transmitters, receivers, generators and complete telephones. It is only recently that this company has entered the field of instruments, having previously confined its output to switchboards and protective devices, manufactured under the Frank B. Cook patents, and which are probably as well known as any on the market. The pamphlet describes in detail the various types of telephones and accessory apparatus, including the new selective-signal, party-line system, which this company is putting into successful service throughout the country, and of which a diagram of circuits and connections is shown.

Western Electric Series Alternating Enclosed-arc System.

The series alternating-current enclosed-arc-lighting system that is offered by the Western Electric company of Chicago and New York is simple and free from intricate complications in mechanical design, while still possessing flexibility in application. A striking feature of the system is that, if desired, it can be used without a regulating device of any kind in the operation of lamps in series on constant potential. The series of lamps can be connected directly to the mains of an alternating-current generator or upon the secondary of an ordinary constant-potential transformer, and will operate at a high efficiency and with a good power factor. This is said to be true, no matter what the number of lamps in series may be, and it is asserted that

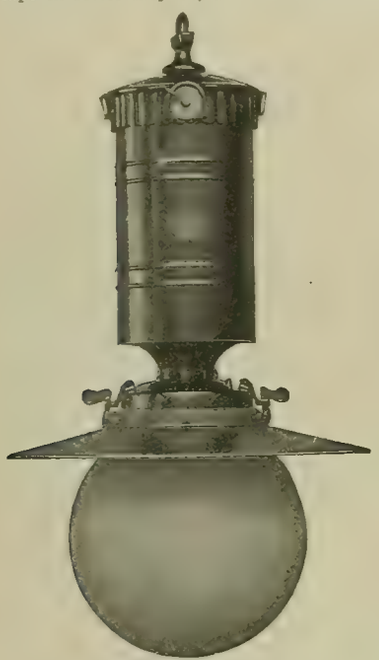


FIG. 1. WESTERN ELECTRIC SERIES ALTERNATING ENCLOSED-ARC LAMP.

any number of lamps can be operated in series with a constant power factor, if the voltage be varied to accommodate the number in series. Each lamp of a series, when operated without an automatic regulator in series, is provided with an automatic cut-out which, when operated, introduces a small choke coil into circuit, consuming about 35 watts of energy. When a lamp is thus automatically cut out, the remaining lamps of the series are not interfered with in any way. When operated with 450 actual watts at the arc on a current of 6.8 amperes, the lamps will burn an average of 90 hours with each trimming, leaving an unburned portion of carbon in the upper holder sufficient for the lower holder on the next trimming.

The lamp, of which an exterior view is shown in Fig. 1, is of the type generally known as the mechanical differential, a shunt magnet operating in opposition to a series magnet. These magnets are of the double-solenoid type. Cored carbons are used in both upper and lower holders, the lower being supported by a tripod holder.

The lamp is cased in heavy copper or zinc, as preferred, made weatherproof, so that no extra hood or cover is required. A metal shade or reflector, white enameled on the under surface, is placed just above the outer globe, and is found effective in controlling the distribution of light, particularly in street illumination. In trimming, the outer globe is lowered and held suspended by a chain, while the inner globe is removed and the carbons replaced.

The accompanying diagrams, Figs. 2 and 3, show the electrical connections of the lamps, magnets, choke coils, etc. A simple change of connections adapts the lamp for operation at any ordinary commercial frequency above 40 cycles, the choke coil of the cut-out being readily adjusted for the frequency desired. Fig. 2 is a diagram of the lamp circuit when used without a regulator, (A) and (B) representing the lamp terminals, (C) the switch contacts, (D) the main magnet, (E) the shunt magnet, (F) the cut-out contacts and (G) the cut-out choke coil. In Fig. 3, which shows the lamp circuit when used with a regulator, (A) and (B) indicate the lamp terminals, (C) the short-circuiting switch, (D) the main magnet, (E) the shunt magnet, (F) the cut-out contacts and (G) the starting resistance.

When lamps are operated directly on the main, the number in series will depend on the voltage. The number may be ascertained roughly by dividing the voltage at the terminal of a series by 78, if operated at 60 cycles, or by 83, if operated at 125 cycles, line drop not included. At both frequencies the arc will have a voltage of 72. In cases where it is desired to operate a larger number of lamps in series than the above figures would give the terminal voltage at the lamp may be reduced to 73, at 60 cycles with 65 at the arc; or to 75, at 125 cycles with 64 at the arc.

When the number of lamps is such that the primary voltage is not proper, a transformer stepping up or down can be used provided with a regulating head, by means of which the voltage at the terminals of the series of lamps can be varied at will by manual operation of the lever of the regulating head. With such a regulating transformer, the number of lamps of the series may be varied from time to time, if desired, the power factor being the same at all loads. Owing to the characteristic of the differential lamp, the illuminating power of a series of lamps may be varied by a movement of the regulator head to increase or decrease the voltage, each lamp responding proportionately.

Fig. 4 is a diagram representing the arrangement of parts and circuit connections of the system when operated in conjunction with an automatically regulated transformer. (A) represents main fuses, (B) primary switch, (Q) transformer showing primary leads to switch (B) and secondary leads to regulator (U), (T) is a small choke coil, to prevent short-circuits of transformer coils, (R) is the controlling magnet of the regulator, (O) is the starting box upon which are mounted the lever (L), contacts (F), (G), (H), (I), (K), and magnet (M) which effects the release of lever (L), allowing it to fly back to the starting position whenever it is de-energized. (S) is a device which short-circuits magnet (M) when the regulator reaches a certain position; (D) is a choke coil or a series of choke coils used in starting the lamps. The lamps used in this system are provided with an ordinary short-circuiting cut-out switch, and in the automatic cut-out no choke coil is used. An ammeter (A) is connected directly in series with the lamps.

The design of the lamp is such that it prevents the setting up of excessive current in a circuit even where a considerable percentage of lamps of a series is short-circuited. The manufacturer calls special attention to the fact that, with its lamps, the number in series on a practically fixed voltage can be considerably increased when necessary, either on account of an overload on the lighting system, or if for any reason it is found desirable to reduce the candlepower of the lamps. No readjustment of the lamps will be required when so

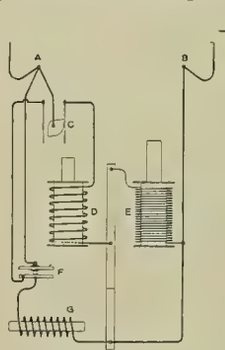


Fig. 2. Lamp Circuit without Regulator.

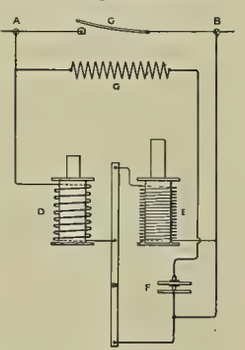


Fig. 3. Lamp Circuit with Regulator.

WESTERN ELECTRIC SERIES ALTERNATING ENCLOSED-ARC SYSTEM.

operated, and the increase in number may reach 20 per cent.

In this lamp, it is asserted, such relative action of the different parts is secured that proportionate changes in voltage and current at the arc can occur simultaneously. In consequence great fluctuations in voltage at the terminals of a series of lamps may take place without interfering with the service, the lamps simply dimming or brightening, accordingly as the voltage is low or high. To meet the requirements of a perfect commercial alternating series system, the ratio of transformation is varied as the number of lamps vary. This arrangement comprises a constant-potential transformer, controlled by an automatic current regulator, and a starting box and switch having an automatic release.

Traction Measures in Chicago City Council.

At the meeting of the City Council of Chicago on January 21st several measures were introduced which relate to the street-railway companies operating in the city. One order introduced aims to prevent the running of cars in trains and requires each company to equip each separate car so that it would constitute a train in itself. Mayor Harrison presented an ordinance requiring that cars stop at any street intersection when signaled. This is meant to prohibit the rushing of cars past street intersections when passengers are waiting for transportation. A resolution was introduced that no further privileges be granted the Union Traction company, the Metropolitan West Side Elevated Railroad company or the Lake Street Elevated Railroad company until they have paid outstanding claims to the city. A measure prohibiting drivers of wagons from using one street-car rail, thereby causing a rut in the pavement and ruining the street, was also introduced.

The mayor submitted a measure repealing the ordinances of the Chicago General Railway company because the latter has failed to keep the space between its tracks in good condition and because it has paid no track rental to the city since December 1, 1896. The company is said to owe the city $9,456 for track rental. The company has what is known as the Twenty-second Street line, which runs west and along Western avenue to Lawndale, and the property is now in the hands of Frank H. Sellers, as receiver.

Trade Education of Central-station Employes.

[*Continued from page 67.*]

Your committee does not believe that any of these courses is adapted to give the greatest returns to central-station employes and their employers. We hold the highest appreciation of general education and heartily believe in its great usefulness, but the need of the central-station employe can only be met by a course that makes immediate contact with his daily work and continues in that contact through every lesson sheet, while it teaches him to keep in continual view the best methods for executing his work. In other words, the need is for trade instruction, rather than for broad education. Such a course in its most elementary form might be readily completed by an industrious man of good caliber, who used his spare hours for study (say four to six hours per week), in 18 months to two years. The existing courses of correspondence schools which are recommended to central-station employes vary in length. Some are as short as need be desired, while others are several times as long. None of them contains the essential element of immediately useful and practical information.

The various schools frankly admit that they have prepared no course that fulfills the requirements held out by your committee, but they severally recommend from among their courses those just outlined, as most nearly touching the requirements. The time required for the industrious man to complete them by study in spare hours is estimated and set down below:

American School — "Electrical Engineering Course." Time, 1½ to two years.

Electrical Engineer Institute—"Course No. 13" (in electric-lighting and central-station practice) or "Junior Course." Time, 2½ to three years.

International Schools—"Electric Power and Lighting Course." Time, 1½ to two years.

United Schools—"Complete Station Engineering Course." Time, two years.

ADMINISTRATION OF COURSES BY THE SEVERAL SCHOOLS.

The methods of administering the courses by the several schools do not essentially differ. The processes are more or less familiar to the member of this association. Two of the schools employ active solicitors for enrolling scholars, and one

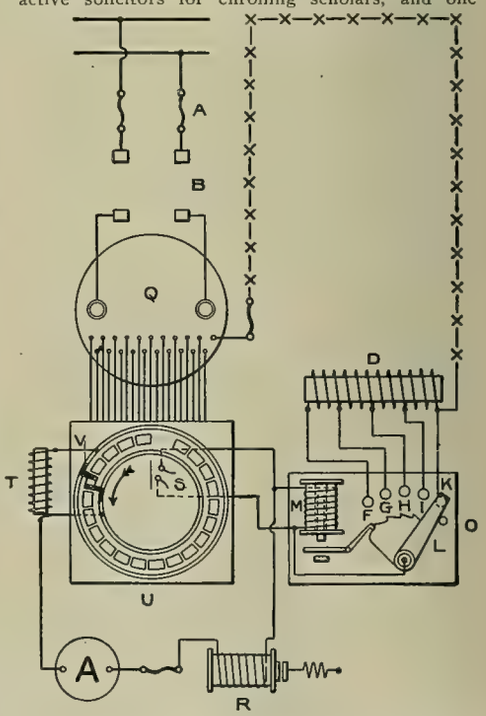


FIG. 4. WESTERN ELECTRIC SERIES ALTERNATING ENCLOSED-ARC SYSTEM.—CONNECTIONS WITH AUTOMATICALLY REGULATED TRANSFORMER.

of these has a remarkably complete organization. The other two schools claim to solicit solely by advertisements and correspondence, but they pay commissions for enrollments brought to them.

There is also a marked similarity between the methods of the several schools in treating the candidate after he is enrolled. Each supplies the scholar with printed "instruction papers" or lessons, which are put out in pamphlet or book form, and expects him to study the lessons, inquire by letter when unable to surmount difficulties, and finally return answers to a set of "examination questions" on the subject-matter of each lesson.

Each "examination paper" returned from the scholar is carefully read by clerks at the principal office, is corrected and graded, and is then returned to the scholar with any pertinent comments.

The process extends to drawings, as well as to written matter. It is really astonishing what good drawings are obtained after a little practice by men who have worked all their lives with the monkey-wrench or coal shovel.

It is not easy to inspire to study by correspondence, but valuable instruction in facts may be given, which is exactly what is required in this case. The majority of the scholars gained under the persuasion of solicitors will not pursue their course for many months under any conditions, but the smaller proportion will carry their courses through to the end, provided they feel they are thereby gaining possession of useful powers. The form of the organization of the several schools seems to be well adapted to their purpose. Each of the schools, except one which does not employ solicitors, frankly admits that only a small percentage (perhaps from five to 10 per cent.) of the scholars enrolled in their numerous courses carry them through. Your committee, however, feels that even this small percentage is sufficient justification for the existence of the schools, provided their work is well done. Of the multitude who fall out before completing their work, a considerable proportion undoubtedly gain benefit by having enrolled and started upon the work. Some of these are forced to drop out on account of circumstances, and may resume the work at a convenient period. The schools allow an unlimited time for the completion of the work, and consequently a scholar may at any time resume his course where it was interrupted.

Character of Instruction Papers.

The question of the character of instruction papers, whether in sheet, pamphlet or book form, of the several schools arises for consideration. To its consideration your committee has applied itself with great interest and diligence. Each of the schools supplied the committee with a set of its lessons, covering an entire selected course, or with a partial set, which is presumed to contain typical lessons. These instruction papers or lesson sheets are made up in fine form, and in the case of one school are supplied to the scholars as several large volumes bound in half leather. The lessons are the foundation of the entire system of each school, and the importance of their place is testified to by the care that has evidently been given by the schools in perfecting them.

The lessons that have been supplied to the committee for its examination may be divided into three classes—

1. Instruction papers adapted to give an elementary, but reasonably practical, view of applied electricity to clerks and others who do not have an intimate knowledge of and contact with machinery.

2. Instruction papers adapted to instruct apprentices and artisans in the important features relating to their daily employment.

3. Instruction papers which are more advanced than the latter, being adapted to the grade of information which may be presumed to be possessed by superintendents, foremen and others, and which verge upon professional engineering.

Your committee will discuss the lesson sheets of each of the schools on the basis of this classification.

The American School of Correspondence furnished to your committee a complete set of the instruction papers relating to the "electrical engineering course," with the exception of six optional papers in mechanical drawing. This is the course which they recommend as adapted to central-station employes. It includes 29 separate pamphlets, as is shown by the outline presented previously. The instruction papers appear to be accurate and reasonably well written. The course appears to your committee to belong to the first class, and to be more distinctively adapted to office clerks and others who do not get contact with the machinery than to the instruction of firemen, dynamo tenders, floor engineers, linemen and others who are well acquainted with the general processes, but for whom it is desired to obtain instruction that will result in economies in station operation.

The Electrical Engineer Institute of Correspondence Instruction recommends either its "junior course" or its "Course 13." The lessons of each of these courses are contained in some 40 or 50 pamphlets that are sent out to the individual scholars. These courses appear to your committee to belong to the third category. They appear to be accurate and logical, and to be adapted for the instruction of superintendents, foremen and others who may be assumed to be men well informed in the general details of their business.

The volumes of the International Correspondence Schools which relate to the "electrical-engineering course" and its offshoots, seem to be admirably adapted to the comprehension of central-station employes, and they are recommended by the school for the instruction of such employes. They belong essentially to the second category. The papers are well written and appear to be accurate.

The instruction papers relating to the electrical courses of the United Correspondence Schools appear to be intermediate between the first and second categories, but they are sufficiently inaccurate to be rendered valueless. This inaccuracy is particularly surprising, since the "mining-engineering course" of this school has been supervised by a number of eminent specialists, and your committee, therefore, hoped to find a thorough appreciation of accuracy in the work of the school. Your committee informed the president of this school that the instruction papers contained inaccuracies, and was immediately assured by him that the school desired to make its instruction as perfect as possible and that it would make every effort to eliminate all errors.

What a Central-station Course Ought to Contain.

Your committee has endeavored to do the utmost justice in its examination of each of the schools. It approves the idea of correspondence instruction as being an excellent one in its place; it believes that good is coming from the correspondence schools, and it has satisfied itself that the administrative methods of the schools are reasonably well planned. Each of the courses, however, which belongs to the second and third categories named above can and must be greatly altered before they are adapted to be of the greatest use to central-station employes, and through them to their employers. The ideal central-station course should contain very much less of "design," and much more relating to good construction and economies in operation. Your committee here outlines a course which it believes would meet the requirements of the average central-station employe, and which would result in great advantage to the central stations if the employes followed it:

Committee's Course.

1. Arithmetic (for those who need it).
2. A small amount of elementary algebra, geometry and trigonometry.
3. Erection and use of steam boilers.
4. Fuel and its economical combustion.
5. Boiler operation and boiler tests (this should include the methods and reasons for testing flue gases, testing the quality of steam, the use of feed-water heaters, economizers, etc.).
6. Erection and operation of steam engines.
7. Testing of steam engines (this should include use of the indicator, testing to determine friction, the consumption of water per indicated horsepower per hour, valve setting, etc.).
8. Condensers, pumps and other auxiliaries.
9. Steam piping and steam-pipe covering.
10. Ohm's law and electromagnetic theory (this should include electrical instruments, flow of currents, etc.).
11. Erection, operation and repairs of direct-current electrical machinery.
12. Elementary theory of alternating currents (single-phase and polyphase).
13. Erection, operation and repairs of alternating-current machinery.
14. Switchboards and switchboard instruments.
15. Electrical transmission and distribution lines and accessories.
16. Construction, testing and repairs of pole-line and underground circuits.
17. Meters and meter repairs.
18. Electric lamps and their proper use.
19. Station economies and station records.
20. Transmission and distribution economies and distribution records.
21. Storage batteries and their uses.
22. Telephones and their accessories. (This does not apply to the larger number of central stations.)

Theorems of applied mechanics, strength of materials and other related subjects are to be suitably treated at points of application.

A properly written course of lessons following this outline should take an industrious employe about 1½ years to cover the ground. Such a man should be expected to spend perhaps six hours of study each week outside of the working period. For men desiring shorter courses covering the duties of a position, this course may be readily adapted for division. As for instance, the first five titles could be used for the instruction of firemen, the first two titles and the second to the ninth, inclusive, of engine men, etc. If the men did not care to go through the entire course they could take the specific subjects that they especially need. The course could be successfully administered in the system of existing correspondence schools. The course aims at producing in the corps of employes a working knowledge of the means for obtaining the highest possible economy available from the machinery and appliances installed by the central-station company, and the possibility of improving the economy by minor alterations. This course would surely be successful in its aim, and it would result in great improvement in the character of the work of employes of the average central-station company, if followed by them, and through them in advantage to the company.

The answer to the interrogatory of the second head has been outlined. The administrative methods of existing correspondence schools will give excellent results when combined with a properly adapted course, such as that outlined by the committee, but the existing courses of the schools are not fully and properly adapted to average central-station requirements.

Third Head.

What Provisions May Central-station Owners Reasonably Supply for the Purpose of Encouraging Their Employes to Study the Requirements of Their Business, and How May Those Provisions Be Executed?

Your committee is firmly convinced that the central-station companies can lend their employes great assistance by providing a perfectly adapted course of correspondence instruction. It is probable that one or more of the existing correspondence schools will arrange such a course, if its need is made known through action of this association. In the administration of this course it is desirable to add to the processes now made a part of the electrical course some means for practical demonstration of central-station methods. The demonstrations should relate particularly to the methods of firing coal, testing flue gases, testing the quality of steam, indicating engines, etc. Analogous demonstrations are made to railroad employes by the International Correspondence Schools through traveling instruction cars, which carry complete outfits of air brakes and other train devices. That which can be done for railway employes can be done for central-station employes; and the central stations should make every effort to bring before their employes complete instruction that is the equal in its kind to the instruction offered to railway employes by the International Correspondence Schools.

Prizes, free payments of scholarship fees and other provisions for encouraging the employes to enter correspondence courses do not hold out reasonable advantages except in a few individual cases. Personal encouragement of the ambitious men who are well endowed with common sense, and the provision of a suitably planned and administered course of instruction which such employes may enter upon will bring the greatest advantage to the central-station companies. It is on these lines that the central-station companies must look in large degree for the improvement of their operating conditions.

The required course, with its administration, can either be had through one or more of the correspondence schools, as suggested by the committee, or through a subscription fund, administered after the manner of the "gas educational fund" of the American Gas Light association.

Your committee recommends that action be taken requesting the correspondence schools to organize and administer a course of instruction for central-station employes which conforms to the recommendations of this committee, and that the committee be continued for further investigation of the results obtained through correspondence instruction.

Discussion.

H. J. Gille, St. Paul, Minn.: I move that a vote of thanks be extended to Professor Jackson and the other members of his committee for the very able paper, and that the committee be continued.

The motion was carried.

By unanimous vote, the recommendations of the committee were adopted.

Professor Jackson, Madison, Wis.: I move that the four correspondence schools referred to in the report be individually requested to reorganize their courses for central-station employes, to conform, as nearly as possible, with the requirements set forth in this report.

The motion was carried.

Mr. Bowen: I want to say that I am heartily in accord with the matter contained in this motion. Great difficulty has been found, as is indicated in this paper, in getting the specific education which is demanded of the employes in various processes. For instance, the cost of the manufacture of gas per thousand feet rests very largely with men, generally without education, who operate the gas works, and it goes without question, I think, that the cost per kilowatt at the switchboard rests very largely with the men who are operating electric plants. There is no correspondence school that can educate a gas employe. We have found that out, to our cost. But they can educate them along the general lines. There is nothing in the way of practical education quite so good as sending a man right into the retort house or into the gas-generating house, to show him how to get the results, and when he gets through under good, experienced tuition, he knows something, and much more than under the tuition of the correspondence schools; but a course should be arranged, so concise, so plain and so short and pertinent to the subject-matter that no mistake can be made.

S. B. Livermore, Winona, Minn.: It is just possible that we central-station managers would like very much to have all our men experts in their individual daily occupation. At the same time, the general tenor of the correspondence school, while it includes arithmetic, algebra and trigonometry, is to elevate the men. If we want a man to become a perfect fireman, we do not want to lose him, but to have him stay there, and my idea of the correspondence-school scheme of education is to take a poor fellow who never had any chance to go to school, but had to go to firing when he was 15 or 16, and give him a chance to learn something during his spare hours, so that some day he may rise to be a superintendent. I know several such cases where men have moved rapidly up from lower to higher positions by the aid of these schools. I think some of the courses are too long, but some of them are comparatively short. They have a course for professional linemen and inside electric-wiring men, and while it is not necessary to

know algebra to be a fireman, yet the whole purpose of the course is to advance men.

Mr. Gille: It seems to me that the point brought out in this report, that the percentage of students that finish that course is very low, indeed, would indicate that there is something wrong. There is quite a number of employes in my department who have started with this correspondence school; there are probably 30 who have started and only one that has finished; and I have inquired several times why this was. It was simply because they had to go over a lot of stuff they did not understand and did not care anything about. They would jump through and pick out matters that interested them particularly or that they believed would do them good, and it seems to me that the recommendations made by this committee are practical. A man in whatever station he happens to be should have a future to look to, and from the correspondence course, properly arranged, he gets not only a general knowledge of the operation of the plant, but also a very good idea as to the machinery itself and the system.

H. Almert, Chicago: I want to state an experience I had about a year ago. I took the lesson leaves of probably the first correspondence school that came out—it is not in existence now—and took all the trimmers, inspectors and wiremen that I have and gave them these leaves to read from, and once a week all through the winter I held a little lecture and went over these lesson leaves and explained them and asked the men questions, and the result was that I got very much better work from the men, but I have only one of those men left, and he is advanced three or four points. The others have found better positions elsewhere. So I have the same task to do over again.

George Cutter, Chicago: The remarks of the last speaker interest me immensely. They prove the value of the course. The paper itself is rather a surprise. We are proud to have had a committee to give such a report on this topic. We are proud that this association is handling this important question of educating men to do their work better, and we are glad that the committee has gotten it down to a practical basis. We all understand that the man who is running a dynamo and has some little trouble with it would like at that particular time to know what the mischief is the trouble. He does not want to go through a long course of algebra or trigonometry to do that. It seems to me that the suggestion of the committee is especially pat. Of course, I would like to see some method by which the employes of the stations could ask questions pertaining to their business, from the correspondence schools, if possible. If not, I would like to see some method introduced by which those employes could ask questions from a source where they could receive correct information at the time that particular point of interest is before them. I should also like to see the central-station managers encouraging their employes to take up such a course, especially after it has received the stamp of approval of such an able committee as we have on this matter.

Mr. Almert: I do not want it understood that I did not feel that I had received what I ought to for my work. I am going to take up my classes again. My former experience will help me, and I think the results that I obtained during the time I had those men with me amply repaid me for the trouble I took, and I think it will pay me to continue.

OBITUARY.

Edwin Holmes.

Edwin Holmes, president of the Holmes Electric Protective company, of 26 Cortlandt street, New York city, died at his home in that city on January 17th. He was born in West Boylston, Mass., 81 years ago, and was educated at the Leicester Academy. He began the study of electricity in 1857 and two years later got a patent for an electrical appliance called the "home protector." This apparatus was a system of stringing wires connected with a bell, which would announce the opening of a door or window in the house once the alarm had been set. He then went to New York city and became interested in the development of the telephone. He was president of the first telephone company in that city, which afterward became the Metropolitan Telephone company, and which is now part of the Bell system. In 1873 he conceived the idea of furnishing protection to the banking houses and the jewelry houses in the Maiden lane district with his burglar-alarm system, and he located a station in Pine street. The Holmes Electric Protective company was formed in 1883. Mr. Holmes is survived by a wife and three children.

Frederick A. Gilbert.

Frederick A. Gilbert, president and manager of the Boston Electric Light company of Boston, dropped dead from apoplexy while dining with friends at the New York Club, in New York city, on January 18th. Mr. Gilbert was 54 years old and was a native of New Haven, Conn., where he began his business career. When the electric light became practicable he bought a New Haven company, made a success of it and purchased several companies in that vicinity. With New Haven friends, about twelve years ago, he purchased one of the electric-light companies in Boston, and when it was consolidated with others he became president and manager. He had been president of the Massachusetts Electric Lighting association since its formation 11 years ago. He had been interested in and a director of mining and other corporations. He leaves a wife and two children.

Chicago Electrical Association.

At the regular meeting of the Chicago Electrical association, held in its rooms in the Monadnock block, on the evening of January 18th, Vice-president Almert presided, in the absence of President R. F. Schucharat, who is confined to his home in Milwaukee on account of illness. The paper of the evening was presented by Mr. Almert, his subject being "Arc-lamp Standardization." The difficulties met with in arc-light photometry were discussed and the construction of the Heiner lamp and standard British candle were described in detail. The author spoke of the great need for standardization of arc lamps and of some steps that would lead toward it. Some valuable points in regard to the variation of the illumination due to the use of different carbons, reflectors, globes, etc., and also in regard to the range of voltages and the strength of current on different systems were brought out in the discussion by C. W. Wiler. Other members taking part in the discussion were Thomas G. Grier and F. S. Hickok.

There were distributed at the meeting copies of a handbook which a committee of the association has recently compiled. The book gives a short history of the society, with its charter, the by-laws, a list of members and officers, and a list of papers that have been read before the association since its organization 10 years ago. In connection with this list are given references, so far as it was possible to obtain them, of the technical journals in which any of the papers were published. The handbook has been carefully prepared and should prove valuable to anyone interested in the association. Copies may be obtained by addressing the secretary, W. J. Warder, Jr., 906 Walnut street, Chicago.

CORRESPONDENCE.

New York Notes.

New York, January 19.—The annual report of the State Railroad Commission, recently submitted to the Legislature, shows that the net earnings of the street surface roads last year were $16,822,382, compared with $14,865,541 for the preceding year, while the dividends declared aggregated $6,889,565, against $7,076,219 for the year previous.

President Noah L. Cocheu of the State Electric Light and Power company was recently sued by a stockholder, who charged him with conspiracy and violation of office, for selling the franchise of the company to the Amsterdam Electric Light, Heat and Power company. Supreme Court Justice Wilmot M. Smith, in Brooklyn, has handed down a decision dismissing the complaint with costs. He says in his opinion that the State company had never earned any money and was heavily in debt, that the only asset it had was its franchise, and that in order to save this a mile of conduit had to be laid. The company did not possess money enough to lay the conduit, and therefore Mr. Cocheu, after giving notice to the stockholders, sold the franchise to the Amsterdam company. Justice Smith says the proceedings were regular and that Mr. Cocheu's action was ratified by the stockholders.

A rumor that the Manhattan Elevated was to be leased to the Metropolitan Street Railway company during the week caused a rise of Manhattan stock to 123⅜. The rumor was denied by Manhattan officials, who said that it was started for speculative purposes.

The proposition to bond the village of Tarrytown in the sum of $35,000 for the purpose of establishing a municipal lighting plant was voted down at the special election.

Official announcement has been made that, beginning on January 21st, through trains will be operated over the Brooklyn elevated railroad and the bridge to Park Row on all lines, with the exception of the Kings County, between the hours of 10 a. m. and 4 p. m. and 8 p. m. and 5 a. m. The forward car of each train of the through elevated trains will be used by local bridge passengers from Manhattan to Brooklyn.

The annual meeting of the stockholders of the Brooklyn City Railroad company was held on January 14th. The following-named directors were elected: E. H. K. Belcher, Eugene Britton, R. L. Edwards, Henry Evans, S. L. Husted, Jr., David G. Legget, Frank Lyman, Edward Merritt, Charles M. Pratt, George H. Prentiss, Alonzo Slote, James Timpson and Edward D. White.

The James F. Hughes company of New York city has been incorporated for $10,000, to manufacture electrical supplies. The directors are J. F. Hughes and H. E. Bailey of Brooklyn and Nathaniel Webb of Greenwich, Conn.

A bill has been introduced before the Assembly making it unlawful for an elevated railroad company to maintain turnstiles.

Construction work on the rapid-transit tunnel is now being carried on in nearly 70 blocks of the city and progress is being made which seems to assure the completion of the railway on contract time. Seven of the blocks have reached that stage of construction where the steel framework is already up and in portions of two blocks the frames are in, roofed over and practically filled in to the street surface. Ample evidence that the road is well under way is in the presence of thousands of pounds of structural steel piled in various streets from the City Hall section to the beginning of the long tunnel at One-hundred-and-fifty-seventh street in Broadway on the west side to beyond One-hundred-and-tenth street and Lenox avenue on the east branch. On every section under way the sewer changes are going on simultaneously with tunnel construction, and so far a great deal has been accomplished.

M. L. G.

Canadian Intelligence.

Ottawa, Ont., January 19.—Mr. R. H. Gilmour, for seven years superintendent in the Waterous Engine Works company, Brantford, Ont., has gone with the Canadian General Electric company. Mr. Hazen Ritchie, chief engineer of the Canadian General Electric company's works at Peterboro, Ont., has been transferred to Montreal to take charge of the Royal Electric company's works, now forming part of the former company's business.

A company has been formed at Yarmouth, N. S., for the purpose of constructing a line of street railway from Yarmouth to Port Maitland, a distance of 12 miles. The company is capitalized at $250,000. The incorporators are: B. B. Law, James Burrill, John Killam, E. K. Spinney and George Bingay, all of Yarmouth.

The Brandon (Man.) Electric company is establishing a long-distance transmission system, and is erecting a plant at a waterpower 10 miles distant from the town. The equipment consists of a 500-horsepower generator and a 500-horsepower, synchronous motor, with 500 horsepower in step-down and step-up transformers. The transmission will be carried out on the three-phase system at 10,000 volts.

At the annual meeting of the Toronto Electric Street Railway company, on the 16th inst., it was reported that the gross earnings for the last year were $1,501,000, as compared with $1,333,542 the previous year. The operating expenses were $775,980, or 51 per cent. of the gross, as compared with $650,324, or 48.8 per cent., in 1899. After paying all fixed charges, there remained a net profit of $454,162, from which dividends of $240,000, or four per cent. on the capital, were paid. The city-pavement charges were met and $150,162 put to the credit of the profit-and-loss account. Since 1892 the company has spent over $1,000,000 of the surplus earnings on improvements to the property. The increase in the price of coal and advances in the wages of employes were the causes of the increase in the operating expenses last year.

Mr. George Johnson of Ottawa, the Dominion statistician, says that in 1891 the census returns showed 80 establishments selling electric light in the Dominion. In 1897 there were 187, which increased to 297 in 1900. The electric lamps supplied by the establishments selling light numbered 443,897 in 1897 and 807,772 in 1900. The largest establishment in Canada in 1900 was the Royal Electric Light company of Montreal, supplying 78,762 incandescent lamps and 1,805 arc lights. The next largest is the Toronto Light company, supplying 75,000 incandescent lamps and 1,650 arcs, while the Ottawa Electric company stands well to the front with 77,255 incandescent lamps and 621 arcs. The province of Ontario has made rapid strides in the employment of electricity for lighting purposes, using 418,573 lamps in 1900, against 201,955 in 1897. The province of Quebec increased its employment of the electric lamp from 185,892 lamps in 1897 to 235,322 lamps in 1900. The other provinces have all developed the use of electricity for lighting purposes in a very satisfactory manner. British Columbia had a couple of establishments selling electric light in 1897, operating only a very small number of lamps. In 1900, however, this province had 13 electric companies, with an equipment of 52,653 lamps. The use of the arc light in Canada has increased from 9,516 lamps in 1897 to 11,917 in 1900. The census of 1891 showed 49 gas works in Canada against 43 in 1900.

The Canadian government has been informed that the Imperial authorities have decided to appoint a departmental committee to inquire into the question of cable communication. The investigation will be a very comprehensve one, and will not only deal with the present cable services in British territory, and the rates charged therein, but will ascertain where it is possible to establish new lines with advantage. This inquiry will begin some time in February next. The Imperial government has been induced to take this step through the efforts put forth by Sir Edward Sassoon, who has manifested a keen interest in the question of cable communication. Sir Edward urged the appointment of a royal commission to make the investigation, but it has been thought best that the inquiry should be undertaken by a departmental committee.

A. V. W.

From the Buckeye State.

Columbus, Ohio, January 19.—The Steubenville Traction and Light company, Steubenville, Ohio, has been incorporated, with a capital stock of $500,000, to build, acquire and operate a street railway within that town, and to build lines through the

country in that vicinity, the termini being defined as Steubenville and Toronto. The incorporators are Justin A. Moore, Jay S. Baisley, J. M. Powers, C. P. McFadden and B. J. C. Armstrong.

It is reported from Ashtabula that work on the new line of the Conneaut and Eastern Railroad company will commence within a short time. This will connect Conneaut and Ashtabula. It is thought that a new company will soon be formed to build a line from Ashtabula to Painesville, and this will complete the connection between Cleveland and Erie.

At the annual meeting of the stockholders of the Cleveland Electric Railway company, held in the offices of Mr. Henry A. Everett, a few days ago, all the old directors and officers were re-elected for another year. No changes will be made in the operation of the road this year. Reports of officers were very satisfactory to all. Superintendent McCormick was re-elected for another year.

Talk is again revived in regard to the proposed electric line from Columbus to Cleveland, which, it is said, is being projected by eastern capitalists. The route for this proposed line will be almost straight from Columbus to Fremont, and will then deviate to make an entrance to Toledo. It is further stated that it will seek a private right-of-way almost the entire distance. Another report states that a line will be arranged from Cincinnati to Toledo.

The net earnings of the Cincinnati, Lawrenceburg and Aurora Street Railroad company have been sufficient in the eight months in which it has been in operation to pay all interest on bonds and the running expenses of the entire year, although a portion of the road has been in operation only four months. Some of the company's bonds are now on the market, the proceeds to be used for extensions and improvements.

Cleveland electric-railway magnates are interested in a new road which will be built from Richmond, Va., to Petersburg, a distance of about 22 miles. It is known as the Richmond and Petersburg Electric Railway company, and is capitalized at $500,000. Major Corbin Warwick of Richmond is the president; Judge J. L. Haner, secretary; J. R. Nutt, Akron, treasurer. Will Christy and L. Mendelbaum are in the directorate.

Machinery is being placed in position at the large carbon plant at Lancaster, and the work of completing the works will be pushed as rapidly as possible. In all there are 11 large buildings, constructed entirely of brick and steel.

The meeting of the directors of the Columbus Edison Electric Light company, held a few days ago, resulted as follows: President, A. Theobold; vice-president, J. F. Martin; secretary and general manager, A. W. Field; treasurer, Emil Kieswetter.

The directors of the Cincinnati Street Railway company have decided favorably in regard to leasing the property of the company to the Elkins-Widener-Dolan syndicate, and have called a stockholders' meeting for January 21st, when they will vote on the matter. The directors will take no action without the favorable vote of the persons who hold the stock, and it is so widely scattered that no one can take advantage of it by having a controlling interest. The proposition of the eastern syndicate includes the payment of six per cent. on the stock of the company and the organization of a company in this state to operate the road. There are some business men in Cincinnati who are very skeptical over the matter, and fail to see how the syndicate is going to come into the city and make the property pay six per cent. and a profit for themselves besides, when the best it has paid is five per cent., and sometimes hardly that. The operating company in this state will be capitalized at $2,000,000.

The Supreme Court has been called upon to pass upon the validity of perpetual franchises, the special case being that of the Cincinnati Edison Electric Light company. Upon the decision in this case many of the deals in railroad and light property in the state will depend.

The Toledo and Western Railway company has filed notice with the secretary of state that a change of plan has been made and instead of making a terminus on the Michigan state line, near Morenci, the line will be extended on to the Indiana line. Luther Allen is the president of the road, and F. E. Seagrave, secretary. O. M. C.

Information from Indiana.

Indianapolis, January 21.—The Kendallville City Council has appointed a special committee to inquire into the advisability of the city operating an incandescent electric-light plant.

A movement is on foot to build an electric railway between Clinton and Paris, Ill. Congressman Hunter of Paris and others are behind the project. Much of the preliminary work has been done.

The city of Knightstown now owns its own electric-light plant, having recently purchased the local plant, owned by H. Walls & Co., for $3,500. The plant will be enlarged and improved and arc lights will be substituted and a new commercial line added.

It is said that the Big Four Railroad company will reduce the fare from Muncie to Indianapolis to 65 cents in order to compete with the electric-line rates.

A few days ago there was a lively race between a trolley car on the Muncie interurban line and a mail train on the Big Four, whose tracks are parallel. Both started from Dalesville at the same time, but the trolley car was the first to arrive at Chesterville, a distance of 13 miles.

A mass meeting of citizens was held at Richmond last week for the purpose of protesting against the construction of a municipal electric-light plant, to cost $143,000, the contract for which was let to the Varney Construction company of Indianapolis by the council. The meeting was largely attended by business men, and jobbery was alleged. Much excitement prevailed. The people insist that the figure is too high, and appointed a committee to see what legal steps could be taken to prevent the fulfillment of the contract. Another committee was appointed to visit the Legislature to secure relief if possible and to allow the construction under the supervision of the same non-partisan board that will have control of it after its completion It is the avowed intention of the Commercial Club to fight the contract to a finish. F.

Southern Developments.

Charlotte, N. C., January 19.—The Consolidated Electric Light company of Birmingham, Ala., has about completed an addition to its plant which cost $150,000 and which makes the total capital invested $1,600,000. Nearly every town in Jefferson County is reached by this company.

Five miles of the new electric line at Greenville, S. C., have been about completed. Mr. J. H. Davis, president of the American Pipe company, which is the real owner of the line, has made a personal examination of the new system, which he pronounces thorough and excellent in every particular.

The Board of Electrical Control of Richmond, Va., has ordered all wires placed underground immediately.

Colonel T. C. Duncan of Union, S. C., and associates have been granted a franchise to build an electric railway in Union. The proposed line will be over three miles long.

The Charleston (S. C.) Suburban and Summerville Railway company has applied for a franchise in Charleston. The franchise will be granted provided electric or cable lines, and not horse cars, are operated.

The Metropolitan Rapid Transit company has applied for a franchise in Birmingham, Ala., to operate an electric railway. Eugene F. Enslen says that the company means business and will expend between $400,000 and $500,000, if the concessions are granted. L.

Western New York.

Rochester, January 21.—The plant of the Citizens' Light and Power company of Rochester is to be largely increased. When alterations are completed it is announced that the station will be able to carry four times as great a load as before the fire in November last. The company has recently acquired additional water rights on Browns Race, so that an abundance of waterpower is available during a part of the year, although steam will be required during certain seasons. The company will install Westinghouse generators for power and incandescent lighting. It is announced that power will be supplied from the station within two weeks. It is predicted that the company will enter into active competition with the Rochester Gas and Electric company when its plant is fully equipped, and there is considerable talk of rate cutting. It is also rumored that the Citizens' company may establish a gas plant, in order to compete the more vigorously for business. The Citizens' company is now controlled by a new syndicate, at the head of which is A. M. Young of New York, who has been identified with many important electrical enterprises. He was instrumental in building the third-rail electric line from Albany to Hudson.

Two electric-railway projects are under consideration at Geneva, N. Y.—one the construction of a road to Rochester. It is predicted that work will be commenced early in the spring. It is announced that the right-of-way from Rochester to the Pre-emption road west of Geneva has been secured, with the exception of that through Victor. William A. Smith of Geneva is at the head of the enterprise of constructing a road from Geneva to Penn Yan along the old Pre-emption road.

The Mechanics' Institute of Rochester, N. Y., has started a course in steam engineering, which, it is believed, will be especially useful to the owners and operators of automobiles. The steam, gasoline and electric carriages will be studied.

President G. Tracy Rogers of Binghamton, N. Y., has called a meeting of the street-railway men of the state, to be held at New York on January 30th, to consider proposed legislation affecting the management of railways.

Officials of the proposed Buffalo-Niagara Falls electric line recently made an inspection of the route of the road, going over the ground in a carriage. They gathered facts to be presented to the State Railway Commission, at the hearing in Rochester, January 25th, showing the needs of the road. Mr. George Moss of Rochester, secretary of the company, stated as soon as the consent of the commission is obtained 1,000 men will be put to work on the construction of the road. The railway is designed principally to carry freight and will transport farmers' produce into the markets of Buffalo, Rochester and Lockport.

It is announced that the construction of the Canandaigua-Palmyra electric railway is assured. The right-of-way at each end of the proposed road has been secured. Canandaigua will be one terminus of the line, in all probability, and the power house will be located at this point. It is thought probable that the railway will eventually be extended to connect with the Sodus Bay electric road and establish a convenient route to Rochester.

Representatives of the Rochester and Eastern Rapid Transit company have been obtaining consents for the right-of-way for a trolley line to be constructed from Canandaigua north to Pultneyville, to Shortsville, Manchester, Palmyra, Marion and Williamson. It is stated that the right-of-way has been practically secured and that the building of the road is assured.

The board of trustees of Bath, N. Y., has been considering a petition that the village establish its own electric-light plant.

The city engineer of Rochester, N. Y., has just prepared a new map showing the location of all street lights. The accompanying figures go a long way toward justifying the claim of Rochester that it is the best-lighted city in the United States: There are 2,932 street lights, of which 2,324 are single arc lights, 464 double arc lights and 144 gas lights. The cost of the service is about $250,000 a year, and the cost of lights per night is as follows: Double arc, 40 cents; single arc, 25 cents; gas, eight cents.

A. E. Suttles, who had charge of the electric-light plant of De Land & Co. at Fairport, N. Y., died January 18th.

The United Contractors' Association of New York State elected the following-named officers at the annual meeting at Utica: President, Rudolph Schmidt, Rochester; vice-president, S. Davis, New York; treasurer, J. C. Sterns, Buffalo; secretary, W. H. Morton, Utica. The next meeting will be held in July in Buffalo. D. W. J.

Northwestern Notations.

Minneapolis, January 19.—There is talk at Madison, Wis., of the Legislature providing for a state electric-light plant for the state capitol, the university buildings and the insane asylum and the historical-library building. It is proposed to have the plant constructed and operated by the engineering department of the State University.

The street-railway company of Seattle, Wash., will equip all its larger cars with air brakes.

The new Gas and Electric company of Waterloo, Iowa, is in charge of the system, succeeding the Waterloo Gas and Electric Light company.

Arthur R. Warren proposes to develop the waterpower of the Chenius River and transmit the power electrically to Tacoma, Seattle, Carbonado, Puyallup and other cities of western Washington.

The Rocky Fork Coal company of Red Lodge, Mont., has made a proposition to the town, to put in a modern alternating lighting plant, if given a 25-year franchise. The lighting has been done from the mine plant hitherto, and has not been entirely satisfactory.

L. A. Pitts has been appointed superintendent of the Union Electric company of Dubuque, Iowa, succeeding Henry Schroeder, resigned. Mr. Pitts was formerly superintendent for the Dubuque Street Railway company.

The Bluff City Electric Light and Gas company of Council Bluffs, Iowa, has reorganized as the Citizens' Gas and Electric Light company, under the laws of New Jersey.

The Railway and Power company of Tacoma, Wash., will build a branch to Lake Park at once, and expects to have the line completed within six weeks.

Merchants at Fond du Lac, Wis., contemplate forming a co-operative electric-lighting association for that city.

J. H. Whitaker has been appointed city electrician for Tacoma, Wash.

J. and F. Evarts have made a proposition to install an electric-light plant for Glidden, Iowa, if assured proper support.

The changes and improvements to be made to the electric-light plant at Walla Walla, Wash., are expected to be completed by February 1st, and the new plant put in active operation.

A council committee of Maple Lake, Minn., is considering estimates of cost for an electric-light and water system.

The village of Hartington, Neb., contemplates establishing an electric-lighting system in connection with its water plant.

Prescott, Iowa, is agitating for a municipal electric-light plant.

The Light, Heat, Transit and Public Service company is the comprehensive title of a new company formed at St. Cloud, Minn., with $100,000 capital stock. The company has secured the Hertig lighting and heating system and has ordered new machinery, which will be installed at once. It is expected to have the lighting and heating plants in service by February 1st.

E. A. Artz of St. Paul has become manager of the electric-light plant at Pipestone, Minn. The plant will soon install two new 60-horsepower boilers and other new machinery, which will double the lighting capacity.

The Sheboygan (Wis.) Street Railway company plans to extend its line from Sheboygan Falls to Elkhart Lake.

The Des Moines (Iowa) City Railway company

has concluded to build the Indianola extension of the line, if entrance can be secured to Indianola. Otherwise, the line will be built only to the army post.

The city of Stillwater, Minn., will appeal to the Supreme Court the case in which it seeks to have the Twin City Rapid Transit company's franchise annulled for failure to extend its line to South Stillwater. R.

PERSONAL.

Mr. B. E. Sunny, western manager of the General Electric company, was elected vice-president of the Union League Club of Chicago on Monday. There was a keen contest, with two tickets in the field, and as candidates from both tickets were elected, the honor is the more noteworthy.

H. H. Robinson, traffic manager of the Central Union Telephone company, has been promoted to the position of general superintendent of the company. It is said that he is the youngest officer to hold such a position of any of the large telephone companies in the United States.

A large number of Americans were awarded decorations of the Legion of Honor last week by the French government for services in connection with the Paris Exposition. Among them were J. Pierpont Morgan, to be an officer, and George Westinghouse, to be a chevalier. Others decorated were Francis E. Drake and Carl Hering, chevaliers.

Adna Brown, one of the prominent men of Vermont and the leading citizen of Springfield, Vt., died at his home there on January 14th, after a short illness, aged 72 years. He was president of the Springfield Electric Railway company, and had occupied seats in both branches of the Vermont Legislature.

Mrs. Julia Abrams of Niles, Mich., who is 83 years of age, is believed to be the first woman telegrapher in the United States. Mrs. Abrams, in company with her husband, Leonard Abrams, now deceased, went to Niles in 1855, and Mr. Abrams was for 10 years telegraph operator on the Michigan Central railroad at that point, during which time his wife became an adept in telegraphy.

A. H. Seymour, one of the oldest telegraphers in the country, died from pneumonia in New York city on January 16th, after an illness of two weeks. Mr. Seymour was born in Manlius, N. Y., in 1835 and became a telegrapher at the age of 15 years. He is said to have been the first sound operator to work in Milwaukee and one of the first to work in Chicago. About 20 years ago he was a chief operator for the Western Union Telegraph company, and later he became manager of the central office in New York of the United Lines Telegraph company, the outgrowth of the Bankers and Merchants' Telegraph company.

ELECTRIC LIGHTING.

Plans are being formulated for the erection of new electric-light plant in Humphrey, Neb. The projectors are H. J. Breunig, J. E. Hugg and B. Martyn.

An issue of electric-light bonds is being considered for Richmond, Ind. It is expected they will be issued in three series, of $50,000 each, at four per cent.

The Chestertown (Md.) Electric Light and Power company has been incorporated, with $25,000 capital stock, by M. A. Hoffman, A. H. Tracy, J. K. Wright and M. De Kalb.

Plans and specifications have been submitted by C. H. Jenks, supervising engineer, for a new electric-light plant, to be erected in Magnolia, Miss., in the near future. Bids will soon be advertised for.

Citizens of Clinton, Ky., have $5,000 to invest in an electric-lighting plant. The town has a population of 2,000. The promoters desire to obtain bids for the necessary machinery, and to engage a superintendent for the plant. Information may be obtained from Don Singletary of Clinton.

As a result of the disagreement between the city officials of Creston, Iowa, and the Creston Gas and Electric company, the latter has been ordered to discontinue its service and the citizens are dependent upon oil lamps. The city demanded a reduction of rates and improvement of service, and the company agreed only on condition that the city would enter into a long-time contract.

ELECTRIC RAILWAYS.

The Lorain and Cleveland Electric Railway company will spend $300,000 in improving its line and facilities this year.

The councils of Scranton, Pa., have directed the Scranton Railway company to issue transfers at all connecting and intersecting points of its lines, under penalty of forfeiture of franchise.

J. F. Megargel and W. H. Bankington of Scranton, Pa., were in Joplin, Mo., recently, looking over the proposed route for the new electric line for which the council recently granted a franchise to F. N. Moore.

The United Power company of East Liverpool, Ohio, has been incorporated, to construct and maintain railroads in Columbiana and adjoining counties in Ohio and Pennsylvania. The capital stock is $900,000.

The Rockford and Belvidere Electric Railway company has about decided to equip its trains with telephones in such manner that in case of accident the train crews will be in instant communication with headquarters.

A new electric road is to be built, it is said, between Louisville, Ky., and Pewee Valley by the Louisville Anchorage and Pewee Valley Railway company, which has been incorporated, with an authorized capital of $750,000.

P. S. Flinn, a New York railroad contractor, states that he has formed a syndicate to build a road from Battle Creek, Mich., to Detroit, and that surveys will be made at once. He is associated with William A. Boland, owner of the Jackson (Mich.) street railway.

The Illinois Interurban Construction company of Chicago has been incorporated, with $75,000 capital stock. The company was formed by Judge Baylies, and contemplates building the proposed line to Belvidere, and others later on. S. E. Bare and C. A. Grover are also interested.

Capitalists of Ypsilanti, Mich., propose building an electric road from Windsor to Chatham, Ont. J. Webb, representing the American capitalists, has met the railway committee of the Chatham and Kent County councils, and this joint committee passed resolutions promising to give the road all possible support.

AUTOMOBILES.

Some misapprehension has been caused apparently by the recent statement that the Woods Motor Vehicle company was about to leave Chicago and establish itself in New Haven, Conn. G. H. Atkin of the Woods company, in speaking of the report, stated that it was started by the announcement of the establishment of a branch factory at New Haven. The company does a large business in the East and the New Haven factory will build a few vehicles to help supply this trade and will include a complete overhauling and repair shop. The company's main factory will remain in Chicago and will do the bulk of the firm's manufacturing business. The cab service operated by this concern in Chicago is to be largely increased with the advent of warm weather by the addition of a number of open carriages of different types, for which there were many calls last year. The two open vehicles put on late in the season were in great demand and highly successful.

TELEGRAPH.

A report from Durban, Africa, states that the Cape-to-Cairo line is now in operation to a point 50 miles north of Katanga and 100 miles beyond the southern line of Lake Tanganyika.

It is reported that officials of the Western Union Telegraph company and the Postal Telegraph-cable company have stated that their companies have accepted the terms imposed by the Chicago Board of Trade officials for renewal of market-quotation service, excepting the exaction that these companies shall not be privileged to render market-quotation service in Chicago. This privilege was placed with the Cleveland Telegraph company, a local ticker concern, which, as President Warren is quoted as saying, is dominated by the Board of Trade.

The project of an extensive network of submarine telegraph cables is being diligently pursued by Germany, and is being actively furthered by the emperor. The latest shape of the project, so far as the far East is concerned, is as follows: Germany and the Netherlands to lay a cable jointly which will go through the Dutch Indies, touching at the Natus islands, Billiton, Palembang, Batavia, Macassar, Amboina, German New Guinea and the Carolinas, with a central point at Shanghai; then branching from Kiao Chou easterly to Japan and America. The Dutch government will lay the cable through its own colonies and Germany will do the rest. The financing of this project is said to be about concluded.

PUBLICATIONS.

The latest catalogue and price-list (No. 21) of the New York Insulated Wire company, 13 Cortlandt street, New York city, is a neat booklet of 80 pages and contains descriptions, price-lists, wiring tables, etc., of the company's Grimshaw, Raven and other kinds of insulated wires, cables and tapes, for telegraph, telephone, bell and electric-railway purposes.

"Draft Without a Chimney" is the title of an interesting little booklet of which the fourth edition has just been issued by the B. F. Sturtevant company, Boston, Mass. This brings the total number of copies printed up to 50,000. It relates to the experience of the Sturtevant company in the use of a fan to produce draft without a chimney in its own works. Copies will be furnished on application.

The Belden system of 110 and 220-volt enclosed-arc lamps for direct current is described in bulletin No. 101, issued by the manufacturer, the Belden-Larwill Electric and Manufacturing company of Fort Wayne, Ind. The company has the following-named agencies: M. B. Austin & Co., 56 West Van Buren street, Chicago; R. N. Stewart & Co., 1732 Champa street, Denver, Colo.; C. E. Wilson, 1000 Betz building, Philadelphia.

The fire report for the quarter ended January 10th of the electrical bureau of the National Board of Fire Underwriters, embodying accounts of fires resulting from electrical causes, has just been issued by W. H. Merrill, Jr., secretary and electrician of the Chicago Underwriters' Laboratories. Copies of the report may be obtained in numbers as desired by addressing the office of the laboratories, 67 East Twenty-first street, Chicago.

A very complete circuit-breaker catalogue has just been issued by the Cutter Electrical and Manufacturing company, Nineteenth and Hamilton streets, Philadelphia. This company makes the well-known I-T-E circuit-breakers, which operate on the inverse time-element principle. The catalogue, which has 125 pages of descriptive matter, illustrations, price-lists and diagrams, treats the circuit-breakers under six different sections, viz., plain overload, no voltage, plain underload, combined overload and no voltage, combined overload and underload, and laminated edgewise, the pages devoted to each section being of a separate color of paper. The catalogue should be in the hands of every central-station and street-railway engineer.

POWER TRANSMISSION.

A new company of capitalists, including General J. S. Carr of Durham, N. C., has been formed, with a view to the development of a number of water-powers in western North Carolina. The company will be known as the North Carolina Electrical and Power company. The capital stock is $100,000, which will be increased by the addition of new stockholders.

The Leadville Electric Power company of Leadville, Colo., has been incorporated for $3,000,000 by E. S. Douglass, L. H. Tatum and G. C. Manly. Surveys have been made, water rights secured and reservoir sites selected, and the power house is to be built about 18 miles from Leadville to supply the city with lighting and power service. The fall is 300 feet and the company says that it has sufficient water to insure a continuous output of 5,000 horse-power. The transmission voltage will be 22,000.

A canal is projected to run from the Tennessee River to the Tombigbee River, leaving the former at some point near Sheffield, Ala., and reaching navigable waters on the Tombigbee River at Aberdeen, Miss. The distance would be about 75 miles and the descent in this distance is fully three feet to the mile, measuring from the low-water mark of each stream. Owing to streams entering the Tennessee River from the South and the Tombigbee River extending north within a few miles of the Tennessee River, the cut would not be great, and there being an abundance of material along the route for construction, it is believed the cost of the canal would not be large. By the construction of such a canal the Tombigbee and Alabama rivers could be made navigable by locks the year round, and a channel would thus be afforded all the time for the vast products of West Tennessee, North Mississippi and western Alabama to deep water. Besides the operation of a navigable channel this canal would undoubtedly offer a good field for investors to erect an electrical power plant, which would utilize the considerable fall in water that could be obtained for the operation of turbines.

ELECTRICAL SECURITIES.

The Twin City Rapid Transit company of Minneapolis has declared a dividend of 1½ per cent. on its common stock, payable February 15th. Books close February 9th and reopen February 19th. The company paid a dividend of 1½ per cent. in August, making three per cent, for the year.

SPACE TELEGRAPHY.

It is reported from London that the International Marine Communication company, one of the concerns employed in developing communication between ships and shore by the Marconi system, has invited Professor Popoff, the Russian inventor, to visit England for the purpose of capitalizing his invention. Professor Popoff has invented a system of space telegraphy, but there seems to be no rivalry between him and Marconi.

Professor R. A. Fessenden, who has been conducting the government's experiments in wireless telegraphy with encouraging success, has gone to Cape Hatteras to erect stations in that vicinity for communication with vessels at sea and with the life-saving stations. Three towers will be erected, one each at Cape Hatteras, Cape Henry and Roanoke Island. It often happens that the Weather Bureau's coast line is blown down when it is needed most, and Professor Fessenden's system, if successful, will replace this line in that locality.

Recent reports from Honolulu seem to indicate that the establishment of a system of wireless telegraphy among the Hawaiian Islands promises to be a decided success. It is stated that there are three

stations, the one on the island of Lanai serving as an intermediary between the Honolulu station and the one at Hilo, on the island of Hawaii. The distance from Hilo to Lanai is over 125 miles, partly over land, and if this line proves successful it will constitute quite a step in advance. The successful operation of the new lines will complete the intercommunicating system of the group of islands, several cables, one for telegraph and the others for telephone service, being now in operation.

SOCIETIES AND SCHOOLS.

"Station Economy of Interurban Railways" is the title of a paper read by Professor John R. Allen of the department of mechanical engineering of the University of Michigan at the fifty-third regular meeting of the Detroit Engineering society, held in Detroit, Mich., on January 18th.

The resignation of John H. Peck as president of the Renselaer Polytechnic Institute of Troy, N. Y., has been accepted by the trustees of the Institute, and a committee of three, comprising Horace G. Young of Albany, Charles MacDonald of New York and Harry B. Dauchy of Troy, has been named to report on a successor.

At the forty-eighth annual meeting of the American Society of Civil Engineers, held in New York city last week, the following-named officers were elected for the ensuing year: President, J. James R. Croes, New York city; vice-presidents, Henry S. Haines, New York city, George H. Benzenberg, Milwaukee, Wis.; treasurer, Joseph M. Knap, New York city; directors, Josiah A. Briggs, New York city; George F. Swain, Boston, Mass.; Emil Kuichling, Rochester, N. Y.; Mordecai T. Endicott, Washington, D. C.; Edward C. Carter, Chicago, Ill.; Frank C. Osborn, Cleveland, Ohio; William H. Searles, Cleveland, Ohio. The association has 2,337 members, the largest number in its history.

The regular monthly meeting of the Engineering Association of the South was held on the evening of January 10th, at Vanderbilt University, Nashville, Tenn. The death of Major Niles Meriwether, president of the association was announced, and a committee was appointed to prepare a memorial sketch of his life. The first paper of the evening was a description of the methods of doing some bridge-pier and foundation work in Chemulpo, Korea, by W. H. Holmes, an American engineer, who has just recently returned from that country. The second paper was presented by Julian W. Kendrick, city engineer of Birmingham, Ala. It was an exhaustive study of the sewerage problem now confronting the Birmingham district.

F. C. Mason, superintendent of police telegraph of Brooklyn, has received a large number of requests from mayors of cities for copies of his paper on the progress and needs of the fire and police departments from an electrical standpoint, which he read at the recent meeting of the League of American Municipalities, and also for copies of rules governing municipal inspection and installation. Mr. Mason is a member of the committee of the International Association of Municipal Electricians, appointed to draft a set of rules on this subject, and he requests that all municipal electricians or other city officials having a code of rules governing this work forward him a copy, so that the committee may have abundant material to select from, and if possible to improve upon. The executive committee of the International Association of Municipal Electricians will meet in Niagara Falls during the month of February to complete arrangements for the annual meeting of the association at that place in September.

MISCELLANEOUS.

The City Council of Chicago has passed an ordinance providing for the leasing of city conduits to private companies for telephone or other wires at prices which are expected to bring in a good income to the city. The wires can only be used for transmitting electricity for light, power, heat and signal purposes.

The City Council of Amsterdam, Netherlands, has voted 6,000,000 guilders ($2,412,000) for an electric plant, which is to furnish electricity for street cars, lighting and motive power. Consul Hill of that city says the prospects seem fair for part, at least, of the supplies to come from the United States. A. W. Ressing is the director of the municipal electrical works of Amsterdam.

In a recent consular report is given a comparative table of the cost of electrical works in different cities on the continent of Europe. The costs per horsepower of the plants were given as follows: Vienna, $262; Hamburg, $286; Frankfort, $207; Dresden, $216; Budapest, $294; Leipzig, $268; Nuremberg, $185; Cologne, $236; Stuttgart, $331; Hanover, $268; Christiania, $230; Darmstadt, $219; Chemnitz, $273; Amsterdam, $290.

TRADE NEWS.

The Chicago store of the American Electrical Works has been removed from 241 Madison street to larger and more commodious quarters at 82 Lake street, where a full stock of the company's products will be carried.

Awards on the machinery for the Puget Sound navy yard have been made by the Navy Department, including the following items: Electric traveling crane, Pawling & Harnischfeger, Milwaukee, Wis., $3,100; one direct-connected generating set, General Electric company, Schenectady, N. Y., $3,584; switchboard and instruments, General Electric company, $410.

The clay-working and coal-mining interests of John T. McRoy, maker of the well-known McRoy conduits situated at Brazil, Ind., and which he has conducted for the last five years, have been incorporated as the McRoy Clay Works. McRoy conduits will continue to be the principal product manufactured. Hereafter the headquarters of the company will be in Brazil, Ind., with branch offices in Chicago and New York.

The American Bridge company has grouped all its eastern plants in one section, and has appointed A. J. Major, formerly manager of the bridge and construction department of the A. & P. Roberts company, as manager of all these plants, which include the following: The Pencoyd plant, the East Berlin plant, the Buffalo plant, the Edge Moor plant, the Elmira plant, the Groton plant, the Hilton plant, the Horseheads plant, the Trenton plant, the Post & McCord plant, the Rochester plant and the Union plant. The New York contracting office of the American Bridge company will hereafter be in charge of S. Fischer Miller, formerly with Milliken Bros.

The Electric Storage Battery company of Philadelphia has placed on the market a new type of Chloride accumulator, especially adapted to the requirements of telegraph, fire and police-alarm, laboratory and other service where voltage rather than amperage is desired. This BT type, although of identical plate construction to the other sizes of accumulators manufactured by the company, is peculiar in having the positive and negative plates, together with the lugs or connectors, cast in one section, forming "couplets," in this way obviating entirely the necessity for bolt connectors or burning, to set up the battery. The plates are simply lowered in the receiving jars, and the only connections to be made are at the terminals, thus effecting a very considerable saving of labor in installation. The BT cell is made in one size only, the plates being four by 3 1-16 inches, the discharge in amperes for eight hours being three-fourths of an ampere, for five hours one ampere and for three hours 1½ amperes. A circular describing these cells will be forwarded upon application to any of the company's offices.

Two calendars for the new year recently issued by the Cutter Electrical and Manufacturing company of Philadelphia command attention by reason of their being printed on red cardboard, with red leaves for the months of the year. One of the calendars has a colored illustration of one of the Cutter company's I-T-E automatic magnetic circuit-breakers, while information concerning the company's products is printed on the back of the cardboard in English, Spanish, German and French. The other calendar shows two views of the I-T-E laminated, edgewise type of circuit-breaker for railway work, its points of merit being stated on the reverse side.

BUSINESS.

The Electric Appliance company, Chicago, is pushing its new line of Eaco jack-knife switches.

W. N. Matthews & Bro. of St. Louis report that they have just closed a contract with Philip Smith of Sidney, Ohio, to act as exclusive agents for his entire product of Stombaugh guy anchors. They will receive, fill and bill all orders for these goods in the future.

Among the interesting and instructive exhibits at the Northwestern Electrical convention was that of the Richmondt Conduit company of Milwaukee. This company showed a line of interior underground conduits and fittings, in which it reports a large business. C. D. Richmondt personally met and entertained the many visitors at his parlors in the Pfister, and was, in consequence, one of the busiest men about the convention.

The Central Electric company, Chicago, announces that it has just taken the agency for the D. & W. Fuse company's well-known products and is prepared to fill orders for these well-known fuses and cut-outs from stock. The D. & W. fuses, the manufacturer says, embody features which have made them popular among users. The Central company also states that the large number of orders it has received for the Hylo baby filament lamp indicates that this lamp is what the trade and consumer have long desired.

The Electric Storage Battery company has recently closed a contract with the Camden and Suburban railway, Camden, N. J., for the installation of an additional battery of Chloride accumulators, making the third order received from this company. The new battery sub-station is necessitated by the extension of the railway company's lines to Moorestown, a distance of 10 miles from its power house at Camden, and will be located at Ponsauken Creek, near Moorestown. The battery will consist of 240 cells, having a capacity of 200 kilowatt-hours.

The Chicago House Wrecking company, West Thirty-fifth and Iron streets, Chicago, announces that it has on hand a large stock of small, new Chicago noiseless dynamos and motors. These machines are moderate-speed and are adapted for all kinds of work. The dynamos range from 25 to 200 lights and the motors from two to eight horsepower. The Chicago House Wrecking company guarantees them to be first class in every respect, and is prepared to quote exceptionally low figures. Full particulars are given in Catalogue No. 156, sent on request.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 15, 1901.

665,874. Apparatus for Telephone Toll Lines. Albert M. Bullard, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed June 7, 1899.

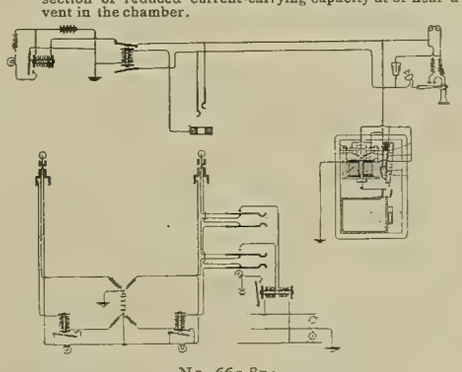
A coin-receiving apparatus is installed at the subscriber's station containing a polarized electromagnet connected with a telephone line. A mechanism is operated by the armature of this electromagnet for directing a coin to one side or the other according to the position of the armature. Contacts at the subscriber's station control the telephone-line circuit and are adapted to be actuated by the deposit of a coin to change the electrical condition of the telephone line and actuate a signal-indicating device at the central office. Means are provided at the central office for impressing positive or negative direct current upon the telephone line to influence the polarized electromagnet and cause it to direct the coin in either of two directions. (See cut.)

665,882. Electric Arc Lamp. James A. Dalzell, Lynn, Mass., assignor to the General Electric company of New York. Application filed December 7, 1898.

A lever is fulcrumed at one end on a post carried by the lamp frame, and has the other end in operative relation to the core of the solenoid. A clutch carrier is pivoted to an intermediate point in the lever and has perforated ears fastened thereto and adjustable longitudinally thereof.

665,888. Cut-out. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed July 27, 1899.

A fuse extends into a chamber formed between two blocks of incombustible material, provided with a removable lining, the terminals of the fuse being connected to spring-actuated retractors. A fuse is provided with a section of reduced current-carrying capacity at or near a vent in the chamber.



No. 665,874.

665,902. Dynamo-electric Machine. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing company, Windsor, Conn. Application filed June 7, 1900.

This machine has unwound pole-pieces and a wound armature with the planes of commutation of the armature circuits arranged to intersect the pole-pieces at approximately one-fourth of their length and create magnetic flux through the armature and pole-pieces, which have their neutral points at approximately one-half of the length of the pole-pieces, whereby the magnetic flux in one direction between the armature and each pole-piece will be neutralized and the magnetic flux in the opposite direction between the armature and each pole-piece will be effective. (See cut on next page.)

665,903. Rheostat. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed November 13, 1900.

A motor drives the controlling arm, and a circuit controller and limit switch are placed at different parts of the travel of the arm to open the motor circuit automatically when the arm reaches a determinate position, the switches being connected to effect opposite directions of movement of the armature.

665,915. Process of Electrolytic Production of Nickel or Allied Metals. Moritz Kugel, Berlin, Germany. Application filed March 24, 1900.

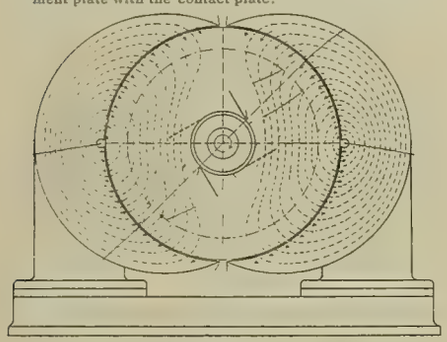
For the electrolytic production of tough, rollable nickel and allied metals, they are subjected to the action of an electric current, in an electrolyte, the temperature of which is over 30 degrees centigrade, keeping the electrolyte acid by the addition of a strong mineral acid not chemically changeable by the current. A highly concentrated solution of a light metal salt not changeable by the current is added to facilitate the maintenance of a uniform acidity without the addition of more acid.

665,923. Telephonic Appliance. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed August 12, 1897.

An electromagnet has a substantially closed magnetic circuit and a winding on one limb only in the telephone circuit. A closed electrical circuit of low resistance is associated with the electromagnet in position to be threaded by lines of force straying from the portions of the magnetic circuit not covered by the winding.

665,928. Electrical Cut-out. Charles G. Perkins, Hartford, Conn. Application filed January 17, 1900.

A contact secured to the base has a loop open on one side and means of attachment to the line wire. A conducting plate is secured to the cap and adapted to pass between the branches of the loop so that the flat face of the contact piece on the cap engages the flat inner surface of the outer branch of the loop, whereby the cap is secured to the base. The contact piece has its end bent to provide a shoulder that engages the farther side edge of the outer arm of the loop. A branch-wire attachment plate is secured to the cap, and a fuse wire connects the attachment plate with the contact plate.



No. 665,902.

665,943. Electric Cut-out. John H. Trumbull, Plainville, Conn., assignor to Charles G. Perkins, Hartford, Conn. Application filed April 2, 1900.

Contacts are secured to the base, each consisting of a piece of metal bent to form a loop open on one side and having means of attachment to a line wire. Contact pieces on the cap are adapted to pass between the branches of the loop so that the flat face of each contact piece on the cap engages the flat inner surface of the outer branch of the loop for securing the cap to the base. The contact pieces have their ends bent to provide shoulders that engage the farther side edges of the outer arms of the loop to lock the parts in engagement. The cap carries branch-wire attachment plates and fuse wires connecting them with the contact plates.

665,950. Towing Apparatus for Boats. Herbert W. Alden, Hartford, Conn., assignor to the Electric Vehicle company, Jersey City, N. J., and New York, N. Y. Application filed September 8, 1899.

A storage battery is carried by a floating vessel. The land tractor comprises a motor, driving wheels and steering devices, and a storage battery is mounted on the tractor, with a detachable mechanical connection between them. An electrical connection is made between the motor and the storage battery supported by the vessel, also detachable, and there is also an electrical connection between the motor and the storage battery mounted on the vehicle, whereby the motor may be operated to drive the tractor independently of the storage battery on the vessel.

665,953. Process of Electrolyzing Soluble Salts. Antoine J. O. Chalandre and Louis J. B. A. Colas, Paris, and Charles J. Gérard, Seveux, France. Original application filed March 21, 1899. Divided and this application filed April 16, 1900.

The subject of this patent is a process of electrolyzing a soluble salt, the electrolyzation of which causes detrimental secondary reactions in the electrolyzer, and which salt is capable of yielding at the anode and cathode gases which when combined form an acid. The process consists in passing an electric current through the soluble salt from an anode to a cathode, combining outside of the apparatus part of the gases from the cathode and anode compartments to form an acid, then introducing the acid thus formed into the anode compartment, where it immediately decomposes to counteract or annul detrimental secondary reactions and liberate or recuperate the gas evolved at the positive pole which has served in the formation of the acid.

665,954. Method of Manufacturing Electroplates. Warren C. Clouse, Kearny, N. J., assignor to the Charles Craske company. Application filed November 14, 1898.

The claims describe a method of obtaining an electrotype including a half-tone or etched or engraved plate and an electrotype of reading matter, which consists in, first, locking up in a form of type a blank block of the size of the half-tone, having the half-tone placed loosely thereon with its face flush with the types: second, blackleading the type-form; third, obtaining in plastic material placed in contact with the form and half-tone a mold from the type in the form; fourth, removing the form from the mold with the half-tone adherent thereto; fifth, blackleading the face of the mold but leaving the exposed back of the half-tone free from black lead; sixth, placing the mold containing the embedded half-tone in an electrodepositing bath, whereby a metallic deposit is produced over the mold and the back of the half-tone at the same time, thus insuring a union between the metallic deposit and the back of the half-tone.

665,955. Composite Electroplate. Warren C. Clouse, Kearny, N. J., assignor to the Charles Craske company. Original application filed November 14, 1898. Divided and this application filed January 4, 1900.

In this electrotype a half-tone or etched or engraved plate and an electrotype shell are united by the extension around the edges of the plate and over the back thereof of a portion of the electro-deposited metal, of which the shell is composed, the electro-deposited metal entering into indentations on the back of the half-tone.

665,957. Receiver for Hertzian Electric Waves. Eugène Ducretet, Paris, France. Application filed May 22, 1899.

Two rods are inserted in a tube made of a suitable non-conductor. Hard-tempered-steel powder is inserted between the adjacent ends of the rods, screw caps fitting the ends of the tube. For adjusting the rods a threaded screw passes through one of the caps, with guard-joints between the outer ends of the rods and the walls of the caps and means for locking the screw in position.

666,003. Insulated Electric Conductor. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 19, 1899.

Two or more layers of non-conducting fabric are arranged to lap joints, and provided each with a number of thin coatings of an insulating compound containing oxidized oil in excess.

666,004. Insulating Electric Conductor. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 19, 1899.

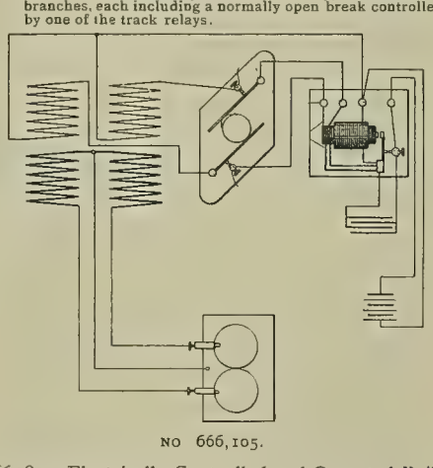
The cable is covered with a number of layers of porous fabric, each layer being covered with several independent closely coherent films of an infusible insulating compound, each film being a residue of a solution.

666,048. Wire-drawing Machine. Theodore M. Foote, New York, N. Y., assignor to Edwin H. Brown, New York, N. Y. Application filed April 14, 1899.

In a wire-drawing machine, comprising a die, a drawing-head and a continuously rotating shaft, an electromagnetic friction device is used for operatively connecting and disconnecting the shaft and head. A controller is in circuit with the electromagnetic device in the path of travel of the wire, having the circuit normally closed to permit the electromagnetic device always to have the shaft and head operatively connected, and adapted when excessive tension is on the wire to open the circuit to disconnect the shaft and head and when the tension is removed to close the circuit to cause again the electromagnetic device to connect operatively the shaft and head.

666,067. Alarm Signal. James J. Ross, Detroit, Mich., assignor to the Three Rivers Railway Supply company, Three Rivers, Mich. Application filed March 26, 1900.

In an electric signal for railway crossings, an alarm circuit has two branches each containing a normally open break. Track relays correspond in number to and control the breaks in the alarm-circuit branches. A main circuit includes a circuit-closing relay and two normally open breaks controlled by the track relays, and an auxiliary circuit includes the circuit-closing relay. A normally open break is controlled by the latter relay, and has two branches, each including a normally open break controlled by one of the track relays.



NO 666,105.

666,080. Electrically Controlled and Operated Railway Switch. Philip B. Williams, Washington, D. C. Application filed October 11, 1900.

A switch point is mounted in a seat in the track. A number of tilting blocks are pivotally mounted between the walls of the seat and levers are connected to them. A bar connects the lower ends of the levers and carries armatures on its ends. Electromagnets adjacent to the armatures are energized by electric circuits.

666,105. Electric Igniter for Explosion Motors. Charles E. Lufbery, Chauny, France. Application filed October 14, 1899.

The interrupter has two wires, one of a great resistance and the other of a low resistance, the wire with great resistance being constantly connected with the source of electricity. A circuit-breaker controlled by the engine is connected with the low-resistance wire. An induction coil has its primary coils connected with the circuit-breaker and the high-resistance wire, the secondary coils of the induction coil being connected with the igniter. (See cut.)

666,121. Means for Controlling Electric Motors. Montgomery Waddell, New York, N. Y., assignor to the General Electric company of New York, N. Y. Application filed March 23, 1887. Renewed January 18, 1897.

A secondary motor has its armature in series with the armature of the motor to be regulated, and regulation of the latter is obtained by lessening the counter electromotive force of the secondary motor.

666,122. Method of Controlling Electric Motors. Montgomery Waddell, New York, N. Y., assignor to the General Electric company of New York. Original application filed January 18, 1897. Divided and this application filed December 13, 1900.

This patent covers the method of starting, operating and controlling an electric motor at any speed desired, which consists in exciting its field, supplying its armature with current, passing the current supplied to the armature through a regulating armature in series therewith, causing the regulating armature to cut lines of force, and varying the rate of cutting of lines of force by the regulating armature.

666,153. Process of Producing Plates for Secondary Batteries. Charles Pollak, Frankfort-on-the-Main, Germany. Application filed February 12, 1897.

The claims describe a method of manufacturing accumulator plates or other objects provided with a solid metallic core and porous parts connected therewith, by a single casting operation which consists in putting into a mold a metal body or core, placing around it a finely grained body or powder, raising the temperature of the mold sufficiently to melt the metal core, but not high enough to melt the powder, then pouring in molten metal and leaving it under pressure until the metal sets, whereby a part of the metal core will be forced into the interstices of the finely grained body, so that the core and porous parts of the product will consist of one continuous metallic body.

666,157. Electric Welding Apparatus. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding company, Lynn, Mass. Application filed September 28, 1900.

In an electric metal-working apparatus adapted to weld a seam while the work is in motion, a transformer is provided with a rotary disk, working terminals mounted on polar extensions of the secondary as closely as possible to the turn or turns of the secondary, and a support for the work and for the transformer whereby the secondary and its working terminals are all at one side of the work.

666,161. Electric Metal-working Apparatus. Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding company, Lynn, Mass. Application filed July 3, 1899.

A transformer has an open magnetic circuit core and heavy secondary connected to the work clamps, a source of continuous current, and a rapid absolute interrupter included in the circuit of the primary and the continuous-current source.

666,162. Transforming Apparatus for Electric Metal Working. Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding company, Lynn, Mass. Application filed July 3, 1899.

A closed-magnetic-circuit transformer has a secondary whose terminals are furnished with electric metal-working clamps. Means are provided for imparting a continuous polarizing tendency to the core of the transformer of one sign and a primary for the transformer is fed with a rapidly interrupted continuous current of power sufficient to overcome the continuous polarizing tendency and thereby to produce rapid reversals of magnetism in the core.

666,177. Trolley Finder for Electric Cars. Edwin S. Booth, Waterville, Me. Application filed September 19, 1900.

A trolley pole is surmounted by a sheave constructed to run on the supply wire and mounted to rotate on a transverse shaft. Bifurcated heads are keyed to the opposite ends of the shaft. Arms pivotally mounted in these heads are provided with means for limiting their upward and downward swing and constructed to be operated to embrace the supply wire to deflect it into engagement with the sheave.

666,183. Electromagnetic Brake. Francis L. Clark, Pittsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed May 14, 1900.

The mechanism comprises a rail shoe, wheel shoes for the wheels, a lever having a shifting fulcrum, another lever connected to the wheel shoes and adapted to be operated in the same direction by the lever having the shifting fulcrum when it is turned upon either fulcrum, and a rail shoe for actuating the lever having the shifting fulcrum in either direction according to the direction of the motion of the car. (See cut.)

666,184. Electromagnetic Brake. Francis L. Clark, Pittsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed May 14, 1900.

This is a brake mechanism for cars having two multiple trucks, comprising a rail shoe, wheel shoes for the wheels, brake levers for the wheel shoes, means connected to the rail shoe for operating the brake levers of one truck by a movement of the rail shoe in either direction, and connections between the levers of one truck and those of the other truck by which the second set of levers are always moved to apply the brakes whichever direction the rail-shoe may be moved.

666,199. Germicide Device for Telephone Transmitters. Adolph B. Larsen, Minneapolis, Minn., assignor of one-half to Frank F. Carlson, Minneapolis, Minn. Application filed April 27, 1900.

A bell-shaped transmitter has a germicide-containing receptacle with its stem passed through the bell and provided at its inner end with a nozzle screw-threaded thereon and holding the receptacle in position.

NO. 666,183.

666,213. Telephone-exchange Circuit and Appliance. George K. Thompson, Malden, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed February 9, 1900.

Two main conductors extend between a sub-station and a central station and respectively form portions of two associated sub-circuits. A third main conductor constitutes a complementary and common portion of both of the sub-circuits. A condenser at the central station is included in one of the sub-circuits, and a source of transmitter-current supply at the central station is connected in the other sub-circuit. A transmitter at the sub-station is connected in the complementary main conductor, and an induction coil for the transmitter at the central station has its two windings included in the two sub-circuits.

666,221. Apparatus for Decomposing Solutions. Daniel N. Hathorne and Harry E. Hobson, Rumford Falls, Me., assignors of one-fourth to Emma A. Hobson, Somersworth, N. H. Application filed January 11, 1900.

A perforated chamber constitutes the cathode. An outlet opens through the bottom of a diaphragm. The anode is a chamber formed of sections having spaces between them and located in the cathode.

DESIGN.

33,916. Electric-light Fixture. William McConnell, New York, N. Y. Application filed December 21, 1900. Term of patent, seven years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, FEBRUARY 2, 1901. No. 5

Recent Extensions at Niagara Falls.

By Orrin E. Dunlap.

The Niagara Falls Hydraulic Power and Manufacturing company has materially increased its power output during the last few months by the new installation in the second section of its power house below the high bank at the water's edge. At the time this station was projected, the plan was to complete it in three parts. In the first section, which is 60 by 100 feet, there are four turbines made by James Leffel & Co. of Springfield, Ohio, together with their connected generators. In the second section of the station, shown in the illustration, five turbines have been installed. Three of these wheels were made by R. D. Wood & Co. of Philadelphia and two by the I. P. Morris company of the same city. One of the R. D. Wood turbines has a capacity of 3,500 horsepower, while the other four wheels in the section are each of 2,900 horsepower.

All of the wheels are placed in a row over the 60-inch valves under the power-house floor. One of the R. D. Wood wheels is connected on one side to a 700-kilowatt alternator of the old Walker company's make, and this machine is operated for the Buffalo and Niagara Falls Electric Light and Power company. On the other side of the same wheel there is an 875-kilowatt, 175-volt, direct-current machine that supplies current to the National Electrolytic company, manufacturer of chlorate of potash. The other two R. D. Wood wheels, the fourth and fifth in the line, are connected to two 800-kilowatt, 300-volt, direct-current Westinghouse generators, and these machines afford current for the lower works of the Pittsburg Reduction company.

One of the wheels made by the I. P. Morris company, the second in line, is connected to a 1,000-kilowatt, 300-volt, direct-current generator of General Electric make, the current from which goes to the Acker Process company. On the other side of this turbine there is an 875-kilowatt, 175-volt machine, direct-current, a duplicate of the National Electrolytic company's machine attached to the wheel first mentioned, the current of which goes to the National Electrolytic company. On the other I. P. Morris wheel there are two 1,000-kilowatt, 300-volt, direct-current machines, of General Electric make, the power product of which is sent to the Acker Process company.

It will thus be seen that three of the new generators furnish current to the Acker Process company. This company is a new tenant on the lands of the Niagara Falls Hydraulic Power and Manufacturing company. Its plant is located on Third street, adjoining the Niagara Falls Brewing company's plant. The buildings erected by the Acker company are of handsome design, of brick, substantially built, and together form the home of a fine industry. This company manufactures caustic soda and bleaching powder, the process used, it is asserted, being 15 times more efficient than is used by any similar plant in the world.

The transmission from the power station to the Acker company's plant is effected by aluminum bar and cable conductors, which extend close to the buildings. The length of the circuit is about 1,500 feet, and the circuit carries 9,300 amperes at 300 volts. In each leg of the circuit there are 31,000,000 circular mils.

The third section of the power station is ready for the installation; in fact, the valves are in position, awaiting the placing of the turbines. This section is also to have five wheels, the contract for which has been awarded to the I. P. Morris company of Philadelphia. To four of these turbines will be attached eight Westinghouse generators, and these machines will supply current to the Pittsburg Reduction company, making it possible for that company to double its output. These generators, it is understood, are awaiting shipment at the present time. To the fifth wheel that is to be placed in the new section of the power house there will be connected two 1,000-kilowatt, three-phase, alternating-current generators, to be used for power purposes, the power having already been contracted for. These five wheels are to receive their water supply through a new penstock having a diameter of 11 feet. This penstock is made of steel, and will stand out from the cliff in column form, the same as penstock No. 2. It is now being erected by Struthers, Wells & Co. of Warren, Pa.

Now that the power house proper has been completed, its dimensions are 100 by 180 feet. The building is of stone, and has a steel truss roof. As

RECENT EXTENSIONS AT NIAGARA FALLS.—NEW TURBINES AND GENERATORS OF THE HYDRAULIC COMPANY.

the new section brings the structure close up to the pulp mill of the Cliff Paper company, all the space of the site has been built upon. However, the Niagara Falls Hydraulic Power and Manufacturing company owns the slope of the bank below its extensive lands on top of the high bank, and it is understood that it will soon begin the erection of a new power station a few hundred feet downstream, right at the water's edge. It is probable that this will bring about an extension of the canal basin to the north, in order that the forebay of the proposed new station may be supplied, but the power company has ample room in which to extend the basin, if it so desires.

In order that the surface canal that runs down from the upper river to the canal basin may be widened, the Erie railroad has been called upon by the Niagara Falls Hydraulic Power and Manufacturing company to move its long trainshed that extended along the north side of the canal between Second and Third streets. The right-of-way owned by the company for the entire length of its waterway is 100 feet wide, and for some little time the company has been extending its canal to the boundary line of this right-of-way. The Erie trainshed has been moved, and the work of widening the canal to its full width at that point will go on. This will increase the amount of water that flows to the basin, and increase the supply there for the use of the turbines in the power house at the water's edge in the gorge below.

In order that the ice may not interfere with the operation of the installation, the Niagara Falls Hydraulic Power and Manufacturing company has this winter adopted a new method of ridding the waterway of this feature of annoyance. A small tug owned by the company is tied to the dock in front of the entrance to the connecting canal at the south end of the basin. The operation of the propeller wheel of the tug agitates the water, giving a greater current in the canal. This forces the ice with greater force to the overflow, where it passes over the bank. When the ice is not heavy all that comes down passes off freely without the use of the tug, but when it is heavy, the operation of the propeller has been found to be very effective, and so, day after day, the little tug is tied to the dock to keep the ice away.

Current Consumption of Electric Automobiles.

Some interesting facts were developed in the recent competition in electric vehicles which took place in Berlin, Germany. The battery taking the first honors weighed only 121 pounds a kilowatt-hour, while the heaviest weighed 286 pounds a kilowatt-hour. The mean weight of the 13 vehicles taking part in the competition was 165 pounds. Upon the assumption of a yearly total mileage of 9,500 the annual maintenance cost of a battery was calculated at a cent a mile. The smallest consumption of energy a ton-mile at the mean speed amounted to 91 watt-hours for a passenger car, a far better performance than previous records are able to show. At the highest speed the consumption increased to 135 watt-hours. However, it is said that in the majority of cases the demand did not vary greatly with the speed, which leads to the conclusion that, in order to obtain the greatest commercial economy of energy, the electrically propelled car should be driven at the highest speed consistent with public safety. By the high speed the consumption of energy a car-mile is not considerably increased, while the number of passengers which may be transported in a given time naturally increases with the speed. With regard to the motor best adapted to the weight to be propelled, the capacity should amount to approximately one kilowatt to a ton of the rolling weight.

Railway Projects of Tom L. Johnson.

Ex-Congressman Tom L. Johnson of Cleveland was in Columbus recently to take part in the street-railway franchise agitation. The Columbus Railway company asks a 25-year extension of its franchise on the present basis of five-cent cash fares and 26 tickets for $1, with transfers. At a meeting of the City Council, sitting as a committee of the whole, to consider the matter, Mr. Johnson submitted a proposition to purchase the entire plant of the railway company and operate it on a three-cent fare basis, with universal transfers. In case agreement as to price to be paid cannot be reached, he proposes to arbitrate the price, each side to select an arbitrator and these two the third. It is expected that this proposition will result in the defeat of the proposed franchise extension.

Various conflicting reports have been published concerning the purchase by Mr. Johnson of the Baker street and Waterloo underground railway in London, which has been offered for sale on account of the failure of the London and Globe Finance corporation. B. Peyton Legare of London came to New York recently for the purpose of seeing the Johnson brothers with reference to this deal. He stated that an American named Willoughby, a real-estate dealer in London, has an option on the property for $2,500,000, and that the Johnsons can have it for that price at its completion. The road is now said to be about half completed.

Cahill Electric Typewriter.

The illustration shows a new typewriting machine in which electromagnetic power is utilized. In appearance and general construction the machine is quite like the ordinary typewriter, and the addition of the electrical feature has not made it complicated, it is said. The very simple electrical device, consisting of a motor frame, an electromagnet and a rheostat, is placed below the type basket. The motor frame has a flat bar on the front side, and is held down by a spring, which is immediately below the magnet. There is but one electric circuit, one contact point and one magnet.

By depressing a key a pendant is thrown over the motor frame and the circuit is closed. Instantly the magnet pulls up the motor frame and shoves up the pendant. The pendant actuates a lever which pulls down a wire, throwing the type bar upward and making the imprint. The circuit is automatically broken. The type bar is free to return independently of the key.

In the company's salesroom and the government departments and business offices, where the machines are in use, a plug has been inserted in the electric-light socket, and current is taken from the local lighting circuits. A flexible twin cable leads to the rear of the machine, as shown in the picture, and is connected by binding posts. In the fuse block for the electric light a quarter-ampere fuse is inserted. The machines can also be operated by using five cells of primary battery or two small cells of storage battery. There is very little current consumed, as was shown by a meter measuring the current used by one machine in constant service for one month. The bill was 12 cents, on a basis of 15 cents a kilowatt-hour for current.

CAHILL ELECTRIC TYPEWRITER.

The strength of the electromagnet is controlled by a rheostat, the handle of which is just back of the magnet, so that the force of the impression is regulated at the will of the operator, according to the kind of work being done. For ordinary work a weak current is used, but for taking carbon copies the strength of the current is increased, so that the type bar delivers a stronger blow. More than 20 distinct carbon copies have been made at one time, of a quality not yet attained by any non-electrical typewriter.

Other advantages of the electrically operated typewriter are thus stated: Only a light touch is necessary, a four-ounce touch being sufficient to operate the key; the depression of the key is only about one-third that of non-electrical machines; a running or overlapping touch is easily acquired by the operator and several keys can be depressed in succession without releasing the preceding key; a saving of one action on each word is made by making the space simultaneously with the last letter of the word; the printing is uniform as to clearness, as each type bar is impelled by the same magnet in the same manner and with identically the same amount of force. The machines are said to be substantially built, and the moving parts made heavier, as they are impelled by an external force of greater power than the light touch of the operator's fingers.

This electric typewriter is manufactured by the Cahill Writing-machine company of Washington, D. C.

Line Construction in the Philippines.

A lineman employed by the United States government in the southern islands of the Philippine group sends the Western Electrician some interesting particulars of the work of the Signal Corps and electricians in that region.

The first move which is made toward sending out an expedition for the purpose of putting up wires through new districts consists in forming the wagon train and providing the supplies. Iloilo is the central supply depot for the southern group, and here are the offices and supply houses for the Signal Corps and the linemen. Usually a wagon train carrying supplies for the putting in of a new line in a new section of the country calls for three to five escort wagons, four mules to each and a spare mule tied behind, for in these islands the roads are bad and the heat depressing, so that, in a trip of 10 to 30 days, some of the mules of each team are likely to give out.

Coils of wire are distributed among the different trams, so as to equalize the load. Then the bags containing insulators and pins are put on, and finally the tools and rations. It is now the custom to provide extra supplies in liberal quantities. The linemen arrange to carry extra tools. The rations carried by the Signal Corps and linemen in the Philippines are very like those taken by the soldiers, consisting mainly in hardtack, beans, tomato sauce, coffee and a fresh-meat fund, which is money allotted by the government for the buying of fresh meat along the line. Then there are a good many chances to pick up vegetables along the journey, and few of the men go hungry. "I recollect, however," says the correspondent, "that one time we went without eating very much for 48 hours for the reason that we were being chased over the country by a force of guerrillas about six times greater than ours. Sometimes rations give out in portions of the country where there seems to be nothing growing but grass and bushes. I know that we were for weeks in certain portions of the islands where the people seemed to be living almost entirely upon grasshoppers and things of that sort."

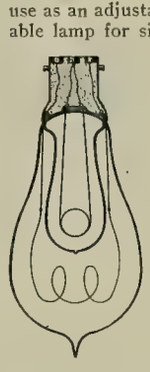
With a party of 40 linemen and wagons, there should be about 30 of the native helpers. When getting to the point of country where the operations are to be begun, the chief operator usually divides the party into two or more sections and sends the sections to various positions along the line, so that work may be progressing at various points. It is very seldom that a party of linemen starts out without a guard of from eight to 16 soldiers, all armed and with no other purpose than to protect the working party from ambush and attack. The usefulness of the guard in the protection of the linemen, the wagon train and the government properties has been proven many times. Hardly a day passes that some of the detachments of the Signal Corps are not molested in some way, and in nearly every case the intruders have been driven off by the guard.

To say that one has put up wires while under fire does not move the average person in the Philippines very greatly, for the reason that to be under the fire of the native soldiers or of the cutthroats is not like being under fire before soldiers of a nation which has trained its men in the art of warfare and in the handling of firearms. "I have been," continues the present writer, "half way up a pole when a dozen rebels not more than 200 yards away have opened fire as fast as they could load and shoot, and not one of the bullets came near enough to produce the buzzing sound with which we are so familiar. These native soldiers have no right to be soldiering. They place the butt of the rifle under the shoulder, between the arm and the body, partly close their eyes and bang away. The ball always seeks the sky. Hardly a lineman who has been in the Philippines for a year or more has escaped being under fire a dozen times. I have been in places where the rebels would make it so warm for us that it seemed folly to remain, but the wires had to be put up. It seems strange that the Filipinos permits the wires to remain in place, when they try so hard to molest the soldiers and the linemen who are putting in a new line. I know that the rebels will engage in conflict with the guard and fight to the last to prevent the line being established, and then, after it is put up, they appear to forget that they could cause endless annoyance to the Americans by cutting down the poles and taking off stretches of wire. Of all the thousands of miles of wire now in operation in the islands, only a very small proportion of it has ever been cut out or destroyed by the insurgents or ladrones, and then, in many cases, simply because they required the wire to use for mechanical purposes.

"One of the great hindrances to the rapid progress of putting up new lines in the Philippines is the lack of poles in some localities, while they exist in great quantities in others. I have been in places where there were stretches of 10 to 25 miles where we could not get a suitable pole and had to haul the poles for long distances. Again, there are numerous batches of poles found together where not needed in large quantities. The poplar makes a good pole, but most of the natives who are sent forward to cut poles or to bring them in use the cocoanut tree. The cocoanut tree makes a fairly good pole and will evidently last a long time, but there has not as yet been time to determine its usefulness under the varying conditions of climatic influences in the Philippines. There are typhoons which bring the wires down and there are white ants which eat into woods and cause trees and poles to become so weakened that they break off under the least strain. The tools with which the natives work are crude, and for some reason they fail to use our axes, but employ the wood bolo for cutting poles, and the result is that the work progresses slowly. However, the poles are obtained free of any cost other than that of labor, and as the natives work for $6 gold a month and their food, the cost to the government is very much less than the usual expense in America."

A Lamp Within a Lamp.

A novelty in incandescent-lamp construction for use as an adjustable sick-room light or as a changeable lamp for signs and footlights is shown in the accompanying cut and forms the subject of a patent of recent date. The lamp comprises two bulbs, represented by the heavy lines in the cut, each containing a filament. The inner bulb is intended to be of colored glass, while the outer one is clear. The two bulbs are fused together at the base of the lamp, and the leading-in wires for the outer filament sealed into the joint at the same time. Each filament is connected through the insulating filling of the base with two separate contact blocks, making four connections in all between the lamp and the socket. The lamp is the invention of Arthur Couch of London, England.



A company has been organized in Canfield, Ohio, to erect and operate an electric-light plant.

Power Development at Massena, N. Y.

In Northern New York, near Massena, there exists an unusual arrangement of land levels and water courses which has only recently been recognized as furnishing an opportunity for the development of a large and constant waterpower. In the neighborhood of the Long Sault Rapids of the St. Lawrence River the latter stream is nearly paralleled by the Grasse River for 18 or 20 miles, the two streams being between three and four miles apart. At the head of the rapids there is a difference of level between the two rivers of about 45 feet, while the Grasse empties into the St. Lawrence about seven miles below Massena. It will thus be seen that the Grasse would form a natural tail race in connection with a canal cut across the intervening country from the head of the rapids. This, in brief, is an outline of the plan followed by the St. Lawrence Power company, which is erecting a hydroelectric plant to utilize the conditions described. The power house, when finished, will be the largest in point of capacity that has been built up to this time. The plans provide for the installation of 30 5,000-horsepower generating units, making a total of 150,000 horsepower as the ultimate capacity of the station.

The canal will be 3½ miles in length, and its course, together with the surroundings and relative positions of the two rivers, are shown in Fig. 1. The average depth will be about 18 feet and the width about 200 feet. The forebay just above the power house will be 25 feet deep. No embankments were necessary, and the only place where solid rock was encountered was at the lower end, where the rock was utilized as a foundation for the

FIG. 1. POWER DEVELOPMENT AT MASSENA, N. Y.

FIG. 2. POWER DEVELOPMENT AT MASSENA, N. Y.—GENERATING STATION AS IT WILL APPEAR WHEN COMPLETED.

station. The average velocity of flow in the canal will be about 3½ miles an hour.

The power house, a view of which as it will appear when completed is given in Fig. 2, is built across the lower end of the canal, its rear wall forming the dam. About 30,000 cubic yards of the stone removed in excavating for the foundation was ground up and mixed with Portland cement and sand from the river to make concrete. The building is of steel construction with brick filling, resting on a heavy sub-structure of concrete, and the roof will be ceiled with wood. It is nearly 700 feet long with a width of about 150 feet. The turbines and generators will be mounted upon horizontal shafts set crosswise of the building, as shown in Fig. 3. Each shaft carries a set of six 54-inch Victor turbines, developing 1,000 horsepower each, which will furnish power to drive a 5,000-horsepower generator mounted on the same shaft. This system is in marked contrast to that employed at Niagara, where the fall is much greater and the volume of water less than at Massena. The generators, built by the Westinghouse Electric and Manufacturing company of Pittsburg, are designed for a normal output of 5,000 horsepower, with a rise in temperature of not more than 36 degrees and an overload capacity of 50 per cent. Each machine weighs 350,000 pounds complete. The generators are of the revolving-field type and will supply a three-phase, 2,200-volt system at a frequency of 25 cycles. At present 15 units are to be installed. The initial exciter equipment will consist of three 300-kilowatt machines, each direct-coupled to a 27-inch Victor turbine running at 275 revolutions a minute.

The switchboard has been very carefully planned and represents a most modern system of machine and feeder control. Each generator panel is placed opposite the machine which it controls. All the switches on the generator and feeder panels will be operated by compressed air, the valves being in turn controlled electrically from an operating stand or "pulpit," shown in Fig. 3, putting the entire station under the control of one operator stationed at this stand.

The power developed is expected to be used for manufacturing in the vicinity of Massena. The St. Lawrence River affords means of transportation by water in both directions, and there are one Canadian and two American railroads which can also furnish transportation facilities. The Grasse River is large enough to carry away all the water needed for development up to 75,000 horsepower, and after that limit is reached the river will probably be deepened and a deep waterway thus formed from the east. There is also some talk of constructing a ship lock at the lower end of the power canal, to afford an American channel around the Sault rapids for westbound boats.

Tesla's Vacuum-tube Lighting.

As is well known, Mr. Tesla has been engaged on experiments in vacuum-tube lighting for the last decade. According to the daily press, he has recently made a considerable advance in this direction. From one account the following statements are taken:

New York, January 26.—Nikola Tesla, who has been striving for years to produce an electric light without heat, feels that he is making perceptible headway in that undertaking. His general plan is to use an alternating current of almost inconceivably great frequency and a lamp consisting of a vacuum tube. The alternations are secured by an instrument of his own invention, known as the oscillator. But after Mr. Tesla entered upon his interesting line of experimenting he encountered various unforeseen difficulties. While he was able to obtain a beautiful light almost at the outset, it was at the expense of more energy than was desirable. In other words, he did not have his invention on a thoroughly satisfactory basis.

By degrees he has improved the efficiency of his apparatus so that his light is now more economical than it was, and he regards it as superior to both the incandescent and arc lights in this respect. At present, however, he is unwilling to indicate precisely the nature and degree of the technical advances made or to use figures in comparing its economy with that of its rivals. One reason for reticence on the latter point may be a recognition of the possibility of further improvement. Mr. Tesla frankly declares that his lamp is not yet perfect. It does not make as good a return in light for the electrical energy invested as he would like. All that he insists upon is that it is now so efficient that he can conscientiously recommend it to those who may wish to put it on the market.

In some of his earlier experiments Mr. Tesla used a straight vacuum tube fully an inch and a half in diameter and six or eight feet long. Latterly, he has employed a more slender one, and by arranging this tube in the shape of a rather compact coil he saves a great deal of space.

A score of lamps of this sort, each with a porcelain reflector over it, may be suspended from the ceilings of rooms on the tenth floor of an office building, while the special apparatus which modifies the current for their use would be down in the basement. The street mains would supply an ordinary alternating current and other wires would lead from the oscillator up to the lamps. For some purposes two wires to each lamp would be preferable, but for others one would suffice. Less copper would be required for inside wiring, and the risks from escaping currents would be diminished rather than increased. The present style of insulation would be more than sufficient.

Funeral of Elisha Gray.

The funeral of Professor Elisha Gray took place on January 23d at the Highland Park Presbyterian Church, Highland Park, Ill. The services were conducted by the Rev. A. V. Pfanstrehl, pastor of the church, and addresses were made by President McClure of Lake Forest University, the Rev. S. Chonas, Professor Thomas and J. J. Johnston, all of whom were friends of Professor Gray. After the services at the church the remains were taken to Rosehill for interment. The pallbearers were O. H. Morgan, R. W. Patton, J. D. Mercerean, F. D. Elliot, J. H. Shields and F. W. Cushing. Among those present were Enos M. Barton, president of the Western Electric company, and other electrical men.

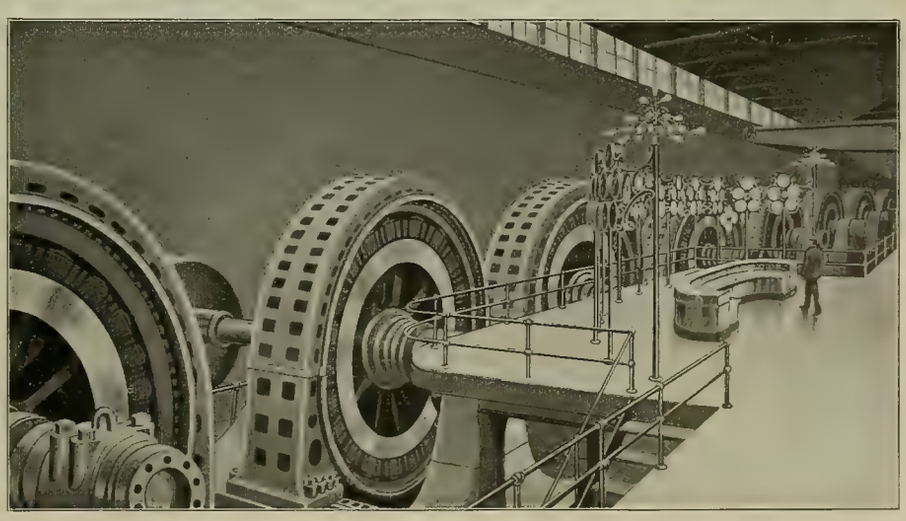


FIG. 3. POWER DELELOPMENT AT MASSENA. N. Y.—INTERIOR OF POWER HOUSE, AS PLANNED, SHOWING OPERATING STAND.

Murphy Third-rail System in Baltimore.

By B. C. Washington, Jr.

It is necessary in Baltimore to move the trains of the Baltimore and Ohio railroad through the city for a distance of 3½ miles with the steam locomotive "dead." For a distance of 1.8 miles the belt line is in a tunnel under the city. Electric locomotives, weighing 96 tons, driven by four 300-horsepower motors, meet the trains and haul them over the belt line. The motors are gearless, the axles of the locomotives being utilized as armature shafts.

At present the overhead-trolley system is used,

FIG. 1. MURPHY THIRD-RAIL SYSTEM IN BALTIMORE.—ELECTRIC TUNNEL LOCOMOTIVES EQUIPPED FOR TROLLEY AND SECTIONAL THIRD RAIL.

but this will shortly be discarded for the third-rail, sectional-conductor system, which is said to meet every requirement of this, the heaviest traction proposition that has confronted railroad managers and electrical engineers. It is necessary at times to push a train of more than 30 loaded freight cars and also a heavy freight engine through the tunnel and around curves, under conditions of curve and grade equal to a one per cent. grade. These conditions have been met by using the changed-over electric locomotives taking current from the third-rail sectional conductor.

The sectional conductor (which is shown in Fig. 1) consists at present of ordinary steel rails laid at a distance of 24 inches from, and parallel to, the tread rail. Every fifth railroad tie has been pulled out seven inches, and on these ties are secured the malleable-iron insulator cleats. In the center is a hexagonal projection, on which fits the "reconstructed-granite" insulator. Reconstructed granite is material made by pulverizing natural granite, molding it into shape and fusing the whole together. On top of the insulator is set the malleable-iron clip which secures the third rail in position.

Wooden guards are fitted into the insulator cleats on each side of the third rail and bolted to the cleats.

The end conductor rails of the sectional system and the ends of sectional third rails at cross-overs are inclined to allow the contact shoes on the electric locomotives to glide up on them from their lowest position. Where one section ends and the next section begins the conductor rail is depressed sufficiently for a short distance to drop the contact of the shoe and open the switch on the rear section.

The electric locomotive is equipped with four contact shoes, two on each side, at the ends. This arrangement is made to overcome all conditions of cross-overs, railroad crossings, etc., where it has been necessary to have the sectional third rail alternately on one side or the other of the tread rails.

Placed along the tracks are automatic magnetic switches controlling the power-house current. (See Figs. 2 and 3.) A 1,000,000-circular-mil insulated copper cable, mounted on poles or hangers, as circumstances may require, carries the current from the power house along the electric system. Similar cables branch from the feeder cable to each magnetic switch or group of magnetic switches. From each of these switches a 1,000,000-circular-mil insulated copper cable is carried in a vitrified conduit filled with insulating compound to that section of the third-rail conductor controlled by the switch.

The magnetic switches have a capacity of 2,000 amperes each, and are enclosed in cast-iron, weatherproof boxes. The switch is practically a solenoid, with two windings, one a fine winding with many turns around the magnet, taking a current of about 550 volts from the generator on the electric locomotives (as described later), through the controller, the contact shoes and the third rail. This current raises the plunger, which closes the switch and feeds the power-house current of 700 volts to the third rail at the moment the weaker generator current passes through the fine winding and closes the switch. Current from the power house passes through the heavy winding of the magnet and keeps the switch closed until the contact shoes of the electric locomotive have passed to the next section; then, the circuits around the magnet being broken, the switch opens by gravity. Carbon contacts being the last to operate, the spark, if any, is between these contacts, thus preserving the metallic contacts from injury. At the instant the contact shoe at the forward end of the locomotive comes in contact with the forward section of the third-rail conductor the switch controlling the feeder for that section closes, and the switch for the rear section opens.

Each of the magnetic switches is provided with a single-pole, double-throw knife switch in series with the fine winding of the magnet. This is used by the inspector to test the magnetic switch and ascertain whether it is in proper adjustment. Should it be necessary to make any adjustment while the section controlled by the switch is in use, the current is fed to that section by means of a temporary bridge. One of these bridges is shown in position in the middle switch shown in Fig. 3.

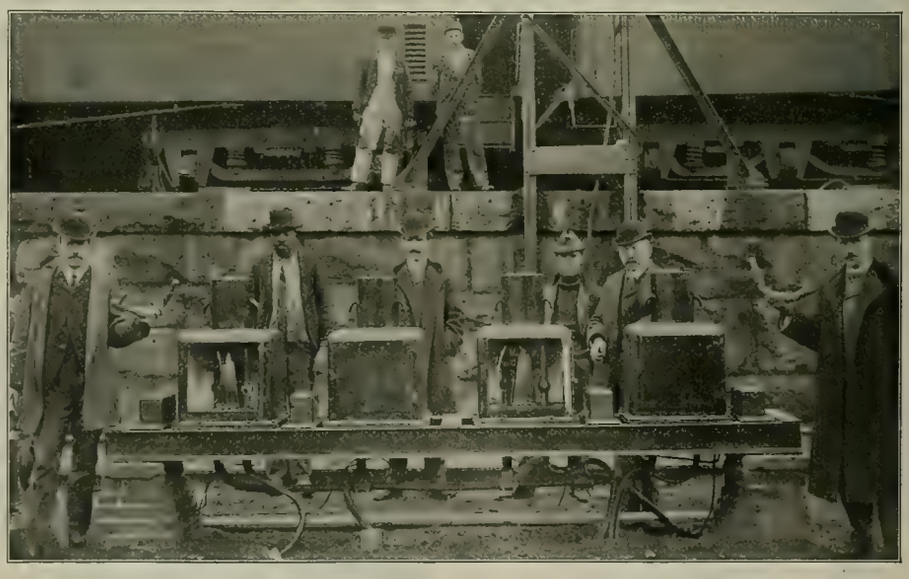


FIG. 2. MURPHY THIRD-RAIL SYSTEM IN BALTIMORE.—SET OF MAGNETIC SWITCHES MOUNTED ON BRICK PIERS.

The electric locomotives were built by the General Electric company, and in adapting them for service on the Murphy system only a few minor changes were made. Instead of the trolley, four contact shoes were added. The winding on the electric motor used for operating the air compressor was altered to permit the motor to operate as a motor or as a generator. The air compressor used to operate the air brakes was altered by the addition of two valves, to permit it to act as an air compressor or as an air engine.

The operation of the system is as follows: The motorman on the electric locomotive turns the controller to the first notch, opening the throttle to the air engine, which, taking compressed air from the storage reservoir of the air-brake system, operates the electric generator, which generates sufficient current to operate the magnetic switch and supply the third rail with current from the power house. At the instant the magnetic switch is closed the power-house current passes through it to the third rail, thence through the contact shoe and the controller to the electric generator which operated the switch and also to the four 300-horsepower motors of the electric locomotive. Immediately and automatically, the small generator becomes a motor operated by current from the power house and drives the air engine as an air compressor, recharging the compressed-air reservoir from which the air engine originally obtained its power.

At no time is it possible during the operation of this system to have a "live" conductor or third rail except when the motorman has turned the controller, and then only one section is active, i. e., the section on which the electric locomotive is operating. Moreover, this section is "dead" while the locomotive is standing.

The electrical engineer will note with interest that the employment of the air engine on the electric locomotive has displaced the storage battery in use in some other systems.

It is obvious that the length of the "live" sections of the third-rail conductor system may vary considerably, and that the danger of injury from contact with a charged conductor can be reduced to a minimum by limiting the lengths of sections to the length of the electric locomotive, or a train length.

The return circuit is carried by the tread rails, bonded in the usual manner.

This system has been brought to its present stage after exhaustive experiments covering a period of more than seven years. The first street-railway, third-rail, sectional-conductor system to be installed and successfully operated was that at Manhattan Beach, N. Y. Since this system was installed, it has been operated for over 34,000 car-miles without a hitch. With this record, it is not remarkable that when the very first time the motorman pulled the controller lever on the reconstructed electric locomotive of the Baltimore and Ohio Railroad Belt Line, operating it by the Murphy third-rail system, the locomotive responded instantly and covered the entire distance of the third-rail trackage without a single break.

The cost of installing this system is said to be much less than that of any other electric-railway system, and as it can be readily applied to steam railroads, it has, apparently, a successful future.

It especially commends itself for use on the elevated roads and in the subways of large cities.

In view of the tremendous shrinkage of passenger travel along steam railroads entering large cities, due to trolley roads capturing the suburban travel, steam-railroad engineers are making a special study of the new electric systems, hoping to find among them a reliable one which eliminates all the elements of danger, and can be readily and cheaply applied to steam railroads.

I desire to express my thanks to the inventor of this system, Captain John McLeod Murphy,

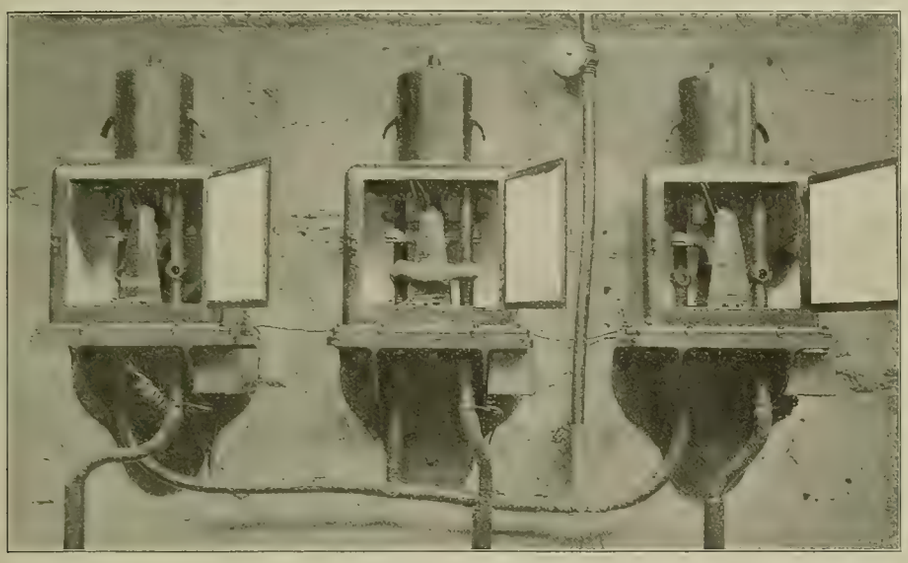


FIG. 3. MURPHY THIRD-RAIL SYSTEM IN BALTIMORE.—MAGNETIC SWITCHES ON RETAINING WALL OF RAILROAD CUT.

and Mr. Charles G. Arnold, assistant chief engineer, for conducting a special test of the system and for explaining in detail the operation of the electric locomotive, the magnetic switches and the system in general.

Long Wire Span over Connecticut River.

About a year ago the Western Electrician described briefly a 1,100-foot wire span over the Wisconsin River at Muscoda, Wis., and remarked that it was one of the longest single spans in existence. Since that time attention has been attracted to the aerial span of long-distance telephone wires across the Connecticut River, near Middletown, Conn., which is 1,300 feet long and consists of 20 wires. The circuits are those of the American Telephone and Telegraph company connecting New York and Boston.

As shown by the illustration, the wires are supported on two steel towers, and these towers are 1,300 feet apart. The towers are built to carry 40 wires, but at the present time there are only 20 wires in position. These are placed 10 on an arm, about one foot apart, and are insulated by saddle-shaped insulators. It was necessary to string all these wires at equal tension, to avoid their crossing in windy weather. To obtain this equal tension each wire is fastened to an iron bolt five-eighths inch in diameter and about 20 inches long. This bolt is provided with a strain insulator at one end and a tightening nut at the other. The tower on the east bank is 182 feet high and stands in a clearing. The tower on the west bank stands upon a bluff on the opposite side of the river, and on this account is only 82 feet high.

It is interesting to note that the wire used on these 1,300-foot spans is the tough Phono-electric, made by the Bridgeport Brass company of New York. It is asserted that this wire is homogeneous throughout and does not depend upon a hardened skin for its strength. This homogeneity gives Phono-electric wire remarkably high tensile strength, elastic limit and great ductility. The size of wire used is No. 8, B. W. G., which has a tensile strength of 82,000 pounds to the square inch and an elastic limit 40 per cent. greater than that of hard-drawn copper wire. These characteristics enable the tightening devices to draw the span exceptionally taut, as is shown in the picture.

LONG WIRE SPAN OVER CONNECTICUT RIVER.

The electric-light plant at Sharpsburg, Pa., will be remodeled and improved in a short time.

COMMUNICATIONS.

Searcy Needs an Electric-light Plant.

To the Editor of the Western Electrician:

Some time ago I advertised some second-hand telephones for sale in your journal, and received numerous responses, and succeeded in placing them in a first-class, new exchange.

This town is badly in need of an electric-light system, and I will appreciate it if you will publish it in your news columns. This is one of the best towns in the state, and the right man could easily get a franchise. The mayor, J. V. Roberts, will be glad to answer inquiries.

W. C. DUGAN.

Searcy, Ark., January 16, 1901.

The Commutatorless Dynamo.

To the Editor of the Western Electrician:

In reading the beautiful Twentieth Century Souvenir Number of the Western Electrician, I noted Mr. James Asher's contribution on a proposed commutatorless dynamo or motor. Mr. Asher has set forth his views with admirable clearness, and his article is very interesting. Yet, without desiring to be aggressive, I must say that I am convinced that a commutatorless, continuous dynamo of high voltage is an impracticability.

In the first place, the so-called cutting of lines of magnetic force does not cause the electrification of the armature coils in a dynamo. If some of the book writers would only make a few experiments, instead of taking everything for granted in copying from their predecessors, the cutting of lines of force would not be quite so fashionable as it is.

A voltage is generated in an armature wire only when that wire experiences a magnetic variation. Ignorant of this fact, a few years ago I made several different commutatorless machines. Some were dynamos of the alternating type; the others proved not to be dynamos.

In Mr. Asher's proposal it does not seem that the wires would experience a magnetic variation. And even if they would, the resultant energy would necessarily be alternating, for the variation would—as ever—consist of alternate increases and decreases of magnetic strength. In fact, a wire cannot be always approaching a magnetic pole; nor can a magnetic pole always increase in strength.

If Mr. Asher has made a dynamo after his plan as outlined and has realized the benefits that he cites, then I shall have to apologize for my presumption and confess that my failures have made me pessimistic.

HARRY L. TYLER.

Corning, N. Y., January 26, 1901.

Giant Transformers.

The rapidly increasing use of polyphase current in power plants of great size is creating a demand for transformers of a larger capacity than have ever before been designed. The Chambly Manufacturing company has recently placed with the Westinghouse Electric and Manufacturing company what is believed to be the largest single order for transformers ever recorded. This order comprises 20 2,750-kilowatt transformers of the Westinghouse air-blast type. Each of these, with an output of over 3,600 horsepower of electrical energy, weighs, approximately, 11 tons and stands nine feet high. Of the 20 units, 10 are to be used to raise the voltage from 2,200 to 25,000 volts at 8,000 alternations. The input is two-phase and the output three-phase. The remaining 10 transformers, for lowering the voltage, receive the three-phase line current at 22,000 volts and deliver a two-phase current at 2,400 or 4,800 volts, as required. The blowers for furnishing the air blast for cooling both the raising and lowering transformers are operated by Westinghouse induction motors.

The well-known Westinghouse methods of construction are employed in these transformers, both primary and secondary being divided into several flat coils wound with many layers, and few turns to a layer, each coil being insulated separately. The advantages of this construction are that it divides the total electromotive force between the several coils, reducing proportionately the strain of each individual coil; also, it divides the electromotive force in a single coil between many layers, thus reducing the potential between the adjacent layers. The regulation of the transformers is also improved and the windings may be connected easily in series or multiple, thus giving a wide range of electromotive force. In case of damage to a coil a substitute may be provided with but little trouble and without sending the transformer to the works.

Iron and copper have been carefully proportioned to secure the minimum losses, and the efficiency of the transformers is very high, being considerably over 98 per cent. It is, however, not sufficient that the loss in a transformer be low when it is first installed, for, as is now generally known, much of the iron that has been used in transformers when subjected to the conditions prevailing in continued service is subject to a material deterioration, more or less rapid, with the result of a corresponding material increase in the iron losses. The Westinghouse company has established a special and thorough process for the manufacture and treatment of transformer iron, producing an iron at once capable of high magnetization with comparatively little energy and having a stable character completely resisting the tendency to deteriorate in service and show increased losses.

A peculiar feature of these large transformers is the change effected in them from two to three-phase and from three to two-phase current, the change being secured by means of special windings invented by C. F. Scott of the Westinghouse company. This greatly increases the flexibility of two and three-phase methods of transmission.

The Town Council of Keyser, W. Va., has granted the Home Electric Light company a lighting franchise for 25 years.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The porcelain insulator is such a familiar and widely extended device that a recent decision of Justice Morris of the United States Court of Appeals in relation to the patentability of one form of it is of general interest. The appeal was taken by Howard P. Dennison against a decision of the commissioner of patents. The technical questions involved were the patentability of a two-part porcelain insulator and the substitution of fusing for cement. The alleged invention consisted of an insulator formed of two or more shells of suitable insulating material, which are secured together by inserting one into the other and then fusing them so as to form practically but a single piece. The insulating material employed was porcelain, in which, of course, there was no novelty, and none was claimed. An English patent issued to Varley in 1861 shows an insulating device composed of two shells or cups of porcelain secured together by fixing one into the other and then connecting them together by cement. The novelty claimed in the case just decided was the fusing of the two cups or shells instead of cementing them. But it was held that there was no novelty in this manner of working, it being an ordinary process. It had already been testified in an interference proceding connected with this case and growing out of it that the usual and ordinary process of connecting two pieces of porcelain is "either with glaze or with slip." Slip is potter's clay in a very liquid state, and glaze is nothing but glass. Connecting with glaze is fusing. And on these grounds the judge held that there was a failure to demonstrate any patentable novelty in connecting two pieces of porcelain by fusing them instead of joining them by cement.

American manufacturers should not jump to the conclusion that Great Britain and Germany are decadent because of the self-flagellation so liberally administered in those countries by industrial writers and others who "view with alarm," as our American platform-builders say, the inroads of American manufactured products. Self-examination so keen and searching as that shown by the enlightened publicists of those countries is not a sign of decadence, but quite the reverse. In England, especially, there has been a sense of false security, but, once this is effectually dispelled, the manufacturers of that country may be relied upon to make strenuous efforts to regain at least a portion of the ground they have lost. Germany, too, owing to its thorough technical education, must be reckoned with. Let us not, in our turn, be flattered into any self-deception by the flutter among our competitors caused by our recent successes. We must follow up and extend our export trade in manufactures with intelligent, painstaking persistence, studying foreign markets and business methods, learning foreign languages and establishing depots and routes for traveling salesmen. Above all, the quality of American machinery and apparatus must not be suffered to deteriorate; we must not relax our efforts to enhance the worth of the product while cheapening the cost of production. A recent issue of a British trade journal contained a paragraph to the effect that a Scotchman who had invented a mechanical device complained to a friend that he could not dispose of it, although it was an excellent thing; whereupon the other ingenious Scotchman advised him to advertise it as "the latest American invention," which he did, effecting a sale in a short time and at a good profit. Let us continue to deserve this reputation, remembering that our active over-sea competitors are far from abandoning the field and are now profiting by some reverses to approximate American enterprise and methods by careful and systematic study.

The right of electric-light companies to lower arc lamps in the streets for trimming has been triumphantly upheld in the state of New York after a lower court had held adversely. The principle was involved in the case of Smalley against the Yonkers Electric Light and Power company, and the Second Appellate Division of the Supreme Court of New York has reversed the judgment which the trial term rendered in favor of the plaintiff, who, while riding a bicycle on one of the streets of Yonkers, came into collision with one of the electric lamps of the defendant, which had been or was being lowered for the purpose of cleaning and supplying new carbons. The rule is well established, says the court, that there is no presumption of negligence, and that to justify the submission of that question to the jury there must be more than a mere surmise that there may have been negligence on the part of the defendant. Likewise, it is equally well settled that a judge will not be justified in leaving a case to the jury when the plaintiff's evidence is equally consistent with the absence as with the existence of negligence in the defendant. Tried by this test, the court holds that the plaintiff gave no evidence which even tended to show that there was any negligence on the part of the defendant. There is no doubt, it declares, that the defendant had a right, through its servants and employes, to maintain the electric-light plant and to clean and replenish the lamps upon the streets in the manner testified to by its witnesses, and the mere fact that the plaintiff came into collision with one of the lamps while being lowered for the purpose of putting the lamp in trim raised no presumption of negligence. He must prove something which warranted the inference of negligence, and not leave his case upon facts just as consistent with care and prudence as with the opposite. The evidence made no suggestion that the lamp was not lowered in the ordinary manner or that there was any conduct on the part of the defendant's servant which was in itself negligent, and the submission of its negligence to the jury, the court says, permitted that body to surmise that there might have been negligence where no negligence had been proved, and this was error.

For several years the surface street-railway companies of Chicago have been desirous of replacing their cable equipments by the overhead-trolley system. Their campaign of education, directed to this end, has been renewed of late. President Hamilton of the Chicago City company says: "I do not intend to cease my efforts for the passage of ordinances that will allow us to take up our cable tracks and substitute electricity. The change will cost us some millions of dollars, but I know that the future will justify the expenditure." President Roach is equally emphatic: "The cable as a motive power for street-car service is fast on its way to oblivion, and in a few years will be unknown in Chicago." The city authorities have no particular love for the cable system, but are loth to permit the overhead wires in the downtown streets. They suggest the electric-conduit system, but at this the railway magnates shake their heads and murmur "Impossible!" The outcome of these differences of opinion is difficult to foresee, but it is likely that the cable will be superseded in a few years in any event.

In New York the situation is different, and yet the Metropolitan company and its patrons are not without their own troubles. New Yorkers have cable roads and also the conduit electric system, but only upon important trunk lines. In the year that ended with last June the Metropolitan Street Railway company ran 9,812,000 horse-car miles in New York city. This was but 800,000 miles less than the total service of the cable cars and it was 40 per cent. of the total service of the electric cars. This covered the working of the Metropolitan system alone and did not take in the lines of the Third avenue system, now owned and worked by the Metropolitan company. If the horse-car lines could have been operated at the car-mile cost of the electric service, the company would have saved $568,000, or four per cent. on $14,200,000. But, says the New York Times, in discussing the situation, "the overhead trolley is out of the question, and the underground construction is so expensive that many of the minor lines would not earn interest after maintenance and working are provided for." Furthermore, the important lines along the river fronts lie so low that the conduits would occasionally be flooded. Thus, the "slow, dirty and even squalid" horse cars are still an important factor in the transportation problem in New York. In Chicago the overhead trolley, so airily dismissed in New York as "out of the question," is used on nearly all lines outside of the downtown business district, and there are very few horse cars. Here, also, the suburban service of the steam-railroad companies enters more largely into the city situation owing to topographical conditions. The Chicago companies contend that it is impracticable to operate slot conduits for electric-railway operation in this city, owing to difficulties of drainage; otherwise, it would seem that the combination of conduit and overhead-trolley systems would be suitable for all large cities, for the objections to the overhead wires on all but the most important and busy streets are not so conclusive as the New York papers seem to imagine.

President Debell of the Northwestern Association.

Edwin L. Debell, who was elected president of the Northwestern Electrical association at the Milwaukee convention of last month, is an experienced and valuable member of the association, having served it in several official capacities and especially as a member and chairman of the legislative committee. He has been a member of the association since its organization and has always taken a lively interest in its welfare. It was generally conceded that Mr. Debell was entitled to the honor, and there was no opposition to his election. The summer convention of the association will be held this year in Sheboygan, which is President Debell's home town, so that he is doubly remembered.

E. L. DEBELL.

Mr. Debell is secretary of the Sheboygan Light, Power and Railway company. He was born in Beaver Dam, Wis., January 10, 1863, and received a grammar-school education. He removed to Colorado in 1877, and from that state went to Chicago in 1879. In this city he was engaged in mercantile pursuits until 1884 when he took up his residence in Sheboygan, where he has since lived. For six years Mr. Debell was connected with a manufacturing concern, but just 10 years ago he became manager of the electric-light company in Sheboygan, and continued in that position until his company was consolidated with the street-railway company, in 1895. Since that time the subject of this brief sketch has been secretary of the united corporation.

Mr. Debell was married in 1886, and those who had the pleasure of meeting Mrs. Debell at the Waupaca convention of last year can readily understand why the new president is so devoted to his home.

Government Specifications for Incandescent Lamps.

Bids recently received at the United States engineer's office for incandescent lamps were required to conform with the following specifications:

In testing for candlepower, the standard of luminous intensity shall be the British standard candle. The photometric test of lamps will be made at 110 volts, by revolving them at not less than 200 revolutions per minute with axis vertical to obtain their mean horizontal intensity, with axis inclined 45 degrees to obtain their mean spherical intensity, and with axis inclined 90 degrees to obtain their vertical intensity. No lamp, under thse conditions, shall show less than 15 candlepower nor more than 17.5 candlepower mean horizontal, nor less than 13 candlepower mean spherical, nor less than 10-candlepower vertical intensity. Filaments must be properly placed in the middle of the bulbs, and must not droop when turned horizontal during any portion of their life. Anchored filaments will not be considered. Bulbs must be uniform in shape and size, of molded lead glass, or equal, and free from defect. Tipless bulbs are preferred. The letters U. S. shall be etched upon each bulb in such a manner that thev cannot be removed. The Edison pattern short base will be furnished. Bases will be of good quality, firmly and accurately secured to the bulbs. The buttons will be of porcelain or other dampproof material, and the interstices must be thoroughly filled and covered with shellac. All lamps must have a satisfactory vacuum. When tested on an induction coil delivering one-half-inch spark, the vacuum should show no glow in the lamp. Lamps failing to meet the requirements of these specifications will be rejected, and the failure of 10 per cent. of any lot will be sufficient cause for the rejection of the entire lot. Each bidder will submit with his bid a sample of the lamp he proposes to furnish, together with description and guaranty of its power and durability.

Changes in Muskegon.

Three new corporations, the Muskegon Traction company, with a capital of $150,000, the Muskegon Lighting company, capitalized at $100,000, and the City Gas company, capitalized at $100,000, have been organized at Muskegon, Mich., to succeed to the ownership of the street-railway, electric-light and gas properties, the controlling interest of which was recently acquired by Liddon Flick and Theodore S. Barber of Wilkesbarre, Pa. The following-named gentlemen are officers of each of the three companies: President, Liddon Flick; vice-president, F. A. Nims; secretary, D. D. Erwin; treasurer, J. J. Howden. These gentlemen, with exception of Mr. Erwin, together with Mr. Barber and L. Kanitz of Muskegon, are the directors of each company. Later the three corporations will be consolidated into a single one, to be known as the Muskegon Traction and Lighting company, with a capital of $500,000. About $150,000 in improvements will be expended on the properties, including the consolidation of the electric-railway and electric-lighting plants.

Electric-light Men Discuss Gasoline Lamps.

At the recent Milwaukee convention of the Northwestern Electrical association a communication was read from an Ohio company, asking for information as to the best manner in which to meet the competition resulting from the installation of gasoline arc lamps. This inquiry elicited a prolonged discussion, in which many of the members participated. It developed that several of the western cities had experimented with varied success with gasoline street-lighting systems. In some places a single Welsbach burner was used, while in other localities five burners were used in a group, the manner of mounting the lamps being somewhat similar to that of electric arc lamps. Similar gasoline lamps were also used for interior lighting, in stores, halls, etc., and in some cases the gasoline was piped to the lamps by small tubes. The lamps had to be started with a blow torch, or some such device, and when they were used for interior lighting the smell of the gasoline was very noticeable.

B. H. Strong of Baraboo, Wis., said that about 30 of the lamps had been placed in his city in the outskirts where it would not pay the electric-light company to place arc lights. He spoke of the objectionable features of the lamps and their short life, adding that he was not worried over the competition. In several places where gasoline or acetylene systems had been adopted by individuals, fires and accidents had occurred, resulting in the replacing of electric lights. H. J. Gille of St. Paul spoke of the importance of meeting the competition, and mentioned that the Kern burner was a recent type of gasoline lamp that was being pushed very hard. Sheboygan had had a little experience with gasoline lamps, according to E. L. Debell, but he thought that the electric-light or gas people would have very little, if anything, to fear from them, unless some radical improvements are made in their construction and operation. In speaking of the objetcionable features of the lamps, he laid stress on the danger from explosion from the gasoline after it was heated, the disagreeable smell and the bother in lighting it.

S. B. Livermore of Winona, Minn., called attention to the fact that while the insurance laws require a merchant who deals in gasoline to keep his bulk gasoline outside the building, no prohibition is made or increase of insurance demanded from those who use gasoline lamps, "although with some of those lamps every 20 or 30 feet a half-gallon of gasoline is used, the gasoline being drawn through thin copper tubing used for feed pipes." In Waupaca, Wis., I. P. Lord stated that an experimental gasoline plant had been installed, and that after running three nights it exploded. The electric-lighting business had been first-rate ever since. George Cutter said that gasoline Welsbach lamps were being manufactured by the thousand in Chicago, and he thought the competition worthy of the attention of electric-light people. G. L. Thayer of Toledo, Iowa, discussed the manufacture of gasoline, and said that it had been found impossible to get a satisfactory gasoline from the Wyoming, California and Texas oils. The eastern oils yield but 10 per cent. gasoline, and with the increase in the use of gasoline the price must be necessarily raised.

T. F. Grover of Fond du Lac, Wis., referred to the danger from fire resulting from the use of gasoline, and mentioned some instances in his own experience where property of the electric-lighting company had been injured or destroyed in fires of gasoline origin. He urged more stringent insurance laws on gasoline risks. Benjamin Strong of Keithsburg, Ill., said that a 62-candlepower gasoline lamp would run 125 hours on about a quart of oil. R. F. Kountz of Neillsville, Wis., said that he had found by his own experience that any electric-light company that furnished good service need have no fear of opposition by gasoline, acetylene or any other kind of lighting. The discussion ended by the passage of a motion which provided for the appointment of a committee of three to examine into and report on the subject of gasoline lighting, either street or commercial, making the scope of the inquiry quite broad, the report to be submitted at the next summer meeting.

The Electric Light company of Roseville, Ill., is considering an enlargement of its plant this spring.

SLIGHTLY INACCURATE.

A series of experiments are being carried on by the Postoffice telegraph officials with the object of discovering whether platinum forms a good substitute for copper in telegraph and telephone wires. Platinum costs £130 per ton, and copper may be obtained at from £80 to £90 per ton, and its greater lightness renders it cheaper to use, and its conductivity is nearly as good as that of the more expensive metal. The tests have established the fact that the life of a platinum wire is shorter than that of a copper wire, as it is more susceptible to atmospheric action. The tests were carried out by setting up a five-mile length of platinum wire near Hanley, a neighborhood in which the atmosphere is heavily charged with sulphurous vapors. It has been practically decided not to use platinum wire unless some means can be found to toughen it.—London Daily Mail.

At a North Country council meeting the electricity estimates were being discussed, one subject being "Feeder Cables and Potential Wires." A councilor asked the question, "What does potential mean?" Not one of the electricity committee felt called upon to answer the query on personal knowledge, relates the Electrical Engineer of London, and so a message was instantly sent to the clerks, which caused consternation in their ranks. Not one could answer the momentous question, when a happy thought struck one of their number—consult a dictionary. This was done, and the meaning of potential wires was given to the council as "Powerful wires, or wires existing in possibility, not in act."

The following bit of advice is found in the Dunkirk (Ind.) Star, credited to an exchange: People do not despise the little pieces of carbon that are found on the street where the electric-light trimmers throw them after supplying the arc lamps with new carbon. They contain medical qualities that are worth their weight in gold to the unfortunate individual whose body is racked with rheumatic pain. The broken pieces of carbon are a great panacea for rheumatism, and they are persons who make it a business to gather them up and preserve them in the interest of rheumatic humanity. Since the fact became known that these pieces of carbon possess a virtue for curing rheumatism, several cures of bad cases have been made. Some people simply carry a piece of the carbon in their pocket as they would a buckeye, and it does the work. Others apply it as closely as possible to the afflicted part.

Mr. Westinghouse and the Nernst Lamp.

In an article in the Engineering Magazine Mr. Walter M. McFarland makes this interesting reference to the relation of Mr. George Westinghouse to important inventions: "Another characteristic of Mr. Westinghouse stands out very prominently in connection with the next great development in alternating-current apparatus, namely, his willingness to examine promising schemes which are presented to his notice, and if, after careful examination, he believes them of value, to have no hesitation in spending both time and money in experimentation to develop them and bring them to complete success. As is well known, Mr. Westinghouse gave his help in this way to Tesla in the development of multiphase apparatus, and particularly what is known as the 'induction motor,' which really made the electrical transmission of power simple and completely successful. In this development Mr. Westinghouse's own practical skill and sound judgment were of great value. The same thing has occurred with a number of other devices which, although originated by others, have been brought to perfection by the experimental work carried on under the direction of Mr. Westinghouse and at his expense. A notable instance is the Nernst lamp, which seems destined to create a revolution in electric lighting, inasmuch as by means of this lamp a given amount of illumination can be secured with less than half the expenditure of current required by the best incandescent lamps. When Mr. Westinghouse secured control of the Nernst patents for America the basic principles of the lamp were known, but it was entirely a laboratory device and anything but a commercial article. He put several of his brightest engineers and physicists, with the assistance of a corps of skilled workmen, at the problem of perfecting the details, and this has now been practically accomplished, after a large expenditure of money. There could not be a better illustration of the fact that the opinion so often entertained about inventions is entirely erroneous, namely, that some man by a happy thought, or an accident, makes a discovery which brings him in a large amount of money without any effort or expense. The development of the Nernst lamp has gone on for a long time, has involved a very large expenditure, and if its commercial development should result in a great reward, it will have been fully earned."

The City Council of Greenville, Ill., has granted a 50-year franchise to U. S. DeMoulin and W. Fay for the erection of an electric-light, heat and power plant in that city.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

The Minnesota Electric Telephone company of Willmar, Minn., has been incorporated. The officers are: President and treasurer, D. N. Tallman of Willmar; vice-president, Jacob L. Schocht of New Ulm, Minn.; secretary, John Williams of Willmar. President Tallman has secured a franchise at Atwater, Minn., for a local exchange, in the interest of the company.

The Merrill (Wis.) Telephone company declared a dividend of $5 a share at its annual meeting recently.

The telephone properties in southeastern Iowa owned by J. C. Hubinger have become involved with the Mississippi Valley Telephone company of Minneapolis and St. Paul. The extensive improvements recently made on the exchanges at Muscatine, Fort Madison, Keokuk and Burlington necessitated a large loan. To secure this, the properties in the four cities named have been turned over to the Royal Trust company of Chicago. The trust company will operate them, pending a settlement of the difficulties of Mr. Hubinger. The receiver of the Mississippi Valley Telephone company says the company owes $175,000 in secured and unsecured claims.

The People's Telephone company of Superior, Wis., has paid a tax of 12½ cents on each telephone in use for one year, its tax amounting to $87.75. This is the first time a tax has been paid in such a manner.

The Fairmont (Minn.) Telephone company declared a dividend of 10 per cent. to stockholders, at its recent annual meeting.

The Northern Minnesota Telephone company will install a local exchange at Staples, Minn., as soon as possible.

The Northern Electric company will make a number of changes and improvements to its local exchange at Ortonville, Minn. A new switchboard will be put in.

A local company will put in an exchange for Clara City, Minn., in the spring.

The Western Minnesota Telephone company announces that it will make the line from Hutchinson, Minn., to Glencoe and from Glencoe to Carver, a metallic one, thus giving an all-metallic connection with Minneapolis.

The State Telephone and Telegraph company will probably make its headquarters at Odebolt, Iowa, soon, where many improvements will be made. The company plans to string between 100 and 200 miles of wire this year.

The Home Telephone company of Oskaloosa, Iowa, has arranged for extensive additions and improvements to its plant. A new switchboard, with 1,000 connections, has been ordered, to replace the present board, which has capacity for but 600 connections.

The Iowa Telephone company has applied to the council of Davenport, Iowa, for an extension of its franchise for 25 years. The company promises to expend $150,000 in the construction of a new exchange and an underground-conduit system in the business section within two years. The company is restringing wires in Sioux City, Iowa, preparatory to placing all wires entering the exchange building at the stockyards in a cable. It is also constructing a line from Burlington, Iowa, to Ottumwa.

The Sheboygan County Telephone exchange will start work immediately on its toll line from Sheboygan, Wis., toward Milwaukee.

The Badger State Long-distance Telephone company of Evansville, Wis., will make Milwaukee its headquarters henceforth.

The Sunnyside Co-operative company, near North Yakima, Wash., has just installed a private exchange, with 19 patrons. It extends for about 20 miles. Those owning the line contribute $50 each toward the original cost of poles, wires and instruments. They are under no additional expense, as the maintenance is to be kept up by tolls paid from outsiders.

The Lisbon (Iowa) Telephone company has made a voluntary reduction in rates of 25 per cent., the change to take effect March 1st, the beginning of the second year of the career of the company.

The Seattle Automatic Telephone company has been granted permission to erect poles for its system in Seattle, Wash.

A syndicate of Independent telephone companies of Iowa is after the preferred stock of the Mutual Telephone company of Des Moines. The syndicate seeks a controlling interest.

A. von Schlegel, formerly manager of the contract department of the Northwestern Telephone Exchange company, has been located at West Superior, Wis., where he is manager of the Douglass County Telephone company. R.

Ohio Telephone Notes.

The Central Union Telephone company has moved into its handsome new home at Dayton, the building being situated on Ludlow street, between Second and Third. The office is on the ground floor, where the long-distance booths are also found. The manager's private office and the cashier's office are also found on this floor. The operating room is on the second floor and the rear portion is used by the wire chief. The new switchboard is of the latest pattern and is a great improvement over the old one which had been in use for years. Light signals are used instead of the old metal tag. The company has made a cut in price at Canton from $42 to $24 for long-distance residence telephones, $30 to $15 for independent residence telephones and $19 for all residences and farm houses within a radius of five miles. It is said the company expects to add 1,000 new subscribers within the next year by this cut. The Stark County Telephone company is arranging to put in a plant and this cut probably foreshadows the fight which it will encounter when the plant is completed.

The Zanesville Telegraph and Telephone company will begin at once the construction of an Independent plant in Zanesville. The suit against the company has held the matter in abeyance for two years, but since the Supreme Court has decided in favor of the company, it will proceed to finish its work. The United States Telephone company already has a line there, so a long-distance service will be given as soon as the local plant is completed.

A test of the use of telephone instruments over telegraph wires has been made on the Baltimore and Ohio road between Ravenna and Kent in this state and the experiment has proved very satisfactory. Persons can talk over the line with perfect ease, while the telegraph instruments are working as usual, and without interruption.

Negotiations are pending for the establishment of a telephone exchange at Worthington, north of Columbus. No conclusion has been reached yet, but both of the companies at Columbus have been asked to make a bid on the improvement.

The Ashley Telephone company, Ashley, has been incorporated, with a capital of $6,000, to build a local plant in Ashley and long-distance lines to Delaware, Mount Gilead and Marion. The incorporators are W. Guy Jones, B. W. Gillfillian, L. P. Lewis, George W. Canter and W. M. Haseltine. The first two are well-known Columbus men.

The Winona Central Telephone company, Winona, Columbiana county, has been incorporated, with a capital stock of $10,000, to operate a plant in the town and county. The incorporators are J. C. Walton, Joseph Masters, Joshua Brantingham, M. L. Barker and others.

The Zanesville Citizens' Telephone company, Zanesville, Ohio, has been incorporated, with a capital stock of $200,000, by Rufus C. Burton, Moses M. Granger, E. S. Grant, William C. Hadshy, William D. Schults and Sherman M. Granger. While it is impossible at this time to ascertain the purposes of the new company, it is probable that it will build a plant in Zanesville instead of the old company organized there two years ago.

In the case of the city of Zanesville against the Zanesville Telegraph and Telephone company, which the Supreme Court took up for a rehearing some time ago, the first decision has been reversed, and in the future the probate courts of the various counties may locate positions for wires and poles for such companies, and may also, if the authorities are correct, locate routes for street railways, in either case where a City Council has first refused to grant the company so desiring to construct a plant the authority for doing so.

O. M. C.

NEW COMPANIES.

The Northwestern Telegraph and Telephone company of Carthage, N. Y., has been incorporated, with $200,000 capital stock.

The United Telegraph and Telephone company of Philadelphia was recently incorporated in Delaware. The capital stock is $10,000.

The Bath and Cameron Telephone company has been incorporated, with headquarters at Bath, Steuben County, N. Y. The directors are Albert Crandall, A. J. Annabel and A. C. Annabel.

The Warrensburg Telephone company of Warrensburg, Ill., with a capital of $5,000, has been incorporated by Mary P. B. Cowen, G. A. Randolph and C. J. Tucker, to operate a telephone system.

The Steuben County Telegraph and Telephone company of Bath, N. Y., has been incorporated, with a capital of $2,000. The following directors are named: J. H. Bowlby and W. D. Carroll, Bath; D. F. Ward, Savonia.

The Subscribers' Telegraph and Telephone company of Watervliet, Albany county, N. Y., has been incorporated for $15,000. The directors are D. S. Johnston and J. E. MacLean of Cohoes and S. J. Cavanaugh of Watervliet.

The American Telephone and Telegraph company of North Carolina, with ample capital to carry on a general telegraph and telephone business in the state, has been organized, with headquarters at Raleigh. A. B. Andrews of Raleigh is interested.

The Mount Pulaski Telephone and Electric company of Mount Pulaski, Ill., has been incorporated, with a capital of $5,000, to conduct a telephone business and furnish light, heat and power. The incorporators are J. W. Collins, H. S. Bekemeyer and George H. Hubbard.

Death of E. M. Jackson.

Mr. Ellis Milne Jackson, superintendent of construction and maintenance for the Central Union Telephone company of Chicago, died of Bright's disease in San Rafael, Cal., on January 23d. He was first taken with the disease last May, and went to California in September with his wife and little daughter, in the hope of regaining his health. Mr. Jackson was born 38 years ago in the Isle of Man and spent the early years of his life in Milwaukee. For many years he was connected with licensed telephone companies of the American Bell Telephone company and was recognized as one of the leading authorities in underground-conduit construction and telephone-circuit distribution. About 1886 he entered the service of the Chicago Telephone company, where he did considerable underground work. He was next employed by the Pacific and Sunset Telephone companies of California, with headquarters in San Francisco, and while there superintended all their early underground construction. His connection with the Central Union Telephone company began in 1895. He served in various technical positions with that company, several promotions advancing him to the position he held at the time of his death. Mr. Jackson's work was characterized by accuracy, good judgment and persistence, traits which helped to make him a master of his craft. Prior to going to California Mr. Jackson resided in Woodlawn in Chicago. He is survived by his wife and child, four brothers and two sisters.

ELLIS M. JACKSON.

Chicago Telephone Company Increases Capitalization.

At a meeting of the board of directors of the Chicago Telephone company on January 23d it was voted to issue $1,000,000 new stock in April. The stock will be delivered April 8th at par to shareholders of record on March 27th. This will make the stock outstanding at that time $8,000,000. In all probability another $1,000,000 will be issued in October. The proceeds of the sale of these additional shares will be devoted to the payment for extensions and improvements which the directors have in contemplation and have partially carried out. The addition of this amount to the capital will not affect the dividend rate. The directors re-elected the old officers and added Arthur D. Wheeler to the list as second vice-president. The officers now are as follows: President, John M. Clark; first vice-president, Byron L. Smith; second vice-president, Arthur D. Wheeler; secretary and treasurer, C. E. Mosley; auditor, George W. Hutchinson; executive committee, J. Russell Jones, Robert T. Lincoln and Byron L. Smith.

Telephone Valuations in Michigan.

In the forthcoming report of Professor M. E. Cooley, appraiser of the Michigan State Tax Commission, the data on the total valuation of telephone property in the state have been practically completed. There are 64 telephone companies in the state, and the total cost of reproduction of their existing properties would be very nearly $6,300,000. The present value of these properties is said to be almost exactly $5,250,000. To make this total the property of the Michigan Telephone company furnishes by far the greater proportion. This company, with its big Detroit exchange and other exchanges in nearly every city in the state, is said to be only $50,000 short of having a cost of reproduction value of $5,000,000. The present value of the property is said to be about $4,200,000. The average local exchange in the smaller cities of the state costs to construct, according to the report, about $20,000, so the entire 60 or more of them represent but little more than $1,000,000 in actual value to-day.

Swedish Telephone Concessions in Russia.

The Russian government recently asked for tenders for the telephone concessions in the cities of St. Petersburg, Moscow, Odessa, Warsaw and Riga. Grants for operating the systems at Moscow and Warsaw have been given to Swedish companies, at the head of which is H. T. Cedergren, director of the Stockholm General Telephone company. This gentleman, in an interview in the London Electrician, makes a number of interesting statements, as follows:

In the Russian cities named the well-known American Bell Telephone company, or, rather, the European branch at Antwerp, has hitherto held the concessions, which were granted for 20 years, to expire on November 1, 1901; and the present competition has been held in order to settle the concessions for a period of 18 years from that date, the competition having been the keener as the Russian towns still offer a wide field for telephonic operations, the use of the telephone not having advanced appreciably during the working by the present concession holders. In St. Petersburg, for instance, there are only 27 subscribers per 10,000 inhabitants, as against no less than 900 in Stockholm to the same number of persons. En passant it may be mentioned that Stockholm in this respect takes first place by a long way over the principal cities of the world, San Francisco coming nearest, but with only 485 apparatus per 10,000 inhabitants, then Berlin with 218, New York with 150, Chicago with 100, Paris with 74, London with only 47, and St. Petersburg (as stated) with only 27 per 10,000.

The cause of the very limited use of the telephone in Russia is chiefly that the lines are old-fashioned, single overhead ones, and because the subscription is rather high, viz.: In St. Petersburg, Warsaw and Moscow, 250 rubles ($128.75), and in Riga and Odessa, 150 rubles ($77.25) a year per apparatus. One of the conditions in the concessions of the Bell company was that on their expiration the plants, etc., should revert to the Russian state, and all these, which the new concessionaires have to take over, have been valued at 1,000,000 rubles ($515,000).

Besides the conditions respecting the taking over of the old Bell installations, and one granting three years only from November 1st next year for the reconstruction of the systems, there were others in the concessions prepared by the Chief Russian Post and Telegraph Administration, as, for instance, insistence upon the new systems answering all modern requirements, the lines to be subterranean, most improved apparatus only to be used, and others. The concessions were granted for 18 years, when the Russian state would have the privilege of taking over the systems, and the price of redemption should be fixed by arbitrators appointed by each party. Everything was thus fixed by the state, so that the only bone of contention was really the price of the annual subscription. As regards the latter, it was stated that it should apply to transverse apparatus, with a small advance for apparatus frequently used and a slight reduction for those less in use, whilst the subscription was to apply to all apparatus within three kilometers from the central station, but for longer distances there should be an extra charge. The Western Electric company of Chicago was a tenderer of bids in all the cities.

As an illustration of the extent of the businesses concerned may be mentioned that the Swedish estimates forming the basis for their tenders fix the cost of the installations in St. Petersburg at 16,700,000kr. ($4,475,600), in Moscow at 15,400,000kr. (the number of subscribers in each city being estimated at 20,000), in Warsaw (10,000 subscribers) at 6,800,000 kr., and in Riga and Odessa (6,000 subscribers each) at 4,000,000 kr. per town. These estimates apply to the whole time of concession—18 years—irrespective of the cost of the sites for the new central stations required.

As already stated, the two Swedish companies tendered for two cities, viz., for Moscow with 70 rubles ($40.68) per apparatus, and for Warsaw with 60 rubles ($35.54). In addition a tender was made for St. Petersburg, but the municipal council there tendered lower with 55 rubles, but, as it is considered that this figure is far too low for an effective service, it may be rejected, and the Swedish tender, which stands next, may be accepted. In Odessa the Raffalovitch firm obtained the contract with 48 rubles, and in Riga, Rucker & Co., with 57 rubles.

Michigan Independent Telephone Association.

The Michigan Independent Telephone association will hold its annual meeting in Lansing on February 6th. Among the subjects to be discussed at the meeting are the provision of means whereby the Independent companies in the state will be mutually benefited and the advisability of having a law passed establishing a low uniform rental for telephones for cities of a certain size, the amount to vary with the amount of telephones in use. J. B. Ware, secretary of the Citizens' Telephone company of Grand Rapids, is president of the Michigan association.

Telephone, Telegraph and Cable Company's Finances.

On January 21st the Telephone, Telegraph and Cable company of New York issued a circular, signed by President W. J. Latta, from which the following statements are taken:

The debts of the company, which were incurred in the purchase of a large block of stock of the Erie Telegraph and Telephone company, have been liquidated, until now they amount to but $379,000. This sum, represented by several notes, is due and payable, part on February 1st and the balance on March 1, 1901. In addition thereto there is due to your subsidiary companies for labor and material expended on construction, which will carry them to March 1st of this year, $75,000. With these paid there will be in the treasury of your company, free and clear, $2,100,000 par value Erie Telegraph and Telephone company and stocks and other securities of companies controlled by this company of a par value of $2,289,966.63, which have cost your company $844,366.17. There are also due and payable assessments in arrears amounting to $1,164,817.50, which, when paid, will be used to liquidate the above floating debt, leaving a cash balance in your treasury of $710,817.50, besides the assets above noted.

Your directors are of the opinion that the best interests of the company require the prompt payment of all assessments now in arrears to the end that the company may be put into possession of funds to meet its obligations. With this done a plan will be laid before you by which the present stock will be made full paid with all future liability eliminated. At the same time some definite programme will be determined upon by which the company as thus recapitalized may pursue the lines originally laid out for it.

These matters are now in the hands of a special committee, consisting of five stockholders, not directors, and two directors, as follows: Randal Morgan, Frank A. Cutting, James Moses, William H. Butler, Frank M. Kelley, Frank Tilford and Henry R. Wilson.

Pending certain investigations now being conducted under the direction of the committee, no permanent plan can be laid before you, but it is thought that one will be ready for submission to you on or before the date of the annual meeting.

The annual meeting of the company is to be held on February 12th.

Independent Growth in Michigan.

The Citizens' Telephone company of Grand Rapids, Mich., now has exchanges at Lansing, Traverse City and Holland, has an interest in the Muskegon exchange and owns the toll lines connecting these exchanges. Upon these toll lines are over 20 smaller exchanges, including Vermontville, Nashville, Middleville, Hastings, Zeeland, Rockford, Cedar Springs, Newaygo, Fremont, Manton and Lowell. Besides these, there are Reed City, Cadillac, Frankfort, Howard City, Sparta, Charlotte, Saranac, Belding and many smaller exchanges with which the company has intimate connection, though not owning them. The Citizens' company owns 6,980 telephones and about 1,800 miles of toll circuits. It connects with 231 exchanges and toll stations within 50 miles of Grand Rapids, 140 of which cannot be reached by any other system. At a recent meeting of the Citizens' Telephone company in Muskegon, a semi-annual cash dividend of four per cent. was declared. J. B. Ware, secretary of the Grand Rapids and Muskegon companies, has been quoted as saying:

"The business is growing, and we are getting in better shape all the time. The prospects are we will continue to grow. The other Independent companies in the state are growing the same way. There has been no failure of any of the Independent companies. Every one has prospered. Around Detroit, where a year ago a great many of the Independent companies sold out, within the last 11 months 12 or 15 new companies have been organized. There are now copper circuits all over Michigan, and Muskegon people can talk to Saginaw and get as good service as it is possible to give anybody. Exchanges have been built in a number of towns which heretofore have not had telephone service. The service will be developed more than ever in the spring."

It is thought that an Independent exchange is certain to be built in Detroit this year, 3,000 contracts for telephones having been secured there in the last few days.

In the annual report of the Texas Railroad Commission, recently filed, there are a number of legislative recommendations, the most important of which is that a law be passed by the legislature at the coming session giving the railroad commission the power to regulate the rates and charges of all telegraph and telephone companies doing business in Texas and compelling all such companies to maintain general offices in that state.

GENERAL TELEPHONE NEWS.

The Cuba Telephone company of Cuba, Allegany County, N. Y., has been incorporated, with a capital stock of $12,000. The directors are Charles Richer, Clarence Richer and G. H. Richer of Cuba.

The T. A. Marshall Telephone company of Keithsburg, Ill., has been incorporated for $50,000, to operate a telephone system. The incorporators are Tom A. Marshall, Frederick P. Burgett and David Adelsdorf.

The Pulteney Telephone company has been organized, with the following-named officers: President, J. M. Hall; vice-president, W. A. Prentiss; secretary and treasurer, H. L. Brush. It is proposed to build a telephone line between Pulteney and Hammondsport.

A new telephone system for Honolulu is being promoted by John C. Carrington of Omaha, Neb. He requires 250 subscribers, of whom 150 have been secured, with a prospect of obtaining the other 100. The automatic call-board system is the one proposed.

The Utah Home Telephone company is asking the City Councils of Salt Lake City and Ogden, Utah, for franchises to install telephone plants in those cities. E. W. Hammer, late with the Chicago Rheostat company, is looking after the company's interests in Chicago.

The Northern Indiana and Southern Michigan Telephone company, with $50,000 capital, has been organized in Lagrange, Ind., for the purpose of securing a number of short lines in the two states named and Ohio for through communication between Toledo, Detroit and intermediate cities and Chicago, so as to compete with the American Bell company.

At the recent annual meeting of the stockholders of the Wood County Telephone company of Grand Rapids, Wis., the capital stock was increased to $18,000. The following-named officers were elected: President, A. L. Fontain; secretary, G. W. Paulus; treasurer, F. E. Kellner, and general manager, C. M. Dougharty. It is probable that the Grand Rapids exchange will be made full-metallic. A 400-capacity switchboard will be added at once.

A bill has been introduced in the Illinois state Senate placing restrictions on telephone companies operating in the state. It prohibits the erection of poles or stringing of wires in territory outside of cities, towns and villages except by permission of the county boards, and inside of cities by permission of the corporate authorities. It also provides for the forfeiture of the franchise of a company refusing to transmit a message tendered by another company in the same business.

A new kind of telephone thief has made his appearance in New York city. Several telephone desk instruments have been taken recently by two men who, it is said, look like honest workingmen, such as would be employed by a telephone company. The men walk into an office, unhook the receiver, talk to an imaginary "Central," then slip the connection, take the telephone from its table and carry it away "for repair." Neither they nor the telephone come back.

S. M. Strong, manager of the Ashtabula Telephone company of Ashtabula, Ohio, has resigned, to accept a position as superintendent of the People's Telephone company of Akron, Ohio. The Ashtabula exchange has grown from 135 to 750 subscribers under Mr. Strong's efficient management. In his new position he will have supervision over the mechanical department of the exchanges at Barberton and Cuyahoga Falls, which are auxiliary to the Akron exchange. Fred G. Frese is general manager of the People's Telephone company.

There is a possibility that three companies may soon be competing for the telephone business of Bath, N. Y. At a recent meeting of the Board of Trustees the application of the Bath Telephone company for a franchise was presented. Action was deferred. Early in the month the Steuben County Telephone company was granted a franchise. The Bell Telephone company is at present doing business in the village. Some opposition to the grant of the franchise to the new company has developed among business men, because if a new system is installed they will be obliged to put in additional instruments to accommodate customers; yet they will require Bell telephones in order to secure long-distance service.

Incorporation papers were taken out in Albany, N. Y., on January 23d by a large telephone company, to be known as the Atlantic Telephone company. The company, which is capitalized at $5,000,000, proposes to maintain a telephone system connecting New York city, Albany, Syracuse, Rochester, Buffalo and all the cities and villages along the route, and to connect these places with other municipalities in the United States and Canada. The capital stock is divided into 50,000 shares at the par value of $100 each. The following-named gentlemen are mentioned as directors of the company: William H. Stayton of Yonkers, John A. J. Campbell, Charles B. Reid, Arthur B. Lafar and James F. Shaw of New York city, George H. Mann of Brooklyn and Warren L. Sawyer of Nyack.

Synchronous Converters.[1]

By W. E. Goldsborough.

Part I.

In the practice of his profession the electrical engineer is constantly facing radical amplifications of the one-time limitations of his field for work. To those of us whose daily occupation is largely confined to the successful commercial management of electrical enterprises, the business details connected with which tax our attention, these changing conditions are often perplexing, while their multiplicity reduces rather than stimulates our curiosity regarding them. In this, as in other fields, however, fortune favors us. Time attacks the "invincible formulæ" in which our seers clothe their theories, and gradually intricacies unfold until comparatively simple illustrations suffice to make clear seemingly complex phenomena.

This paper treats of one of the most useful electrical devices that the end of the century has placed at the disposal of the engineer, and I trust the paper may in some measure extend your appreciation of the worth of the device.

The synchronous converter is the chief exponent of a type of machine that embodies a greater number of the principles underlying the design and construction of dynamo-electric machinery than any other apparatus used in the development and distribution of electric power. And yet, it is in many respects a wonderfully simple machine. The direct-current dynamo has been in use, relatively, for so long a time, and we have become so familiar with it, that it is no longer regarded as a complicated mechanism. In the same way the alternator is so frequently met with that it has become a well understood part of station equipment. In fact, the direct and alternating-current dynamos have been partners from the first, and we instinctively associate them together. But who does not look with interest at the modern "rotary" or synchronous converter?

The combination of the direct and alternating-current machines into a single unit has resulted in the production of a marvelously ingenious device, and made the link between the two great divisions of electric power distribution. It is a machine which, when belt-driven, develops either direct or alternating-current power, either separately or simultaneously. Under these conditions, it will fulfill the functions of either a direct-current generator, an alternating-current generator or a double-current generator.

If, on the other hand, it is operated electrically from a source of direct-current power, it can be used either to develop mechanical power as a shunt motor or as a source of alternating-current power. In the latter case, the machine is frequently called an "inverted-rotary."

And, finally, the machine can be operated from an alternating-current source of power, either as a synchronous motor developing mechanical energy, or as a producer of direct-current electrical energy. The last-mentioned arrangement is the most common condition of operation of the machine, and when so used it is known as a "rotary" or a synchronous converter.

The synchronous converter is then, properly speaking, a device for converting alternating into direct-current power.

In view of the fact that practically all electrical rotating machinery is now equipped with a distriubted coil form of winding, the statement is not surprising that any direct-current, constant-potential generator can be changed into a synchronous converter by suitably tapping the armature coils and leading the taps out to collector rings. Or, that any alternator having a distributed winding can be made into a "rotary" by suitably tapping the junction terminals of adjacent armature coils and connecting them to a suitable commutator. In designing a synchronous converter, the latter practice is substantially what is followed, with the result of producing a machine suited to the limitations imposed by frequency considerations, as well as to the other factors governing the conversion of power.

To gain an insight into the theory of the working of these machines, let us for a moment consider the working conditions in direct-current generators and motors. If a shunt dynamo is operated with a given field excitation and at a given speed, a given electromotive force is maintained at the brushes for any specified condition of loading. If the same field excitation is given to the machine, and the same electromotive force impressed at its brushes, the machine will operate as a motor; and the direction of its armature rotation, the strength of its armature current and the power it develops will be the same, assuming 100 per cent. efficiency. But, although the armature currents in the machine in the two cases will have the same intensity, they will flow through the armature conductors in opposite directions.

Now, consider the case of an alternator. With a given excitation, speed and load, the machine will develop a definite voltage when driven as a generator of alternating-current energy. If, however, the machine is driven electrically, with the same field excitation, the same direction of rotation, the same speed and the same impressed voltage, it will develop an amount of mechanical energy that is exactly equal to the electrical energy previously developed, but the direction of the flow of current in the armature at corresponding instants of time will be opposite in the motor to what it was in the generator. Of course, for the moment, we are neglecting all losses inherent to the machine, and considering that it has an efficiency of 100 per cent., and that the line constants are such as to reduce the operating constants to electrically the same terms.

That is, if the machine has an (assumed) efficiency of 100 per cent., other things being equal, it develops as a synchronous motor an amount of mechanical energy that is equal to the electrical energy it develops when operated as a generator; but the current flowing in the armature windings is reversed in the two cases.

It may be generally stated, then, that if constant field excitation and constant direction of armature rotation be maintained, the flow of current in the armature of any electric machine when used as a generator is opposed to the flow of current in the armature when the machine is used as a motor.

If we consider a machine having two independent direct-current windings on its armature, the terminals of the coils of which are brought to separate commutators (a commutator being placed at each end of the armature body), we have a combination that is known as a dynamotor. Every other slot in the armature core contains the conductors of the first winding, and the intermediate slots the conductors of the second winding.

If the first winding is adjusted for 110-volt work at 90 amperes, and the second winding for 220-volt working, it is possible to draw 45 amperes at 220 volts from the second winding, if the first winding is connected to 110-volt power mains. In other words, assuming 100 per cent. efficiency still, the machine operating as a motor from the 110-volt mains develops the same amount of power in its second or generator winding that it absorbs in its first or motor winding, but at an increased voltage. The current in the second winding will, however, be flowing in a direction along the slots that is opposite to the direction of the current in the conductors of the first winding. Such a machine is a transformer or converter of direct currents, as it transforms the direct current to a higher voltage, and thereby performs the function that, in alternating-current working, is characteristic of the static transformer.

Attention has been called to the fact that practically the same form of distributed coil winding is now used for both alternating and direct-current armatures. When all of the junction points of adjacent coils are brought down to commutator bars, the winding suffices for a direct-current generator. When only the junction points under the centers of the poles (for a given position of the armature) are brought down (those under the [N] poles being connected to one collector ring, and those under the [S] poles being connected to another), the winding suffices for an (single-phase) alternating-current generator.

From the dynamotor just considered, the commutators can be removed and collector rings substituted, with suitable taps connecting the two sets of collector rings to evenly spaced coil junction points on the first and second armature windings respectively. A machine results which, when connected to an alternating-current circuit (of proper frequency), can be made to operate as a synchronous motor, developing in the second winding alternating-current power to the same amount, but of double the voltage. Here, then, we have an unusual type of alternating-current step-up transformer. The transformation differs from that which takes place in the static transformer essentially, simply in that the core over which the coils are wound rotates. The first winding is the primary, the second the secondary, and in these windings, as in the windings of the static transformer, the currents in the primary and secondary flow in opposite directions. This machine has no place in commercial development, as the static transformer performs all the functions of which it is capable better and cheaper, but the machine is worth considering as a link in the chain of our discussion.

Now, let us go back and consider a further modification of the dynamotor. Suppose it were wound with two identical direct-current windings. Then, as the first winding is exactly like the second winding, the voltage at each commutator would be 110 volts, and the ratio of transformation between the two ends of the machine would be unity. Currents of equal intensity would flow through conductors of equal section in the two armatures, and all magnetic effects due to the currents in one winding would be completely annulled by the currents in the other winding. The armature would simply spin in its bearings, giving out to one circuit what it took from another, as long as its efficiency was maintained at the assumed value of 100 per cent.

An alternating double-current armature corresponding to the above would transform its energy at the same unit ratio, and could be operated as free from all reactions of armature currents upon its fields, the currents in the first and second windings in this instance also completely annulling one another's magnetic effects.

Now, let us make another change. Take from the armature body one of the two identical direct-current armature windings, and replace it by one of the two identical alternating-current armature windings of the machine just considered. If the resulting machine is supplied with alternating-current power at 78 volts, it can be operated as a synchronous motor; and from the second or direct-current winding, direct-current energy can be drawn at a voltage of 110 volts. As by our previous assumptions the machine develops and delivers 10 kilowatts of power, the alternating current will have to have a value at least as great as 128 amperes, to produce the required 90 direct-current amperes. This machine, which we may call a "synchronous dynamotor," is but one step removed from the synchronous converter. As it has two independent windings, there is no electrical contact between the two systems. Alternating-current power is supplied and direct-current power delivered, and the net effect of the currents is that they flow in opposite directions through the conductors of their respective windings. As the alternating currents vary in intensity from zero to maximum values, while the direct currents are to all intents and purposes constant, we have the condition of a fluctuating quantity opposite to a constant quantity. Therefore, at any given instant, the net magnetizing effect of the armature currents may or may not be zero, according as instantaneous values of the alternating currents are equal to, or are less, or are greater than, the direct currents; but the average magnetizing effect of the working component of the alternating current is exactly balanced by the magnetizing effect of the direct current. When, therefore, a converter of this double-winding type is adjusted to maximum economic working, the armature exerts practically no influence upon the magnetic conditions existing in the field circuit.

So far we have assumed an efficiency of 100 per cent. for the several machines considered; an assumption which, unfortunately, can never be realized. The "synchronous dynamotor" discussed in the last paragraph has its defects, in spite of all assumptions. When running free and without load, the power required to overcome the hysteresis and eddy currents of the armature core and the exciting energy required by the field winding are the chief losses. As the load comes on the machine at the direct-current side, greater and greater currents flow in the double windings, and to the no-load losses must be added at full load the copper losses of both the first (or alternating) and the second (or direct-current) armature windings.

In a set consisting of an independent synchronous motor and a direct-current generator mounted on the same base and directly connected, we have to contend with a field copper loss, a friction loss, and an armature copper loss in each machine. In a synchronous dynamotor, the field copper loss, the friction loss and the core loss are reduced, but the armature copper losses remain the same as in the case of the two independent machines. Now, if we could get along with one winding on the synchronous-dynamotor armature, confining both the alternating and the direct currents to one winding, a great gain would be effected. The direct and alternating currents would be flowing in opposite directions in common conductors, and tend to annul one another. Such an arrangement would entirely remove the copper loss of one winding and greatly reduce the copper loss of the other.

The synchronous converter is the machine in which this principle is carried out. The junction points of the coils of the distributed winding on the armature of a synchronous motor (whether it be a single-phase, a two-phase or a three-phase machine matters not), are tapped and connected to the bars of a commutator. As a matter of convenience, the collector rings are usually placed at one end of the armature body and the commutator at the other. This is the only modification commonly made in the machine. It is then speeded up and brought into synchronism with the supply circuit in the same manner as before the commutator connections were added. Instead of loading the machine mechanically, however, the load is applied by taking off direct-current power from the commutator. Since there is but one winding on the armature, the direct currents are drawn from the same winding to which the alternating currents are supplied. In a measure it is true that the alternating current never enters the winding of the machine at all. A large part of it never does, but flows directly into the direct-current mains, since twice in every oscillation of the alternating current the direct current entirely neutralizes the alternating current in the windings. Outside of the armature windings, however, the direct and alternating currents at these times are flowing in the same direction. What current there is flowing in the armature winding is made up of the differences in the instantaneous values of the (constant) direct and (variable) alternating currents in the various armature conductors.

The reduction of the average current intensity in the armature conductors greatly reduces the dimensions of a machine for a given capacity below what is required for either an ordinary synchronous motor or direct-current dynamo of similar capacity. This is a matter of considerable importance, and a feature not to be overlooked.

[*To be continued.*]

1. Read before the Northwestern Electrical association at Milwaukee, Wis., on January 17, 1901. Mr. Goldsborough is professor of electrical engineering at Purdue University, Lafayette, Ind.

National Multiple Alternating Enclosed-arc Lamp.

The National Arc Lamp company of Lorain, Ohio, has recently placed on the market a new enclosed-arc lamp which employs a novel type of carbon-feeding mechanism and embraces several radical changes in the mechanical construction. The company's adoption of this mechanism for multiple alternating-current circuits eliminates the necessity of choke coils (the operating coils furnishing the necessary reactance), springs or moving iron parts and their attendant difficulties, and allows the maintenance of an exceptionally high-voltage arc with a low amperage consumption. A simple description of this principle is as follows:

It has been demonstrated that a single convolution of conducting material surrounding an iron core through which is passing an electrical current will have a movement or tendency of movement toward the center of the iron core; in other words, it will move to that position around a core where it

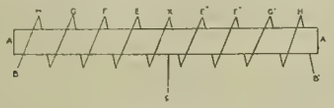


FIG. 1. NATIONAL MULTIPLE ALTERNATING ENCLOSED-ARC LAMP.—SOLENOID.

will have an equal amount of iron on each side to conduct the magnetism produced by it. Two or more of these turns will increase the strength of effort, the ratio being in direct proportion to the ampere turns. Considering a solenoid, as in Fig. 1, (A) (A') being an iron core and (B) (B') consisting of nine turns of insulated, flexible wire, (X) is the central convolution, surrounding the core at (C). The flow of current from (B) to (B') would cause the convolutions (H), (G), (F) and (E) and (H'), (G'), (F') and (E') to move toward the convolution (X), which, being in the center of the core, would have no movement, but would increase the power of the rest of the turns by increasing the magnetism in the iron core. Now, suppose the convolutions (X), (E'), (F'), (G') and (H') to be held stationary with reference to the core, and (H), (G), (F) and (E) to be bound together so as to obtain their combined effort. Pass the current as before from (B) to (B'), and the result will be the movement of the section consisting of (H), (G), (F) and (E)

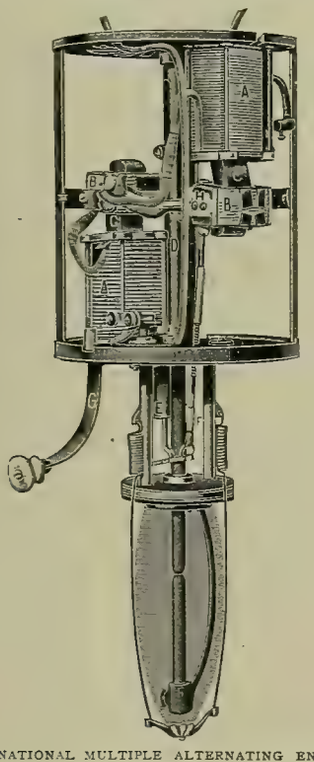


FIG. 2. NATIONAL MULTIPLE ALTERNATING ENCLOSED-ARC LAMP.

toward the stationary portion consisting of (X), (E'), (F'), (G') and (H'). Two different forces thus work in harmony—the movement of a coil toward the center of its core, as just shown, and the attraction of two coils toward each other regardless of the core. This has been appropriately termed the "divided-coil" principle, and seems to allow of the use of a power heretofore lost in previous types of electromagnets.

In its application to the regulating mechanism of the National arc lamps (Fig. 2) two divided coils are used, the moving sections (B) (B) being securely fastened to the opposite ends of the centrally pivoted rocker (H), to one end of which the carbon-lifting device (F) is attached. The coils and carbon circuits are in series, so that fluctuations of the arc resistance act directly upon the regulating coils. With no current passing through the lamp, the moving sections of coils (B) (B) are receded from their respective stationary portions (A) (A) by the weight of the upper carbon, carbon-holder, clutch and dash-pot plunger. Upon the admission of current, the moving-coil sections move toward the center of the cores (C) (C), aided by the mutual attraction of the divided sections and separating the carbons.

As the arc resistance increases from carbon consumption or other causes, the moving coils recede, lessening the distance between carbons. A very interesting feature of this device is that the power or pull of the coils is the same over their entire length of travel, a result which has long been sought, and the great advantage will be readily understood from the claim made, that the lamp is absolutely independent of voltage fluctuations. An increase of from 20 volts around the arc up to 100 will cause a current fluctuation of less than one-half ampere.

Another radical difference lies in the method of securing coils to the frame. This lamp has its stationary coils bolted solidly to the frame, allowing of no vibration whatever, thereby securing an alternating mechanism which is noiseless, the only perceptible noise being a slight arc hum, and that on the higher frequencies only. Another novelty, the value of which will be readily understood by those familiar with alternating-current lamps, is that the amount of iron in the coils does not change, as in a mechanism using a solenoid with a movable-iron core, so that the reactance varies only with the strength of current flow.

The manufacturer asserts that the following results are obtainable with the use of this mechanism on multiple alternatng-current circuits: "Lamps can be adjusted to burn successfully with a current consumption of 4½ amperes with a voltage of 85 around the arc on 100-volt mains, which means that one gets as much light as he formerly got with lamps using from six to seven amperes and a low-arc voltage. One can operate 100 National lamps with the same transformer capacity he is now using for 75 lamps. The inductive load is greatly reduced, insuring correct meter readings and full voltage for incandescent lamps on the same circuit. A better diffused light with the 'moving-arc shadows' reduced to a minimum. Excellent results with domestic carbons. A saving of 25 per cent. in transformer, meter and copper bills." The company states further that while a six-ampere, 70-volt arc lamp uses 420 watts in the arc and 80 watts in the mechanism, making a total of 500 watts, a National lamp consumes 380 watts in the arc and 30 watts in the mechanism, making a total of 410 watts.

Smith-Vaile Direct-acting Pressure Pump.

The accompanying illustration shows one of the latest compound direct-acting pressure pumps. The machine is one of the largest of its type built, and will be installed by the Columbia Gold Mining company of Oregon, and will be operated condensing. The pump was built for mine-station

SMITH-VAILE DIRECT-ACTING PRESSURE PUMP.

work, the water end being designed for a working pressure of 600 pounds per square inch, with ample margin for safety. The valve seats are of bronze, of a special composition and type, setting on steel seats and located in individual chambers, easy of access. The entire water end is made of a special semi-steel composition. An extension piece is provided, with an adjustable shoe for the guidance and support of the plunger. The water plungers are of bronze and of the trombone type and packed, reciprocating through deep glands, especially accessible. The entire end is mounted on heavy cast-iron foot pieces. The steam end is of the cross-head type, lagged in polished steel. Steam valves of the semi-Corliss type are used, the area ports for the induction and eduction of steam being especially liberal. The valve adjustment is on the outside. Special equalizing valves are provided, and the rock stand supporting the valve gear is located in such a manner as least to interfere with the inspection of the working parts and to obviate any trouble due to vibration. The cross-heads are of a special type, being guided on the lower tie-rods. The manufacturer of the pump is the Stilwell-Bierce & Smith-Vaile company. Dayton, Ohio.

Oerlikon-Bullock Machinery in the United States.

The interesting announcement is made by the Bullock Electric Manufacturing company of Cincinnati that it is now prepared to receive orders for alternating-current generators and motors of any size. The machines sold by the Bullock company will not be experimental, inasmuch as the company has purchased the designs of the Oerlikon company of Zurich, Switzerland. The latter company was the pioneer in the development of alternating-current machinery abroad and is to-day a leader in the field. The Bullock company states that it will use the same care in the construction of its alternating-current machinery as it has in the manufacture of its direct-current machines, which the company has been building for some years and which are to-day recognized as being of high grade.

Electric Canal Haulage in Belgium.

By Léon Gérard.

Probably the most interesting example now in existence of electric haulage on canals is found in Belgium, on the Charleroi Canal, at Brussels. The canal is a very narrow one, about 50 miles long, and connects the Charleroi coal district with the port of Antwerp, passing Brussels on the way. The important Mons district is not yet connected with the sea, except through French territory, and the Liége district reaches Antwerp through about 120 miles of canal and river. This explains why British and German coal compares very favorably in price with Belgian coal, even at Brussels, which is 31 miles distant from Antwerp by canal route.

It was, therefore, of great commercial importance to connect Brussels by waterway in a more efficient manner with the coal basin of Charleroi, and this was done by electric towing of the boats on the canal. With the old way of towing the boats by horses a speed of 1¼ miles an hour was obtained, but with the electric system this has been increased to from 2½ to three miles, with no more expense per mile for the same tonnage. The cost is about two shillings per boat per mile. The boats have a capacity of 70 tons, and the annual traffic amounts to about 600,000 tons.

The haulage system on the canal has been laid out according to the designs and under the direction of the writer, and comprises a number of small electric road carriages—automobiles they might be termed—rated at about five horsepower, which take the places of the horses previously used. Electric current for the three-phase motors is taken from overhead conductors through three separate trolleys. There are altogether eight overhead wires, the lowest three being the trolley wires which supply current at 600 volts; the upper three are feeder wires carrying current at 6,000 volts, and the two intermediate wires on the small insulators are for telephone service between all the sub-stations along the line and the main power stations. The sub-stations are three miles apart, and each contains a transformer outfit for bringing the voltage down to the 600 mark for the trolley lines.

The whole 50-mile course between Brussels and Charleroi is supplied from two generating stations, one at Oisquercq, and the other at Roux, the two being 29 miles apart. The Oisquercq station contains three 125-horsepower Corliss engines, driving three Brown-Boveri three-phase alternators at 6,000 volts and 10 amperes. The arrangements at the Roux station is similar, but the engines there are of 325 horsepower each. As that particular part of Belgium is the most thickly populated and also the most active in an industrial way, it is not astonishing that the electric power available from these stations should be applied to other uses besides towing on the canal, and we find, therefore, that it serves for lighting purposes in many places, and for driving various small establishments, operating printing presses, looms, forge bellows, woodworking and other machinery. Indeed, the rapidly growing demand for current for these secondary uses, as they might be considered, was what prompted the laying out of the station at Roux on a larger scale.

The canal automobiles work over sections of varying length. A motor tows its boat until it meets another one going in the opposite direction. The two do not pass each other, but exchange tow lines and retrace their routes. The driver has two seats at his disposal, one for each direction; consequently the motors have neither to turn nor to exchange trolleys. The exchanging of the tow lines occupies about a minute.

The banks of the canal are so narrow that passing of two motors would be dangerous; in fact, on certain parts of the canal the banks are in such poor shape that, instead of using the motor carriages mentioned, electrically driven tugboats have to be employed. A speed of between seven and eight miles an hour can be maintained by these tugs without throwing the trolley off the line. The current is conveyed to the boat through an insulated cable of three conductors, supported by the boom on the vessel's mast. In towing two 70-ton boats a speed of about two miles an hour is reached. The system of the boom, of the cable and the trolley is so perfect that the tug is entirely free to turn around like a steamboat; it can keep at a distance of 60 feet from the line, though its mast is only 14 feet above the water. With large tugs and a suitable mast the distance from the tug to the line could be increased up to 90 feet.—Cassier's Magazine.

The Cincinnati Edison company has announced its intention of submitting bids for the public lighting of Cincinnati this spring. This will necessitate the company's going into the gas business, and it is expected that it will ask for an amendment to its charter granting it the right to manufacture and distribute artificial gas and distribute natural gas.

Arc-lamp Standardization.[1]

By Harold Almert.

When the arc lamp was first introduced and installed in a building or public square people heard of the new light which was destined to rival the sun and flocked to see it from miles around. They were very much impressed by the terrific glare, and enterprising merchants were not slow to recognize the attractive power of this new light. Although the cost was high, the advertising they received in return amply repaid them for their outlay. At that time little or no attention was paid to the quantity or quality of illumination, and to put an opal globe around the arc would have been equivalent to putting your light under a bushel.

After the novelty had worn off, and with the appearance of several makes of lamps on the market, the relative value of each, as light producers, began to receive some attention; not very much, however, as the principal topic of discussion at that time was the advantages of the different systems, as they were then called. When it became an established fact that the arc light had come to stay, and that the field was a good one, a large number of experimenters went into the field to improve both lamps and generators. But this development, which you are all familiar with, is not within the scope of this paper.

The various scientific bodies, both in this country and abroad, together with a large number of investigators, have given the subject of arc-lamp standardization considerable attention from time to time, but as yet no standard or practical basis for the comparison of the relative values of the different lamps now on the market has ever been suggested. Any suggestions that have been made have been of so scientific a nature as to put them entirely out of reach of the makers and users, except those with extensive laboratories at their command.

The writer believes that what is wanted at this time is some definite understanding between the manufacturer and user as to what a lamp should and should not do.

The difficulties met with in arc-light photometry are many, and if we compare the results of different investigators, or even the different results of the same investigator, we find such great differences that many have abandoned the idea of obtaining anything like accurate information from these sources. However, during the last two years such improvements have been made in apparatus and methods that I feel safe in saying that the results from experienced investigators may be relied upon within 10 per cent.

Professor Matthews divides the difficulties met with in arc-light photometry into two classes—"those peculiar to the source" and "those peculiar to the method." Of the first the most troublesome is the continual wandering of the arc from place to place over the tips of the carbons. Variations of the luminous intensity in any given direction, taken by the ordinary photometer, are oftentimes as high as 200 per cent., due to this cause. Professor Matthews has reduced the error from this source very materially by his "double-mirror method," which he described in the report of the committee on arc-light photometry of the National Electric Light association. Briefly, it consists of nothing more than the employment of two mirrors instead of one, and in taking light simultaneously from opposite sides of the arc at the same inclination to the vertical, both mirrors being capable of ready adjustment at any angle in the vertical plane.

Of the different light standards in use, none is probably more satisfactory than the Reichsanstalt amyl-acetate lamp, brought out by the Physikalische Reichsanstalt of Germany. For constancy, reproductibility and ease of adjustment, the amyl-acetate lamp, often called the Hefner lamp, after its inventor, von Hefner-Alteneck, far surpasses the others. It is constructed of brass throughout, with the exception of the wick tube, which is made of german silver, to avoid corrosion by the combustible, and for this reason the parts and interior are well plated. The wick is moved up and down by a worm gear which actuates two spur wheels. All the fittings are attached to the top or cap of the lamp, which unscrews from the body or bowl for filling. The lamp is provided with a flame gauge for adjusting the flame to an exact height of 40 millimeters. At this height, with the proper wick and combustible, the lamp gives one Hefner unit, which is, as near as we can get at it, about 1.12 British candles. This, of course, conveys no definite information of its luminous intensity, as no one knows definitely what the luminous intensity of the British candle is.

The Hefner lamp, however, has been generally adopted as a standard and has received international sanction. But, like all the others, it is not free from faults. If the height of the flame is five millimeters below standard, the light is only 85 per cent. of the standard. If the flame is five millimeters above standard, the light is 112 per cent. In order to be sure of your results, you must either test the purity of your amyl-acetate or else purchase it from the German commission. The light also varies, due to atmospheric moisture. It has been found, by Lebenthal, under the best conditions, to vary as much as 8.5 per cent., depending on the season of the year.

The amyl-acetate used in these lamps for commercial purposes is derived from the distillation of amyl alcohol, obtained from fusel oil with a mixture of acetic and sulphuric acids, or by distilling a mixture of ethyl alcohol, sulphuric acid and potassium acetate. It burns with a fairly clear flame, feebly luminous and somewhat reddish in color.

This brings us to one of the other serious difficulties in arc-light photometry, namely, comparing our light with a standard of a different color. When this is necessary, the results can be little better than guesswork.

In addition to the double-mirror method I mentioned before, Professor Matthews makes use of a rotating sectored disk to reduce the error due to this source to a minimum. It is also quite common to utilize secondary standards in the form of incandescent lamps burning above their rated voltage and derived in this way. An incandescent lamp is given a little excess voltage when on the photometer and then compared with the primary standard. This lamp is then put in place of the standard and still another incandescent lamp compared, giving it a still higher pressure, and so on, until the last one attains a color near that of the arc, or as near as the safety of the lamp will allow. These lamps can, of course, only be burned for a short time, as they deteriorate very rapidly when burned at abnormal voltage.

Returning now to the British candle, we find abstracts of the specifications given by the Metropolitan gas referees in the American Gas Light Journal. The finished candle is 10 inches long and is 0.9 inch in diameter at the bottom and tapers slightly to 0.8 inch in diameter at the top. The wick should be made of three strands of cotton plaited together, each strand consisting of 18 threads. The strands should be plaited with such closeness that, when the wick is laid upon a rule and extended by a pull just sufficient to straighten it, the number of plaits in four inches should not exceed 34 nor be less than 32. The wick should be steeped in a liquid made by dissolving one ounce of crystallized boracic acid in a gallon of distilled water, to which two ounces of liquid ammonia have been added. The wicks are then pressed until most of the liquid has been removed, and dried at a moderate heat. Twelve inches of the wick thus made should not weigh more than 6.5 or less than six grains. The weight of ash remaining after the burning of 10 wicks which have not been steeped in boracic acid, or from which the boracic acid has been removed by washing, should not be more than 0.025 grain. The spermaceti of which the candles are made should be extracted from crude sperm oil, and it should be so refined that it has a melting point lying between 112 and 115 degrees Fahrenheit. Since candles made with spermaceti alone are brittle, and the cup which they form in burning has an uneven edge, it is necessary to add a small portion of beeswax or paraffin to remedy these defects. The best air-bleached beeswax, melting at about 114 degrees Fahrenheit, is to be added to the spermaceti in proportions of not less than three per cent. and not more than 4.5 per cent. The candles thus made should weigh, as nearly as may be, one-sixth of a pound. As the rate of burning a candle is affected by the force with which the wick is pulled when it is set in the mold, the strain commonly applied by the careful maker is found to be about 24 ounces. The wicks, before steepings, should be washed first in distilled water made alkaline, with one or two per cent. of strong liquid ammonia, then in a 10 per cent. solution of nitric acid, and, finally, should be thoroughly and repeatedly washed in distilled water.

At first sight, one would naturally suppose that candles made according to the foregoing specifications would fulfill all the requirements of a good standard, but, like all others, there are a number of faults. As early as 1888 a committee on light standard reported to the British association that the standard was unfit to be called a standard, with the development of science at that time. If it was found so then, it is certainly more so now. Some of the faults found with it at that time were: Uncertainty in the composition of the spermaceti, the weaving of the wick, the fluctuations in the flame due to variations in the length and form of the wick while burning, and the filling and emptying of the cup of the candle. These conclusions were based on an extended series of measurements, performed with unusual accuracy and care. These same objections have been voiced by individual investigators from time to time. Even if its luminous intensity were constant, the color of the light would render it unsuitable. The earlier and more crude methods of extracting the spermaceti left considerable oil in it. This served to brighten the light. With the gradual improvements of this process, the wax has become "drier" and the luminous intensity has been observed to decrease proportionally. The beeswax used to render the candle less brittle is another uncertain quantity.

The normal flame height is usually 45 millimeters, and this must be kept so within reasonable limits, as only approximate corrections can be made. Above this height the flame will become unsteady and flicker. When this occurs, the wick must be snuffed to reduce the flame to the proper height, as indicated by the flame gauge. The correction must be made frequently to obtain good results.

As the spermaceti is consumed and the wick lengthens that portion exposed to the flame becomes curved and deforms the flame. This curving effects a change in the length of the photometer bar by changing the center of the light source. A variation of the luminous intensity along the photometer bar of four per cent. has been found due to this cause. The charring of the wick impedes the flow of the spermaceti by capillary attraction. And here, again, as in the Hefner lamp, we find a variation in the luminous intensity of as high as 8.4 per cent., due to atmospheric moisture.

Under normal conditions, the flame should consume 120 grains of wax per hour. Air current and draughts will naturally affect this, by concentrating the heated air on the walls of the cup formed in burning. If these walls become heated and yield the melted wax will run out and change the quantity of light.

The foregoing faults, together with numerous others, render the candle entirely unsuitable as a standard for practical use.

It is somewhat surprising that, with the advanced state of the art, we have no international practical unit of the illuminating power. In Germany, until a short time ago, the standard was based on the paraffin candle. In France the carcel forms a particular type of lamp developed there, and in England and the United States the candlepower. With the sanction of the Hefner unit, some people objected to its adoption inasmuch as it was not an absolute standard, and with the improvements which might come later it was thought probable that another change of name would be necessary and would add confusion.

To the general public the term candlepower conveys some idea of the quantity of luminous intensity, while the term Hefner unit does not. It has therefore been argued by some that the Hefner lamp be used and its luminous intensity be changed so that it will be nearly as possible equal to that of the English candle, and then the term candlepower substituted for Hefner unit.

For comparing the luminous intensity and efficiency of one light source with another, it is customary to make use of the mean spherical and mean hemispherical intensities. These terms are quite useful for this purpose, but are of little service for indicating the specific illumination of any particular object or for the illumination in any specific direction.

Briefly, the mean spherical intensity is the mean radial distribution of luminous intensity about the arc as a center, and is derived by integrating the values of the areas of the polar diagrams of the four quadrants, and finding a circle whose area is equal to the area of these four. This is, as I have stated, of value for comparing the total luminous intensity and efficiency of light sources, but in a great many cases the light above the horizontal is of little or no value. Then, in order to arrive at a fair comparison, we make use of the mean hemispherical intensity.

For instance, in comparing the values of direct-current arcs for street illumination, we would work out the mean luminous intensity of the lamps in the two quadrants below the horizontal, because the light above the horizontal is of little or no service except when close to light-colored buildings or other surfaces which might reflect the light so as to make it useful.

For noting the difference in the distribution of light of open and enclosed arcs and the effects of the various kinds of enclosing globes and shades on the latter, the polar diagrams prove to be very useful.

In discussing the efficiency of direct and alternating-current lamps as light producers, it is a common error of some people to compare the constant-current, series alternating enclosed lamp with the constant-potential, direct-current enclosed lamp, or to compare the antiquated constant-current series direct open-arc lamp with the most modern constant series alternating enclosed-arc lamp, and so on. I have heard prominent engineers argue for hours at a time until finally someone would get up and tell them that they were trying to compare apples with potatoes, and then the discussion would suddenly come to a close.

From what has been said thus far, I think you will all agree that there is nothing within the reach of the average isolated plant or central-station man to prove or disprove the merits of the different lamps on the market. The percentage of users of a comparatively small number of lamps is so large that something ought to be done to place within their reach facilities for measuring the commercial worth and efficiency of this product with the same accuracy as they do the weight of coal or any other commodity.

It is well known that the size and quality of carbons, the size, shape and kind of shades, outer and inner globes, and the coating on the inside of the latter very materially affect the quantity, quality and distribution of light. Let our scientific bodies and institutions place knowledge of this kind, together with the relative efficiencies of the direct and alternating arc, within the reach of all.

With this data at hand and the adoption of some standard for amperes and volts at the arc, loss in the mechanism, regulation, etc., for lamps of the various systems, together with a careful examination of the mechanical makeup of the lamp, the average man should be in a position to test, without much trouble and expense, the relative merits of the different lamps submitted to him.

1. Read before the Chicago Electrical association, January 18, 1901. Mr. Almert is superintendent of lighting at Lincoln Park, Chicago.

BOOK TABLE.

THE COPPER HANDBOOK. By Horace J. Stevens. Houghton, Mich.: Horace J. Stevens. 1900. Pp., 328, 5¾ by 8¾ inches. Price, $1.

The history of the copper industry is one of absorbing interest. A large number of companies in this, as in every other branch of the mining industry, have sunk thousands of dollars in the attempt to produce paying properties, and have failed dismally. But, on the other hand, some of the more fortunate ones have turned out to be brilliant and lasting successes, and the dividends which they have paid have grown to such amounts as to make the nominal value of their capital stock look ridiculously small. Such, for instance, is the Calumet and Hecla property, by far the most successful of all, which in 1899 paid dividends amounting to four times the par value of its stock.

Probably no more carefully compiled or comprehensive a sketch of the Lake Superior copper region has been published than that of Mr. Stevens. The work begins with a general historical review of the whole region, including the political history of the Upper Peninsula, and the discovery of copper. It will be remembered that this metal was obtained from mines on the shores of Lake Superior by the Mound-builders long before the time of Columbus. The second chapter of the book is devoted to miscellaneous information, including a sketch of the Michigan College of Mines at Houghton, and then follows an outline of the geological features of the country. This leads up to what is perhaps the most interesting part of the work, and that which shows the result of the greatest pains in preparation—about 50 pages of well-arranged tables, containing information of much value and interest, not only to people engaged in the business, but to others as well. Hardly a question could be asked about the region or the principal companies engaged there which could not be answered by reference to these statistics, and the arrangement of the matter is logical—a point often overlooked in compiling statistics. As an instance of this a set of figures giving the annual production, in pounds, of several mines during a series of years is followed by another showing the percentage gain from year to year, and this in turn leads to tabulated statements of the percentage of Lake Superior copper to the entire United States output, the value of the Lake copper production by years, and a table showing the fluctuations in the market price of copper for every month from January, 1860, to December, 1899, inclusive. A descriptive list of defunct copper-mining companies is given, these being arranged alphabetically. The latter half of the work is devoted to a careful descriptive list of the active companies now doing business in that region. In this list the companies are arranged geographically, affording a better opportunity of comparing the larger concerns.

The fact that this industry was pursued so long ago, together with the immense profits that it has yielded and the increasing demand for the metal particularly for use in the electrical business, will make this work especially valuable as a book of reference. It is the intention to publish a revised edition each year.

Electrical Duties in Salvador.

In the new tariff which has gone into effect in Salvador the duties on electrical equipment are as follows: Electric motors, 18 cents per 100 pounds; magnets, 18 cents per 100 pounds; articles, apparatus, machinery, tools and materials for telegraphs and electric lights, 18 cents per 100 pounds, and an exemption from the surtax of 55 cents per 100 pounds additional for public debt, to which all articles not specifically exempt are subjected; globes and illuminating sundries of all kinds, $4.60 per 100 pounds; telephones, electric bells and parts of same, $5.52 per 100 pounds; small electrical machines, $5.52 per 100 pounds; mica, 92 cents per 100 pounds. Thirty per cent. additional is charged on the total duties for charitable purposes. In addition to the foregoing provisions for electrical apparatus, a contract was entered into between Carlos Melendez and the government of Salvador, by which he enjoys the privilege of importing, free of all duty, until 1905, all kinds of electrical machinery and fittings and all wire cables. Such goods are to be covered by an invoice describing them minutely, and it is understood that such goods so imported are to be used in works established by Melendez.

Proposed Statue of Dr. Gilbert.

A full-length marble statue of Dr. William Gilbert, who is happily described as the father of electrical science, is shortly to be erected at the instance of the members of the medical profession at Colchester. Dr. Gilbert was physician to Queen Elizabeth, and his work "De Magnete," published in 1600, laid the foundations of electrical science. The statue which is to be erected in his honor will be placed in a niche in the main façade of the new town hall at Colchester, a handsome building now in course of erection. The cost of the statue will not be less than £150, and toward this sum £130 has already been subscribed entirely by the medical men of the borough and its immediate neighborhood.—Electrical Engineer, London.

CORRESPONDENCE.

New York Notes.

New York, January 26.—The Rapid Transit Board has adopted resolutions providing for the underground extension to Brooklyn. Plans will be sent to the Park Board and the Municipal Assembly at once, and it is believed that work can be commenced within a year. The route, as now planned, is from the postoffice through Park Row, Broadway and State street to East River at a point in South street, then under the river, emerging in Jerolomon street in Brooklyn and running past the City Hall and through Fulton street and Flatbush avenue to Flatbush station.

The board has also provided for express service to One-hundred-and-fifty-seventh street, instead of to One-hundred-and-third street, as heretofore, by laying turnouts at One-hundred-and-third, One-hundred-and-sixteenth and One-hundred-and-forty-fifth streets and a third track on the viaduct from One-hundred-and-twenty-third street to One-hundred-and-thirty-fifth street, allowing the express trains to pass the locals without stopping. The extra cost will be about $100,000, which will be paid the contractor under the head of "extra work," provided for under the contract. The total amount to date paid to Contractor John B. McDonald is $1,685,000. Four men were hurt in an explosion of gas in the tunnel at Fourth avenue and Twenty-second street recently. The gas was ignited by a lantern carried by one of the men in violation of the rules.

An organization known as the Cross Country Railroad company is seeking to construct an electric road from Liberty avenue, Brooklyn, to Rockaway Beach, a distance of four miles, traversing a new turnpike across Jamaica Bay. It is opposed by A. A. Gardiner, representing the Long Island Railroad company. A hearing was held before the State Board of Railroad Commissioners recently and it will be continued in New York city on February 8th.

The new through service over the Brooklyn bridge caused much confusion when it was begun. To passengers living some distance from the bridge in Brooklyn it is a great convenience, as they can be carried from New York to their homes without change and for one fare. For bridge passengers, however, the new arrangement is less advantageous, as only one car is set apart for 2½-cent passengers, and those wishing to ride simply to the end of the bridge often find the "emigrant car," as it has been dubbed, filled to overflowing. The present platform arrangements will not permit of the reservation of more than one car for bridge passengers.

Senator Wagner has introduced a bill providing for a uniform rate of five cents between any two points on the elevated roads in Brooklyn. The bill also provides that it shall be the duty of companies operating the elevated railroads to run trains on a headway of not less than five minutes between 6 a. m. and 9 a. m. and between 5 p. m. and 8 p. m., and not less than 10 minutes the balance of the time each day, excepting the time between 11 p. m. and 5 a. m., when the headway shall be 20 minutes.

Assemblyman Dempsey has introduced a bill with regard to charges upon street railways and elevated railways of New York city during what he designates as "workers' hours." Mr. Dempsey's bill provides as follows: On all street railways, both surface and elevated, operating in the city of New York between the hours of 5:30 a. m. and 7:30 a. m., hereby designated "workers' hours," there shall be given to each passenger, on payment of one fare, a return or excursion ticket, good only for the day on which it is issued, and to be used between the hours of 5 p. m. and 6:30 p. m.

At a meeting of the stockholders of the Brooklyn Rapid Transit company on January 25th the former directors were re-elected. The members of the board are A. N. Brady, H. C. Duval, E. H. Harriman, J. G. Jenkins, H. H. Porter, Henry Siebert, T. S. Williams, August Belmont, A. R. Flower, R. Somers Hayes, W. G. Oakman, Clinton L. Rossiter and D. H. Valentine. The meeting was adjourned to February 1st. B. W. Folger, Jr., of Kingston, Ont., has lately been appointed superintendent of the elevated system of the company. M. L. G.

Western New York.

Rochester, January 26.—The annual meeting of the Rochester Railway company was held on January 22d, and disclosed the fact that a new combination has obtained a large interest in the corporation, so that three new representatives were named on the board of directors. The new board is constituted as follows: Frederick Cook, T. J. Nicholl, J. N. Beckley, E. H. Satterlee, C. M. Clark, E. W. Clark, Jr., H. P. Brewster, Jacob Gerling, George W. Archer, T. De Witt Cuyler, James Richardson, Benjamin Graham and H. Sellers McKee. The three new members are E. W. Clark, Jr., C. M. Clark and James Richardson. E. W. Clark, Jr., and C. M. Clark are identified with the firm of E. W. Clark & Co. of Philadelphia and Mr. Richardson is a member of the firm of Richardson & Clark of Providence, R. I., which is closely connected in business interests with the Philadelphia firm. At the meeting about 40,000 of the 50,000 shares of stock were represented, of which the Clark interest cast votes for 22,000 shares. The executive committee of the board of directors, which has charge of the policy of the company, consists of Chairman E. W. Clark, Jr., C. M. Clark, James Richardson, H. Sellers McKee, T. J. Nicholl and Frederick Cook. Plans for the improvement of the plant were discussed by the directors, but the details were not given out. The matter of securing additional power and the construction of new rolling stock was considered.

An electric-railway company has been organized in Wayne County, under the name of the Lyons and Sodus Point Electric Railway company. The following-named gentlemen are interested in the road: Calvin Hotchkiss, Lyons; I. B. Bashford, Lyons, Daniel Platt and J. M. Ludington of Rochester. It is expected that the road will carry freight as well as passengers. D. W. J.

From the Buckeye State.

Columbus, Ohio, January 26.—The stockholders of the Mahoning Valley Electric Railway company and the lines controlled by it met at Youngstown a few days ago and chose directors, who immediately organized by electing officers for the various companies represented. There were no changes of any importance. The officers of the controlling company are as follows: President, M. A. Verner, Pittsburg; vice-president, C. F. Clapp; secretary, J. E. McVey; general manager and treasurer, A. A. Anderson. The company is said to have in view improvements that will require the expenditure of $800,000.

It is said that within a few days there will be a new company organized at Cleveland, to build the projected line of the Cleveland, Elyria and Western, between Berea and Medina, and that the line will be extended on to Wooster. The incorporators will be the same persons interested in the first-named road, with a few additional capitalists.

The Hamilton, Glendale and Cincinnati Traction company of Cincinnati was incorporated a few days ago, with a capital stock of $25,000, by W. P. McCarty, W. S. Munsell, Leo Kelley, Claude Ashbrook and Fred Neidermeimen, all of Cincinnati. It is the intention to build a line from the terminus of the Millcreek Valley road to Hamilton, and it may be that the Cincinnati Street Railway company is interested in the matter.

The Market Street Railway company has been granted a franchise by the Columbus council, and the preliminary survey will soon be made.

The Buckeye Traction company of Bucyrus has been organized with the following-named officers: President, R. V. Sears; vice-president, C. Feiring; secretary and treasurer, W. A. Blicke. The company will build a line between Bucyrus and Norwalk.

The line of the Dayton, Tippecanoe and Troy Traction company will be built in the spring, Hon. Peter Schwab having secured the necessary finances in the East last week. This will be an extension north for the Southern Ohio Traction company. It is said that there has been a distinct plan formed to extend this line north and the system of the Northern Ohio south until they meet, thus forming a continuous line from Cincinnati to Cleveland, probably by way of Columbus.

Representatives of the Cincinnati and Eastern Electric Railway company have been endeavoring to secure a right-of-way in Cincinnati, in order to begin the construction of their road at an early date from Cincinnati to New Richmond, Ohio.

The Southern Ohio Traction company has obtained control of the Cincinnati Northwestern Railroad company, which will give it an entrance into that city.

A local syndicate in Cincinnati, it is said, will submit a proposition to lease the lines of the Cincinnati Street Railway company.

The directors of the Columbus Electric company have chosen the following-named officers for the ensuing year: President, George W. Bright; vice-president, O. A. Miller; secretary and treasurer, A. W. Field.

The Dayton, Springfield and Urbana Railway company has begun work on a line from Osborne to Xenia.

It is stated, upon what seems fair authority, that the Northern Ohio Traction company will early in the spring build a line from Akron to Canton. If this is done, it will probably be in connection with the plans of William A. Lynch, of the Canton-Massillon Railway company. Thomas L. Childs reports that most of the contracts have been awarded for building his line from Canton to Akron, and says he does not believe the Northern Ohio Traction company will build to the same town.

The directors of the Camden Electric Railway company of Huntington, W. Va., are considering the advisability of building a line of road from Ironton to Portsmouth.

The Union Electric Railway company has secured the right-of-way for a line from Delaware to Magnetic Springs.

At the annual meeting of the Little Consolidated Street Railway company, held in Cleveland a few days ago, the reports showed that the total receipts for the year amounted to a little less than $1,500,000, which is $28,000 more than the receipts of the year before. The old directors were re-

elected. The directors' meeting will be held later on when Senator Hanna can be present.

The Toledo, Waterville and Southern Railway company was incorporated last week, to build a line from Toledo to Napoleon. The capital is placed at $25,000, and Harry E. King and Thomas H. Tracy, with others, are interested. On the same day the Toledo, Napoleon and Defiance Railway company was incorporated, to construct a line between the same points. William R. Hattersley, Richard Hattersley, Holland C. Webster and others are interested in this line, and it is said that most of the right-of-way has been secured between the two points. The first company is supposed to have been incorporated for the purpose of extending the Maumee Valley road from Maumee to Napoleon, and from present prospects there will be some competition in the way of securing franchises and rights-of-way, as the two propose to go over the same route. O. M. C.

Northwestern Notations.

Minneapolis, January 26.—The franchises of the Electric Street Railway company of Mankato, Minn., has been sold to Twin City capitalists, who will proceed to construct the system during the coming season.

Unless the Twin City Rapid Transit company files its articles of incorporation in Minnesota, as required by the Somerville law governing foreign corporations, legal steps will be taken to collect the $1,000 penalty for delay. The corporation has its legal home in New Jersey. It has sought to pay a tax on a portion of its capitalization, but the state treasurer has refused to accept the check tendered.

Joseph Holverson contemplates establishing an electric-light plant for Danvers, Minn.

An electric-light system is under consideration for Custer, S. D.

The Postal Telegraph company has started stringing wires from Sioux City, Iowa, for its extension to Sioux Falls, S. D.

The Western Union is stringing its tenth line between Sioux City and Omaha.

The electric elevators in the courthouse at Minneapolis have finally been put into good shape. Ever since they were put in they have given a great deal of trouble. An expensive storage battery was installed, with the idea of keeping power stored up against a time of need. But it failed to meet the demand upon it, and a light engine was put in to supplement the power. Later, two other light engines were added, and it was found that they could not stand the heavy strain of stopping and starting the elevators. One of them blew out a cylinder head as an evidence of the fact. The storage-battery plates were then found to be worn out. Two heavy engines of about the same power replaced the three light ones, and new plates were put in for the storage batteries. Since then the elevators have operated well, and there has been no complaint.

The Light, Heat, Transit and Public Service company of Fargo, N. D., has been incorporated, by A. G. Whitney of St. Cloud, Minn., and others.

The Rock River Electric company of Beloit, Wis., has been incorporated, with $50,000 capital stock, to build an electric-car line from Janesville, Wis., to Rockford, Ill., with a branch to Beloit.

The Chicago and Northwestern railroad will use an electric light in its block tower at Jefferson, Iowa, hereafter. The company has been disinclined to use it, fearing it might be put out at any time, but Electrician Croan has connected the circuit supplying the lamp through another lamp, which hangs in the depot office, so that if anything happens to the tower light, the other light will go out.

Efforts will be made to have the matter of purchasing the electric-light plant by the city of Oshkosh, Wis., submitted to voters at the next election, in the spring.

The Clinton Gas Light and Coke company of Clinton, Iowa, desires to buy the electric-light plant of the former city of Lyons. The city of Lyons has been consolidated with Clinton.

Surveys have been started for the electric railway projected to run from Des Moines to Newton, Iowa. The line is outlined to run through Altoona, Mitchellville and Colfax. Mrs. Alice Butler of Cleveland, Ohio, is largely interested in the project.

The street-railway company of La Crosse, Wis., is figuring on installing a new power plant. If the plans are carried out, the new plant will be much more powerful than the present one. The present dynamos will be retained for an emergency.

The Seattle (Wash.) Electric company will double-track its line to South Seattle and will change the route and make other improvements. The University car line will be improved also.

Fairbanks, Morse & Co. of Omaha have been granted a franchise for a lighting plant for Ord, Neb. Work will be begun on the system at once, and it is expected to have it completed by March 1st.

The Tacoma (Wash.) Street Railway company has begun actual work for the change of grade for the Delin street hill.

The North American Telegraph company held its annual meeting in Minneapolis, January 22d, and declared a dividend of 2½ per cent. for the last six months. The officers were all re-elected.

The contractor has begun work on a new power station for the Chippewa Valley Electric Railway company of Chippewa Falls, Wis. The company has had trouble ever since beginning to operate the interurban line. It is expected, with the completion of the new plant, that all trouble will be obviated and the time between Chippewa Falls and Eau Claire will be considerably reduced.

Ed. Guthier of Mapleton, Minn., has leased the electric-light plant at Fulda, Minn., and is making a large number of changes and improvements. It is expected to have the remodeled plant in operation by the first of March.

The Seattle and Tacoma Short Line Railway company has filed articles of incorporation, to operate a line between the cities named, in Washington. The company represents the interests of Fred E. Sander, who has secured franchises in both cities. Construction is to be started in a very short time.

The Muscatine (Iowa) Electric Railway company is preparing to construct a new power plant, to accommodate the new machinery which has been ordered. R.

PERSONAL.

J. H. McGrew, manager of the Kester Electric Manufacturing company of Chicago, died at his home in La Grange, Ill., on January 27th. He was born in Galesburg, Ill., on October 19, 1852, and leaves a widow and one daughter.

The many friends of Ralph W. Pope, secretary of the American Institute of Electrical Engineers, will extend to him their sympathies in the recent loss of his wife. Mrs. Pope died at her home in Elizabeth, N. J., on January 26th, after an illness of several weeks. She was a native of Great Barrington, Mass.

Joseph Gillette Noyes, secretary and treasurer of the National Electrical Manufacturing company of Hartford, Conn., died at his home in Milford, Conn., recently. He was for some years manager of the electrical department of the New Haven Clock company in New York city. When the National Electrical Manufacturing company succeeded the other he was given the position he held at his death.

Charles E. Roehl has been appointed electrical engineer of the Brooklyn Rapid Transit company. Mr. Roehl has for four years been electrical engineer of the St. Joseph Railway, Light, Heat and Power company of St. Joseph, Mo. He is a graduate of the University of Michigan, and has held positions with the Sprague Electric Railway and Motor company and the Edison General Electric company at Portland, Ore.

J. W. Peterson, who has for some time been identified with J. Holt Gates of Chicago, has associated himself with the Chicago office of the Northern Electrical Manufacturing company and the Stanley Electric Manufacturing company, and will hereafter direct his zeal and energy toward selling the apparatus of these two companies. Mr. Peterson enjoys an extensive acquaintance with western manufacturers, and no doubt will continue to live up to his reputation as a selling engineer.

ELECTRIC LIGHTING.

A municipal lighting plant is proposed for St. Joseph, Mich.

The village of Ambler, Pa., is advertising for bids for street lighting.

The village of Morris Run, Pa., will soon erect an electric-light plant.

Moriarity Bros. propose to erect an electric-light plant in Waitsfield, Vt.

J. N. Struck & Bro. of Louisville, Ky., are in the market for a 125-kilowatt generator.

Bids will be wanted until February 22d for erection of an electric-light plant at Lake Providence, La.

The Marion Light and Water company of Marion, N. C., has been incorporated, with $20,000 capital stock.

The Village Council of Sharpsburg, Pa., wants bids on two 150-horsepower boilers for the lighting plant.

Lisbon, Ohio, will construct an electric-light plant and operate it in connection with the waterworks.

Messrs. Gruhlke & Flack have obtained a franchise for lighting the streets of Waterloo, Ind., with electricity.

The Woodland Electric and Gas company of Woodland, Cal., has been incorporated, with $100,000 capital stock.

The Rocky Ford Coal company of Red Lodge, Mont., contemplates the erection of an electric-light plant there.

The Newbern water and electric-light plant at Newbern, Tenn., has been destroyed by fire. The loss is about $10,000.

A. L. Thompson of North Yakima, Wash., has been granted an electric-light franchise in Prosser, Wash., to run 26 years.

The Hoopeston Electric Light and Heating company of Hoopeston, Ill., has been incorporated for $30,000, to install and operate a lighting, heating and power plant. The incorporators are Frank Lindley, Robert Holmes and Fred B. Penwell.

The Detroit, Ypsilanti, Ann Arbor and Jackson Railway company has been incorporated in Michigan, with a capital stock of $2,600,000.

The Buffalo and Niagara Falls Electric Light and Power company of Buffalo, N. Y., has increased its capital stock from $200,000 to $500,000.

The Ice, Light and Water company of Lexington, Miss., has elected J. E. Stanfield as its president and will erect an electric-light plant in the early spring.

The plan to put in an electric-lighting and heating plant in Alden, Iowa, is meeting with favor among the people, and arrangements will soon be made to install an electric-lighting system.

L. J. Kelim, as manager, has secured articles of incorporation for the Loveland Electric Light and Power company of Loveland, Colo. Work on the new electric-light plant will begin at once.

The Sunset Electric Light and Power company of San Francisco, Cal., has been incorporated, with $200,000 capital stock, by J. Magnin, M. H. Schoenberg, H. W. Hunsaker, B. Sharpiro and others.

A 20-year franchise for lighting the city of Beresford, S. D., with arc and incandescent lamps has been granted by the City Council to Hon. L. N. Crill of Richland, and work on the new plant will begin at once.

A band of 80 Boers raided Brak Pan, South Africa, on the morning of January 20th and put a guard over the employes of the electric power plant while they damaged the dynamos and other machinery. The power station belongs to a German company and supplies the suburbs of Johannesburg and the mines in that vicinity with light and power.

The Cicero Yaryan Hot Water Distributing company has asked the town board of Cicero, Ill., for a franchise for a plant to furnish electric light and power and establish a hot-water heating service in Cicero, and the Chicago Suburban Light and Water company has also asked for a franchise for a hot-water system there. The municipal-ownership commission appointed to investigate the question of municipal ownership of water and lighting plants recommends municipal ownership, and advises that plants be built in Cicero as soon as possible, if the Chicago Suburban Light and Water company will not dispose of its plants. That part of the commission's report dealing with municipal ownership of lighting plants asserts that lights for private use would cost little more than half the price now paid, and those for street lighting would cost much less.

ELECTRIC RAILWAYS.

The Hamilton, Glendale and Cincinnati Traction company of Cincinnati, Ohio, has been incorporated, with $250,000 capital stock.

G. F. Payne & Co. are taking sub-bids for a power house to be built at Reading, Pa., for the Philadelphia and Reading Railway company.

The Board of Commissioners of the town of Belair, Md., has granted to the Belair and Havre de Grace Electric Railway company a franchise over the streets of Belair.

The Central New Jersey Trolley company is procuring franchises for the operation of lines connecting the principal towns in Hunterdon and Warren counties, N. J.

The Board of County Commissioners at Omaha, Neb., have decided to grant a franchise to the promoters of the proposed electric line between Omaha and Fremont.

The council of Durand, Mich., has granted a franchise to W. R. Benson and H. S. Hadsall of Owosso, Mich., to operate and maintain an electric-railway system in Durand.

The Central London Railway company (operating the "tuppenny tube") has declared a dividend for the first five months of its existence at the rate of three per cent. per annum.

The Interurban Electric Railway company of Fort Worth, Texas, of which J. T. Voss is manager, will expend $70,000 in improvements, including the erection of a new power house.

The Toledo, Napoleon and Defiance Railroad company has been incorporated for $25,000, to build an electric line from Toledo to Defiance, through Lucas, Henry and Defiance counties.

The stockholders of the Toledo, Fostoria and Findlay electric road, at a meeting in Fostoria, Ohio, recently, decided to construct the line from Fostoria to Toledo during the coming summer.

The Chicago and Milwaukee Electric Railway company has put on a special car for distributing the Chicago morning papers along its line from Evanston to Waukegan, Ill., leaving Evanston at 5 a. m.

The revival of the project for a road from Milwaukee to Lake Geneva, Wis., is reported. Several surveys have been made at different times, and the promoters are trying to secure a franchise in Milwaukee, where they are represented by James L.

O'Connor. The proposed route lies through a rich farming country, and the backers of the road rely as much on the freight business which they expect to do as on the receipts from passenger traffic.

The Toledo, Waterville and Southern Railway company of Toledo, Ohio, has been incorporated for $25,000. The company proposes to build and operate an electric railway between Toledo and Napoleon.

There is a revival of the project to build a street railway to Perrysville, Pa., from the present terminus of the United Traction company of Pittsburg. Among those interested are J. D. Thomson, R. Wilson and J. Wilson.

The Laporte and South Bend Railway company is being organized, with a capital stock of $1,000,000. The company purposes to build a street railway between Laporte and South Bend, Ind. E. R. Lacey and C. A. Wilson of Laporte are interested.

A franchise is sought from the city of Birmingham, Ala., by a new street-railway company known as the Metropolitan Rapid Transit company, in which M. F. Emslen is interested. The company will spend about $500,000 if the concessions desired are granted.

It is stated that of the deep-tunnel, electric-railway projects in London there are three open for traffic, four authorized and under construction, seven authorized and 13 projected new. The total mileage embraced in all these schemes amounts to 107 miles.

Application has been made to the Village Board of Elkhart Lake, Wis., by J. M. Seaman of Sheboygan and P. P. Brickbauer for a 75-year franchise to build and operate a street-car line in Elkhart Lake, connecting with the interurban line of Sheboygan.

The Pennsylvania company is building an electric motor car under the supervision of Mr. Mansfield of the Indianapolis and Vincennes division. If it proves successful the company will place such cars on its suburban lines to meet competition of electric lines.

The Chicago Heights Street Railway company has been incorporated for $100,000, by Frederick E. Von Ammon, Arthur H. Pugh and Major McGregor. The object of the company is announced as the development of property held by the stockholders in that district.

The Western Indiana Railway company has petitioned for a franchise for the use of the National and Rockville roads for an electric line from Indianapolis to Danville, Ind., which it proposes to construct. F. Woods, F. Joss, C. Fairbanks and others are the promoters.

The City Council of St. Joseph, Mich., will soon be asked for a franchise by the Indiana Railway company, headed by H. A. Chapin. This company purposes to construct an electric line from South Bend, Ind., to Niles, Mich., and thence through Berrien Springs to St. Joseph.

The cable power house of the Metropolitan Street Railway company of Kansas City, Mo., at Ninth and Washington streets, was destroyed by fire on the night of January 26th. This is the station which drives the Summit street cable. The cable machinery is driven by duplicate 300-kilowatt direct-current motors, receiving their power from the main electrical generating plant of the company on the Kaw River. The loss is stated to be about $75,000 and is fully insured. Sixty cars in the adjoining car barn were burned.

The Rochester and Eastern Rapid Railway company of Canandaigua, N. Y., has been incorporated, to operate a street-surface railroad 45 miles long from the easterly end of the Monroe avenue line of the Rochester Railway company, in the town of Brighton, near Rochester, in Monroe County, to Geneva, in Ontario County, with a branch line from Pittsford to Fairport. The company has a capital of $500,000. The directors are Albert E. F. White, John Winter, A. Birdsley Parker, Frank C. Andrews and Oliver H. Bau of Detroit, Eugene H. Satterlee of Rochester, Oscar N. Crane of Canandaigua, Spencer F. Lincoln of Naples and John F. White of Buffalo.

At the special meeting of the stockholders of the Lake Street Elevated Railroad company, on January 28th, the directors were authorized to issue $1,275,000 in five per cent. bonds, and to use the money so raised for the purchase of the Chicago and Harlem road. The issue of $800,000 additional bonds was also authorized to provide for the construction of the new power house, which is expected to result in a saving of about $70,000 annually in the cost of power. The Lake Street bonds will be guaranteed by the Union Elevated Railroad company, and the Chicago and Harlem road will turn over its property eventually without indebtedness. The present $218,000 of bonds now outstanding will be retired, a like amount of Lake Street bonds being retained in the treasury out of the purchase price of $1,275,000 until this is done.

AUTOMOBILES.

An automobile show, said to be the largest hitherto assembled, opened on January 26th in the Grand Palais des Beaux Arts in Paris. The exhibition is a very extensive and complete one, a total of 5,556 exhibitors having their goods on view. The exhibits are classified under 11 different groups. Everything shown is thoroughly practical in working, as the models of all the big carriages had gone through a road test, having to make the trip to Versailles and back and be examined, to obtain the official certificate of efficiency.

PUBLICATIONS.

Under the heading "Some More Telephone Talk," the Couch & Seeley company of Boston has issued a circular describing its tubular drop, combined jack and tubular drop, combined ringing and listening key, plug and metallic jack.

The General Incandescent Arc Light company, New York city, has issued an eight-page bulletin (No. 74) on its type L3 enclosed-arc lamps for multiple-series connection on 200 to 600-volt, constant-potential, direct-current light, power and railway circuits.

The tenth anniversary of the Street Railway Review was celebrated by the appearance of its January number as a special issue, containing well-chosen articles reviewing the progress of the last decade in the street-railway field and a three-color marine view as a supplement.

The first number of the Railroad Digest, published in New York city, has made its appearance. The new periodical, which succeeds the Railroad Car Journal, will be issued monthly and will contain a digest of railroad literature. The initial number of the journal in its new form is a very creditable number.

The paper on "Steam Turbines, with Special Reference to the Westinghouse-Parsons Steam Turbines," read by Francis Hodgkinson before the Engineers' Society of Western Pennsylvania, has been reprinted from the proceedings of the society and issued in a neat cover by Westinghouse, Church, Kerr & Co.

Air compressors of every type, carbonic-acid-gas compressors, the Clayton air-lift pumping system, vacuum pumps and compressed-air tools and appliances of every description, as manufactured by the Clayton Air Compressor Works of New York city, are well illustrated and intelligently described in a recently issued 80-page catalogue.

The Engineering Magazine, for its first issue of the new century, issued a special "Works Management Number." The issue, which is very voluminous, contains 340 pages of text, with articles by prominent authorities upon modern problems of organization, management and mechanical equipment of industrial engineering establishments, while the advertising pages are nearly equal in number.

A reprint of the paper by L. G. White, superintendent of the Columbus Edison Electric Light company, on "The Desirability of Using Storage Batteries in Connection with Stations of Medium Size," read before the Ohio Electric Light association last August, has been issued in circular form by the Electric Storage Battery company of Philadelphia. The paper treats of the installation of the latter company's Chloride accumulators in the Columbus station, and views are given of the battery room, booster and end-cell switches, switchboard, recording-voltmeter charts, etc.

A handsome specimen of the printer's and engraver's art has recently been issued by the York Manufacturing company of York, Pa., in the shape of a catalogue of the company's ice-making, refrigerating and other machinery. The York standard compression type of machine with single-acting vertical compressors and horizontal engine is described in detail and well illustrated by a number of detail and general views and by plan and elevation drawings. Small and special machines, can and plate ice-making plants, ammonia fittings and apparatus, engines, air compressors, boilers, tanks, etc., are all treated in the catalogue, and several views of the company's factory are given. The publication should prove valuable to persons interested in refrigerating apparatus.

SOCIETIES AND SCHOOLS.

The subject for discussion at the meeting of the Chicago Electrical association on February 1st was the recent changes and revisions of the Board of Underwriters' Rules.

At the annual meeting of the Illinois State Association of Engineers and Surveyors, held in Bloomington, Ill., on January 24th and 25th, a paper on "The Proposed Subway for the Street-railway System of Chicago" was read by W. H. Rosewater. The following-named officers were elected: President, H. G. Paddock, Moline; vice-president, Emil Rudolph, Chicago; trustees, P. C. Knight, Pontiac, and J. G. Melluist, Bloomington. The next annual meeting will be held at Joliet in 1902.

The Michigan Interurban and Street Railway association has been organized in Detroit. The officers of the new organization are: President, W. L. Jenks of the City Electric Railway and the Rapid Railway companies of Port Huron; vice-president, J. D. Hawks of the Detroit, Ypsilanti and Ann Arbor Railway and the Grand Rapids, Grand Haven and Muskegon Railway companies, and secretary and treasurer, Ben S. Hanchette of the Grand Rapids Street Railway and the Grand Rapids, Holland and Lake Michigan Railway companies. The executive committee also includes R. S. Rand, of the Michigan Traction company of Kalamazoo, and George A. Hart of the Manistee, Filer City and East Lake Railway company.

A revival of the rumors of affiliation of the Armour Institute of Technology with the University of Chicago follows the announcement that no special provision was made for the institution in the will of the late Philip D. Armour. While the Institute is said to have an endowment of $3,000,000, the friends of the school hope that the widow and son of the late philanthropist will carry on the work in which Mr. P. D. Armour took so much interest during the latter years of his life. However, the fact, that, so far as is known, there has been no definite arrangement made toward securing a successor of Dr. Frank W. Gunsaulus as president of the institution seems to indicate that the rumors of affiliation may have some foundation.

ELECTRICAL SECURITIES.

The directors of the North Chicago Street Railway company have authorized an issue of $4,800,000 bonds, bearing 4½ per cent. interest, to take up the outstanding bonds bearing higher rates of interest. The $1,260,000 certificates of indebtedness of 1915 will be taken up on April 1st of this year.

MISCELLANEOUS.

The Indiana Senate has passed a bill establishing electrical execution as the mode of inflicting capital punishment in that state.

The Indianapolis Board of Public Safety is advertising for bids for a new $65,000 electric fire-alarm system. Bids will be opened on February 8th.

An electrolytic process for the manufacture of sugar has recently been taken up, experimentally, by a French firm. It consists in passing an electric current through the juice by means of zinc plates inserted in a series of tanks, the juice being mixed with manganate of lime. Several successful experiments have been made, and it is said that the action of the electric current, in connection with the manganate of lime, has a wonderful effect on the clarification of the syrup.

The largest turbine installation in Norway is now being constructed on the River Glommen. The object of the undertaking is to supply Christiania and adjacent towns with electricity for lighting and motive purposes. Dams have been built at two waterfalls, with a canal about three-fourths of a mile in length for feeding the turbines. The falls are estimated to yield 16,000 and 10,000 effective horsepower, respectively. They are situated about 24 miles from the capital, and close to the Trunk railway, which is naturally a great advantage.

The Swiss, Austrian, Swedish, Norwegian and German manufacturers of calcium carbide have formed a combination for the purpose of establishing price schedules and a mode of controlling the sale of their product. The German acetylene industry is very important, there being at present in the empire over 200,000 plants producing this gas. Thirty-two of the smaller towns in Germany are lighted by acetylene gas, and a number of other plants are in course of erection. The gas is also used by the railroads for lighting passenger cars.

Judge Lowell, of the United States Circuit Court, District of Massachusetts, has handed down an opinion in the Eickemeyer winding case of the General Electric company against the Webster and Dudley Street Railway company of Webster, Mass. The bill sought to enjoin the defendant from infringing claims one, two and four of United States letters patent No. 377,996. The complainant's invention concerns the application to drum armatures of identical coils, machine made, any one of which can be placed upon and taken off the armature by itself. A large number of patents were introduced by the defendant in evidence, but the patent in suit was held to be valid. As to the fourth claim, the court finds that the defendant has infringed, while no infringement is found on the first and second claims. A decree for the complainant is entered.

TRADE NEWS.

The Franklin Electric company of Davenport, Iowa, has been incorporated for $50,000, to do electric manufacturing and conduct allied enterprises. The officers are: President, John Austin; secretary, H. M. Hawley; vice-president and treasurer, W. H. Crecelius.

It will be interesting to the many friends of F. A. Wunder in both the East and the West to learn that early in this month he intends starting in business for himself as general sales agent of the Ball Electric company, New York city, manufacturer of arc dynamos and lamps. Mr. Wun-

der's address will be 95-97 Liberty street, New York city.

The Kentucky Electrical company of Owensboro, Ky., manufacturer of the Kentucky incandescent lamp, as well as of motors and dynamos, states emphatically that it is "not a member of either of the incandescent-lamp manufacturers' combines."

The Canadian Electric Chemical company, limited, has been incorporated in Sault Ste. Marie, with $100,000 capital, to manufacture alkalis, chemicals and chemical compounds, and all electrical, hydraulic, mechanical or automatic machinery. The provisional directors are: William V. Gibbs, Clayton E. Platt, F. H. Clergue, B. J. Clergue and Henry C. Hamilton.

Articles of incorporation of the Richmondt Electric Wire Conduit company of Milwaukee, Wis., were filed last week. The object of the corporation is to manufacture wire conduit tubing and electrical supplies generally. The capital stock is placed at $50,000, divided into shares of $1 each, and the incorporators are Daniel E. Murphy, C. D. Richmondt and D. Hayes Murphy. This company manufactures a type of iron interior conduit designed to insure perfect grounding. The tubing is first pickled to remove any salts which may have been caused by corrosion, and it is then reamd. After the tubing has been completely galvanized the interior wall is given a coat of enamel, the ends being first rounded to remove burrs. The couplings are also galvanized to insure a perfect connection and a non-oxidizable joint, which will insure grounding of the entire conduit. This product has received the approval of the National Board of Fire Underwriters. The company has been successful since its organization, and will shortly occupy its new building, which is 85 feet wide by 400 feet long and 35 feet high, and will allow a considerable increase in the working force.

BUSINESS.

W. N. Matthews & Bro., St. Louis, report business as being unusually active for this season of the year, particularly in their "used" material line. They have received recently several large orders for "used" outriggers and weatherproof wire.

Incandescent lighting is having a veritable boom in this country or else Packard lamps are becoming favorites with the users. At least, that's the idea of the Electric Appliance company, Chicago, which has to point to something for its increase in sales.

The generating plant of the new twin-screw Red Star ocean-liner, Vaderland, consists of four dynamos driven by engines built by the B. F. Sturtevant company of Boston. A very complete system of artificial ventilation has been installed by the same company and Sturtevant engines are used to drive the eight induced-draft fans.

The Schultz Bridge and Iron company has been awarded the contract for a pier and warehouse at Progresso, Yucutan, Mexico, for the Compania del Ferro Carrill Muelle y Almacenes del Commercio. The pier is to be constructed for a double-track railroad and will be 40 feet wide and 550 feet long; eight-inch, solid-steel piles will be used.

ILLUSTRATED ELECTRICAL PATENT RECORD.

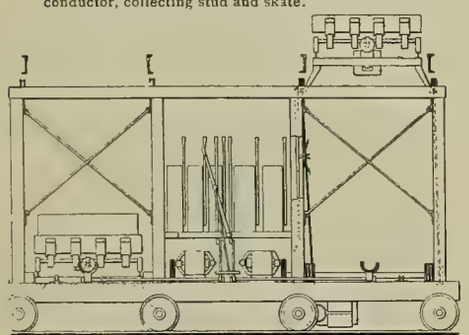
Issued January 22, 1901.

666,255. Electric Switch and Resistance. Claude W. Atkinson, Cardiff, England. Application filed June 2, 1900.

A starting switch for electric motors includes a magnetic controller adapted automatically to prevent the switching on of the current to the motor until the field-magnets of the motor are energized and to switch off the current from the motor on overload. A series of resistances are arranged in series with contacts and a contact arm adapted to make contact with the contacts and be controlled by the magnetic controller.

666,258. Electric Traction. Robert Brown, Birmingham, England. Application filed August 21, 1900.

A flexible medium hangs loosely between a pair of arms depending from the car. A three-armed lever is mounted within a box, carrying a pulley rotatable upon one of its arms. A spring is connected with the opposite arm, and a contact fixed adjacent to the outer end of the central lever arm is in constant electrical connection with the main conductor, collecting stud and skate.



No. 666,303.

666,271. Column-printing Telegraphic Instrument. Frederick H. W. Higgins, London, England, Assignor of one-half to Wilfred King, London, England. Application filed October 10, 1899.

The transmitting instrument comprises a keyboard of the Wheatstone type and a magneto-electric machine sending alternating currents. The receiver comprises a spring-operated train of wheels controlled by an escapement. A type wheel is actuated by the train, and an electromagnet with a polarized armature controls the escapement. An electromagnet with an armature which is not polarized controls a local source of energy for actuating the printing frame. A spring-operated train of wheels rotates the paper-feed roller, an escapement controlling the train. The printing frame is made to release this escapement. Circuit connections are made between both of the electromagnets and the magneto machine whereby alternating currents are sent to the electromagnets.

666,303. Storage-battery Transfer Car. George H. Condict, New York, N. Y., assignor to the Electric Vehicle company, New York, N. Y. Application filed September 3, 1898. Renewed June 28, 1900.

The car carries two elevators for removing a spent battery and for supplying a charged one to a motor vehicle, and means for operating and controlling the movements of the transfer car and of each of the elevators independently. Charging platforms arranged adjacent to the line of travel of the elevator car contain mechanism for moving a tray of batteries horizontally. A motor connected with the elevator operates mechanism to move a battery on to the elevator platform or from the elevator platform to the charging platform. (See cut.)

666,306. Electric Railway. Johannes W. Ehlers, Hamburg, Germany. Application filed December 19, 1899.

The main conductor is partially inclosed by an insulating bed mounted in the track rail. A covering strip of rubber or of an elastic and insulating equivalent has cavities in its lower surface and is adapted to close down on to the lower bedding of rubber or of an elastic and insulating equivalent. Sectional conductors are mounted on the top of the rubber covering and have contact lugs extending downwardly through the covering into the cavities. (See cut.)

666,315. Method of Construction of Electric Motors. Frederic A. Johnson, Binghamton, N. Y., assignor to the Stow Manufacturing company, Binghamton, N. Y. Application filed August 30, 1900.

A hollow field-magnet pole is detachably connected to the frame. A cup-shaped nut engages the neck of the pole-piece to secure it in position, and a plunger moves in the hollow neck carrying a bolt. A hand-wheel engages the bolt for adjusting the plunger. (See cut.)

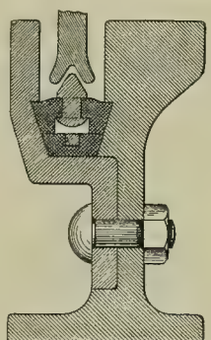
666,329. Lightning Arrester. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric company, Chicago, Ill. Application filed July 13, 1899.

This arrester is provided with carbons, arranged so as to have opposing adjacent faces, and having these faces coated with a permanent adhesive insulating material.

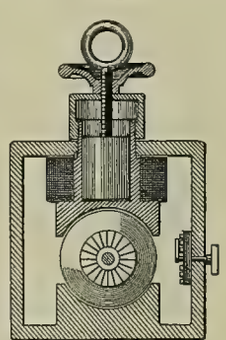
666,387. Apparatus for Producing Alkali, Electricity and Hydrogen from Alkali-metal Amalgam. Josiah W. Kynaston, Liverpool, England. Application filed December 5, 1899.

For denuding alkali-metal amalgam of its alkali, superposed shelves in an iron tank carry thin layers of the amalgam in close proximity to iron cathodes. Leads connect the alkali metal amalgam on the shelves and the cathodes with the translating device.

666,400. Cord Adjuster for Electric Lights. William C. Tregoning, Hartford, Conn. Application filed November 19, 1900.



No. 666,306.

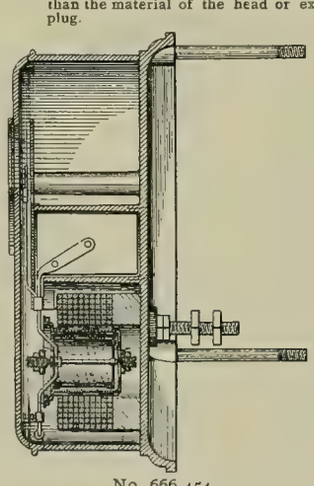


No. 666,315.

An adjusting block has a longitudinal groove extending along one side and terminating in volute openings near each end and a perforation through the middle of the block and opening into the groove.

666,403. Rail Bond. Montraville M. Wood, Chicago, Ill. Application filed November 22, 1900.

An internally expanding plug has its central or internal part harder than the material of the rail bond, but softer than the material of the head or external portion of the plug.



No. 666,454.

666,431. Electrotherapeutic Apparatus. John S. Mead, Buffalo, N. Y., assignor to Albert W. Courtney, Buffalo, N. Y. Application filed August 25, 1900.

An induction coil has one of the terminals of its primary coil connected with one pole of a generator. An electromagnet has one of its terminals connected with the same pole of the generator, two contacts forming the other terminals of the electromagnet and primary coil. A vibrator comprises an armature moved in one direction by the magnet and in the opposite direction by a spring. Switch members are carried by the armature and arranged to bear alternately against the terminal contacts.

666,444. Telephone-exchange Central-station Switchboard Apparatus. George K. Thompson, Malden, and Ernest C. Robes, Medford, Mass., assignors to the American Bell Telephone company, Boston, Mass. Application filed February 13, 1900.

The switchboard contains sub-station-line and toll-line sections. A pneumatic-tube instruction-ticket system is described, comprising a group of pneumatic tubes extending between switchboards of one series and those of the other, and adapted for the conveyance of loose instruction tickets uniformly from the switchboard sections of the sub-station-line series to those of the toll-line series. A supplementary pneumatic system consists of branch transmission tubes leading from the switchboard sections of the toll-line series, respectively, and a common receiving tube in which the branches merge, leading to a suitable depository.

666,454. Electrical Measuring Instrument. Henry P. Ball, New York, N. Y., assignor to the General Incandescent Arc Light company, New York, N. Y. Application filed June 12, 1900.

The moving system consists of a rotatable spirally arranged magnetically responsive body. Lines of force are produced parallel to the axis of motion of the body. Means are provided for increasing the length of the lines of force, these means bearing such relation to the rotatable body that the lines of force will be shortened by its rotation. (See cut.)

666,457. Privacy-device Apparatus for Polystation Telephone Lines. John A. Barrett, Summit, N. J., assignor to the American Telephone and Telegraph company of New York. Application filed September 8, 1900.

The apparatus at each sub-station of a central-energy, party-line circuit consists of the telephone-supporting hook lever, a normally open bridge of the main conductors adapted to be closed by the hook lever when relieved of the weight of the telephone, a normally open telephone bridge, with station telephones connected therein, and an electrogravity switch controlling the continuity of the telephone bridge and comprising a high-resistance electromagnet included in the first-named bridge, a drop-plate normally maintained in a vertical position by the armature of the magnet but adapted to yield to gravity and fall when released therefrom, and thereupon to close the telephone bridge. A visible signal plate is carried on a rod rigidly secured to the axis of the drop plate of the electrogravity switch and adapted to appear at or disappear from an aperture or window according to the position of the drop plate, and thereby indicate the engaged or disengaged condition of the line. (See cut.)

666,545. Lightning Arrester. William N. McAnge, Suffolk, Va. Application filed March 23, 1900.

The base carries a core having a helical groove, a choking coil wound in the groove and lying below the surface of the core, a conductive protecting cylindrical casing for the coil engaging the core and separated from the coil by a continuous interspace, a ground connection with the casing, a fuse wire in series with the coil, and means for attachment of line and instrument wires with the coil and fuse, respectively.

666,586. Insulator. Henry W. Woolbert, Smethport, Pa. Application filed August 27, 1900.

An insulator consisting of fragile material has two incut openings at one end to receive wires, and an incut opening at its opposite end for receiving a wire, and a metal support embedded in the insulator.

666,602. Electrical Glow Lamp. Arthur Couch, London, England. Application filed June 11, 1900.

See illustration and description on page 78.

666,618. Electric Igniter. Charles D. Wright, Chicago, Ill. Application filed May 29, 1899.

A handpiece comprises a continuous piece bent to form a spring, having near one of its ends a transverse loop and provided with a contact arm located across the loop, and its other end passing through the loop and provided with a yielding contact point.

No. 666,457.

666,628. Fire Alarm. Walter J. Partridge, Norwood, Mass., assignor to the National Fire Alarm company of Maine. Application filed July 14, 1900.

A series of brackets or supports have electrical contacts with one wire of an open circuit, and are insulated from the other wire which they support by an easily fused non-conducting material so arranged that on the softening of the non-conductor, the insulated wire sags and forms an electric contact with the bracket, thus closing the electric circuit to operate a suitable signal.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, FEBRUARY 9, 1901. No. 6

Engineering Features of Montgomery Ward & Co.'s New Building.

Montgomery Ward & Co. have done a mail-order business in Chicago for over a quarter of a century, and their business has grown so rapidly during recent years that they have been forced to enlarge greatly their facilities for handling the trade. This has led to the erection of the new 12-story building at the northwest corner of Michigan avenue and Madison street, facing Lake Michigan, and immediately adjoining on the south the firm's old eight-story building. Considerations leading to the design of the new building as it stands to-day were that it would be a structure which could be easily found and would be known to the concern's out-of-town customers and which also would be a credit to the firm and an ornament to the Lake Front on which it is located. Montgomery Ward & Co. now have the largest store in the world doing an exclusive mail-order business. Twenty-five acres of floor space are occupied and 2,000 clerks are employed.

The new building (Fig. 2, page 94) is 12 stories high, while a tower, as the central and major motive of the design, rises to the height of 25 stories, the distance from the street level to the top of the weather-vane figure surmounting the tower being 390 feet. This figure, which has been designed to typify "Progress Lighting the Way for Commerce," is 14 feet in height and is made of heavy sheet bronze (gilded) on a skeleton of five-inch solid-steel shafting and structural steel. The revolving part, which weighs 2,200 pounds, is electrically illuminated at night, as described in detail later. The statue was designed by J. Massey Rhind of New York, under direction of Richard E. Schmidt, the architect of the building. Fig. 3 is a view of the top of the tower and the weather vane, taken with a telescopic lens.

A full skeleton-steel, fireproof construction has been used throughout the building. The structure has a frontage of 86 feet on Michigan avenue and extends back 163 feet, the tower structure being 40 feet square. The foundation consists of about 1,200 50-foot piles, capped with dimension stone, concrete and steel, 17½ feet below the sidewalk level. White Georgia marble in rusticated courses is used to face the first three stories, pressed brick and terra-cotta being used for all the upper stories. The structure is rich in modeled terra-cotta and marble carving executed by prominent artists. The fireproofing material consists of semi-porous tile blocks. The window frames of the entire building are of cast-iron or galvanized sheet metal. Maple floors are used except in the halls, which have surfaces of art marble. In the tower there is absolutely no wood. The first two floors are used for offices and reception purposes. The main entrance is beautifully and richly finished in marble and mahogany.

With the erection of the new building arose the problem of furnishing light, heat and power to both the new and old structures. It was early decided to provide an independent power plant, and as the basement-floor space was very valuable, it was decided to install vertical generating units. Accordingly, the power plant was placed in the rear of the basement floor, the engine room being 45 by 32 feet in size, with a 20-foot ceiling. In this small space are erected two 300-horsepower, vertical, cross-compound, Reynolds-Corliss engines each directly connected to two direct-current generators. A switchboard and some auxiliary apparatus complete the engine-room equipment. A view of the room is given in Fig. 1, showing No. 2 engine on the right and a portion of No. 1 engine on the left. The engines have cylinders 14 and 24 inches in diameter, and a 30-inch stroke and are run non-condensing. They are guaranteed to develop one indicated horsepower-hour on 20 pounds of dry steam at the most economical point, which is when developing 300 horsepower with a steam pressure of 155 pounds at 125 revolutions a minute. The

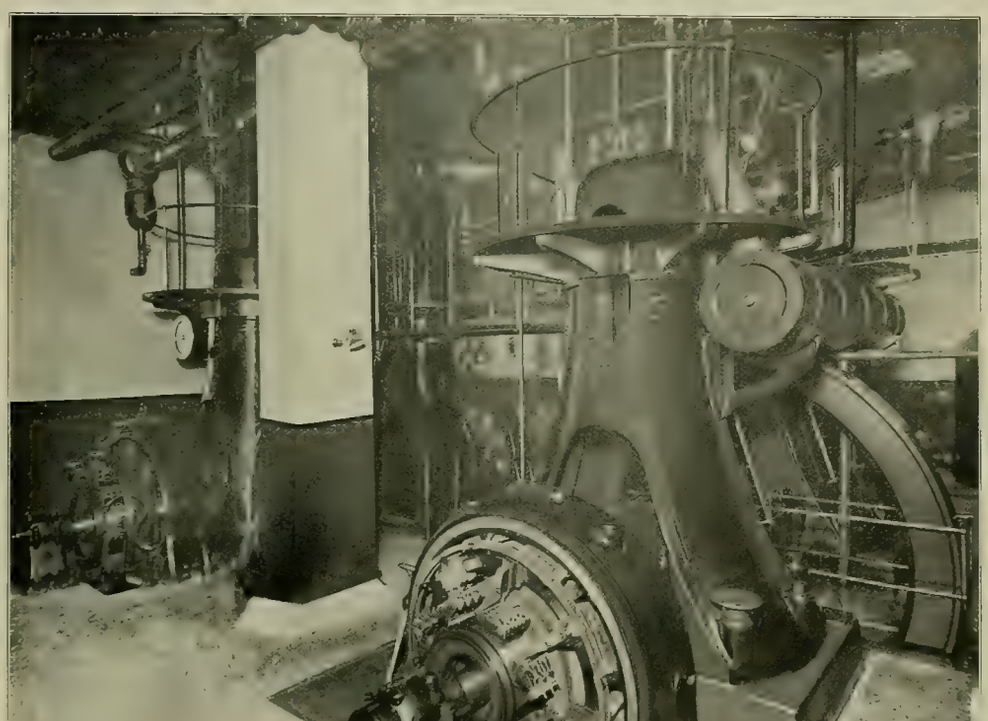


FIG. 1. ENGINEERING FEATURES OF MONTGOMERY WARD & CO.'S NEW BUILDING.—ENGINE ROOM.

engines fully came up to their guarantee on a recent test. They are designed to develop as high as 420 horsepower each. The latest type valves are used on the engines, they being located in the cylinder heads and provided with double eccentrics, thus diminishing the clearance.

Mounted on the ends of the shaft of No. 1 engine are two Western Electric 115-volt, eight-pole, 100-kilowatt generators, guaranteed to run with a 50 per cent. overload without excessive heating for half an hour. On No. 2 engine are connected two Westinghouse 100-kilowatt generators of the same voltage and of similar design. The generators are run in series on a three-wire system. The three-wire feeder mains are run from the switchboard to all centers of distribution, where they are converted into two-wire, 110-volt feeders.

The switchboard, of which a good view is given in Fig. 4, is 18 feet long and six feet high, standing one foot above the floor, and consists of five panels of pink Tennessee marble, 1¾ inches in thickness. A bronze scroll frame surrounds the board, while a clock with open scrollwork on top completes the ornamentation. The use of flush instruments, with bronze facings, adds to the pleasing appearance of this handsome board. The two outside panels on either end are identical, the lower half of each controlling one generator, the upper half supplying two feeder circuits. The complement of instruments and switches on each of the four panels includes a 1,500-ampere I-T-E circuit-breaker, a Wirt rheostat, a single-throw, three-pole, 1,500-ampere, generator switch, two single-throw, three-pole, 600-ampere feeder switches, an ammeter registering to 1,200 amperes and a voltmeter with a 120-volt scale. On the center panel are mounted two 150-volt pressure voltmeters connected with pressure wires to the center of distribution on the eighth floor, a 220-volt ground-detector voltmeter connected to an Ellicott ground detector and two single-throw, three-pole, 800-ampere feeder switches. These latter switches control two feeder circuits, supplying the old building, while the other eight switches are on the new-building circuits. The instruments used on the board are of the Weston type.

The back of the switchboard presents a very good piece of workmanship. All the machines are fused, as well as supplied with circuit-breakers. Fuses for each feeder circuit are provided and are mounted on slate slabs. A separate Thomson recording wattmeter is connected in circuit with each generator. The feeders are taken from the board to the centers of distribution in iron-armored conduit. Circuits leading to distributing points on the west end of the second, fifth and eighth floors and on the east end of the first, third and seventh floors consist of 350,000 - circular - mil cables for the two outside wires and a 700,000 - circular-mil cable for the middle wire. One circuit of two 400,000 and one 800,000 - circular - mil cables is carried to a center of distribution on the thirteenth floor to supply the tower and weather vane with light. All wires are carried up in raceways in the ends of one of the passenger-elevator shafts. No doors to the floor openings are provided in these raceways, and the top and bottom ends are sealed with tile arches. The backs of the raceways in the elevator shaft are of sheet metal, which can be removed in sections if it is necessary to get at the wires. All the wiring in the building is run in iron-armored conduit, except on the top-story ceiling, where open wiring on porcelain knobs is used.

The cut-out boxes on the first and second floors are of elaborate design. The switches and connections are mounted on marble boards with bronze trimmings, the rear boxes having glass doors, while the boxes in the front of the two floors have ornamental bronze doors. The cut-out box shown in Fig. 5 supplies 78 circuits on the rear of the first floor, each lamp or group of lamps being separately controlled from the box. The rear second-floor box is similar, while the two front boxes supply 52 circuits.

There are about 5,000 16-candlepower incandescent lamps used in the two buildings. In the old building 40 110-volt, enclosed-arc lamps of the Manhattan and Jandus types are used. The incandescent lamps on the first, second and ninth floors are arranged in clusters of four and six lights

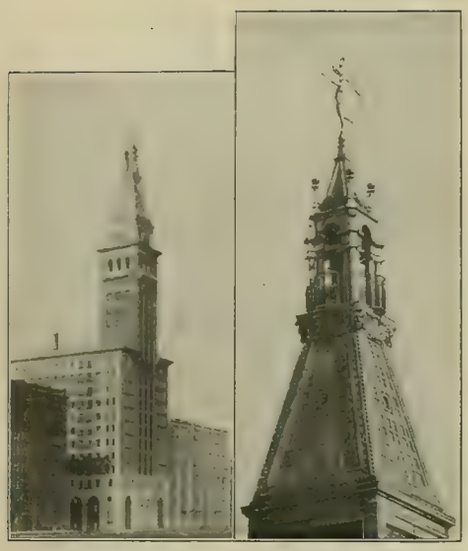


Fig. 2. General View of Building. Fig. 3. Details of Tower and Weather Vane.

ENGINEERING FEATURES OF MONTGOMERY WARD & CO.'S NEW BUILDING.

each. Opal globes with artistic bronze trimmings enclose the clusters, giving them the appearance of arc lamps.

For the purpose of illuminating the weather-vane figure on the pinnacle of the tower, four standards are provided just below the statue, as may be seen by a close inspection of Fig. 3. On each of these columns is mounted a ribbed-copper reflector, covered with glass and containing seven 32-candle-power incandescent lamps. These reflectors are mounted in sockets, so that the light can be thrown solely on the figure, giving it the appearance of floating in the air. This illumination is provided every evening till 11 p. m., at which time the generating plant is shut down.

The boiler equipment comprises two Heine safety water-tube boilers, each of 300-horsepower capacity. They are fitted with Hawley down-draft furnaces and supply steam at 125 pounds' pressure. The furnaces connect into a steel stack 5½ feet in diameter and 200 feet in height. Two boiler feed pumps, a fire pump of a capacity of 1,000 gallons a minute and a 1,000-horsepower Cochrane feed-water heater are provided. There is a double system of main steam headers running from the boilers to the engine room, each being independent of the other, to provide against shutting down the plant in case one header breaks. In fact, practically the whole plant, from the boilers to the engines and generators, has been installed in duplicate, so as to forestall the shutting down of the plant in case of almost any accident.

At the left, in Fig. 4, is shown the gauge board. It consists of a slab of marble similar to the switchboard and has mounted upon it a hydraulic 1,500-pound gauge for the elevator service, a pressure and a vacuum gauge on the heating system, receiver gauges for the two engines and a high-duty steam pump, a steam gauge on the main steam header and a recording steam gauge. All of the gauges are of the Crosby type. Above the board is a tank register or gauge to show the height of water in the house-service tank.

Outside of the lighting service there is considerable power used throughout the two buildings, the total amounting to about 170 horsepower. Nearly all of the motors are connected to the 220-volt circuits, those in the basement being supplied from an independent circuit which is brought down from the cut-out boxes on the floors above. Two five-horsepower motors in the pump room are belted to two Deane triplex house pumps which force water to a 10,000-gallon tank on the roof for house service. A Kroeschell Bros. refrigerating apparatus of five tons' daily capacity is installed in the engine room. The carbonic-acid-gas compressor is driven by a 10-horsepower motor, as shown in Fig. 6. The gas is circulated in pipes through a tank in the corner of the room and water is cooled by the direct-expansion principle. This water, which is used for drinking purposes, is circulated by means of a 2½-horsepower, electrically driven pump. Artesian water is used, it being pumped from a 320-foot well under the old building by a 10-horsepower motor. A telescope

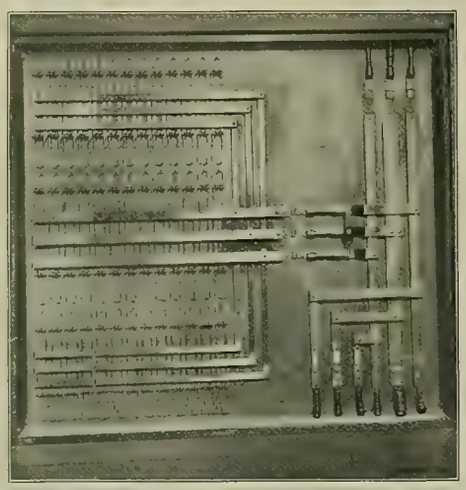


FIG. 5. ENGINEERING FEATURES OF MONTGOMERY WARD & CO.'S NEW BUILDING.—78-CIRCUIT CUTOUT BOX.

ash elevator used to remove ashes from the basement to the alley is driven by a five-horsepower motor.

The larger portion of the electric power for motor service is used for elevator purposes. The arrangement of the elevators is rather unusual and quite interesting. There is one Sprague electric elevator driven by a 30-horsepower motor and two Otis electric elevators operated by 22-horsepower motors. These elevators are used for passenger purposes and run between the first and twelfth floors in the new building, a distance of 142 feet. A 15-horsepower Otis electric elevator (Fig. 8) is located on the twelfth floor and runs from that floor to the observation cage on the twenty-fifth floor of the tower, the total lift of this elevator being 185 feet, which is the longest run of any electric elevator in the city.

Other elevators for freight purposes include a 12-story, link-belt carrier elevator, an eight-story elevator of the same type and a moving-incline elevator, running from the basement to the shipping room on the first floor, driven, respectively, by a 10-horsepower and two five-horsepower motors. On the carpet floor a Singer carpet-sewing machine (Fig. 7) is driven by a one-horsepower motor. In the same room three ordinary sewing machines are driven by a two-thirds-horsepower motor, while in the dressmaking department 25 Singer machines are operated by means of a 2½-horsepower motor belted to two shafts. A mail-numbering machine is also driven by a small motor on the office floor.

In the old and new buildings there are installed seven freight and three passenger elevators of the high-pressure, hydraulic type. These are operated by a high-duty, 100-horsepower, Laidlaw-Dunn-Gordon steam-pumping engine which pumps against a pressure of 700 pounds in a hydraulic accumulator. This pump is a three-cylinder, compound, non-condensing engine, and has steam cylinders, 15, 18 and 18 by 24 inches in size. The three water plungers are 4½ inches in diameter and are outside packed. On a recent test this pumping engine gave a steam consumption per horsepower per hour of 25.88 pounds of dry steam at 123 pounds' gauge pressure. The pump is designed to run, and did do so, under test, at 700 pounds on the water end, with a steam pressure of 125 pounds, delivering 250 gallons a minute at a speed of 51 revolutions. As an auxiliary supply for this hydraulic-elevator service, a 75-horsepower duplex steam pump is provided.

The heating of all the floors except the first and second is by direct radiation and is furnished by a Warren Webster vacuum system. The two lower floors are heated by indirect radiation from a large centrifugal ventilating fan on the ninth floor. This fan has an output of 25,000 cubic feet of air a minute and is driven by a 20-horsepower motor. This system is controlled by a Powers regulating apparatus. About 25,000 linear feet of radiation is used in the buildings. As the exhaust

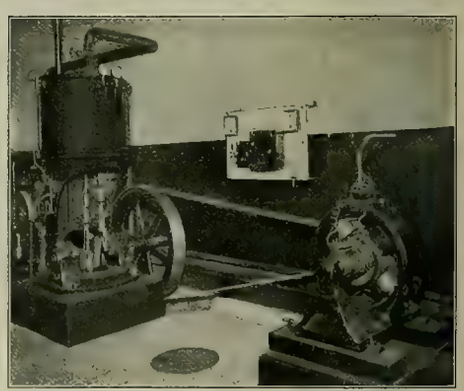


FIG. 6. ENGINEERING FEATURES OF MONTGOMERY WARD & CO.'S NEW BUILDING.—ELECTRICALLY DRIVEN REFRIGERATING APPARATUS.

steam from the engines and auxiliaries is not sufficient to meet the demands in cold weather, some live steam is used.

A Westinghouse air-brake apparatus is used for blowing out the dynamos and other purposes. There is installed an Adams patent sewage lift which is automatically controlled to lift the low-level drainage to the street sewers. Meeker & Cross patent folding doors are used on the elevators and a

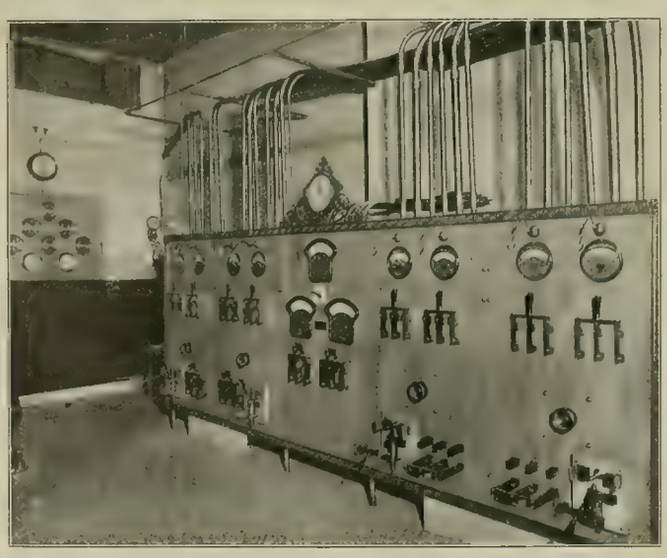


Fig. 4. Switchboard and Gaugeboard.

Fig. 7. Electrically Driven Carpet-sewing Machine.

ENGINEERING FEATURES OF MONTGOMERY WARD & CO.'S NEW BUILDING.

light-signal system is installed in connection with the passenger elevators. A house-telephone service, with about 50 telephones throughout the buildings, is supplied by the Chicago Telephone company. Conduits were run for the telephone cables during the construction of the building.

The general contractor for the construction of Montgomery Ward & Co.'s new building was the George A. Fuller company. The wiring and switchboard were installed by the Western Electric company. The Franklin Engineering company and Pierce, Richardson & Neiler were the consulting engineers for the mechanical and electrical plant. William H. Leland, chief engineer of Montgomery Ward & Co., is in charge of the installation. Mr.

FIG. 8. ENGINEERING FEATURES OF MONTGOMERY WARD & CO.'S NEW BUILDING.—TOWER ELEVATOR ON TWELFTH FLOOR.

Schmidt, the architect, planned many of the engineering features. He laid out all of the electric wiring, as well as the conduits for the telephone cables, and designed the cut-out boxes and reflectors for the weather-vane lighting.

Detroit and Chicago Electric Railway.

The construction of an electric railway between Detroit, Mich., and Chicago—a distance of nearly 300 miles—is the purpose for which the Detroit and Chicago Traction company was organized in Brooklyn, N. Y., recently. The company has filed its articles of incorporation with the secretary of state at Lansing, Mich., certifying to a capitalization of $4,000,000. Besides its purpose of building an electric railway between the two cities named, it is provided that the company may construct branch lines in such Michigan and Illinois cities and villages as may be deemed necessary to carry out the purpose of the organization, and may also build cars and do other things essential to the business.

The route proposed will parallel closely the line of the Michigan Central railroad, passing through the principal cities on the route of that road, such as Ann Arbor, Jackson, Albion, Marshall, Battle Creek, Kalamazoo, Niles and Michigan City. Press dispatches assert that the company will secure control of the Detroit, Ypsilanti and Ann Arbor Railway company, which now operates a line between Detroit and Ann Arbor, a distance of 40 miles. Grading is now being done for an electric railway between Ann Arbor and Jackson, a stretch of another 40 miles, by a company closely allied with the Detroit-Ann Arbor company. Between Battle Creek and Kalamazoo, which are 23 miles apart, the Michigan Traction company is operating a line. This latter company is owned and operated by the Railways Company General of Philadelphia, but it is stated that the new Detroit and Chicago company may effect a consolidation with the company. Control of this line, together with the Detroit-Ann Arbor road and the Ann Arbor-Jackson road under construction, would give the new corporation possession of about 100 miles of railway out of the 290 miles necessary to connect Detroit with Chicago.

The incorporators of the Detroit and Chicago Traction company are men prominently identified with electric-railway construction in Michigan, and are already interested in several roads, projected and in operation. The gentlemen named in a Lansing dispatch as the incorporators are: W. A. Foote of Jackson, Mich.; W. A. Boland of Grass Lake, Mich.; George J. Carr of Montclair, N. J.; Isaac W. Maclay of Yonkers, N. Y., and P. H. Flynn, John McCarty and F. C. Cochran of New York city. The officers of the company are as follows: President, W. A. Boland; vice-president, P. H. Flynn; secretary, W. A. Foote; treasurer, F. C. Cochran. Mr. Boland and Mr. Flynn, it is stated, hold a large number of shares of the stock as trustees. While the company is capitalized at $4,000,000, it is probable that an equal amount of bonds will be issued.

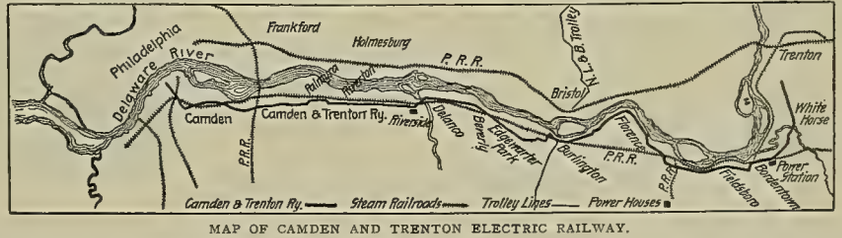
Camden and Trenton Electric Railway.

An electric railway has been opened by the Camden and Trenton Railway company which affords direct connection between the cities of Philadelphia and Trenton, N. J. The road, which is about 30 miles long, starts from the Market street ferry in Camden, opposite Philadelphia, and, as shown by the accompanying map, runs northeast through the territory bordering on the New Jersey side of the Delaware River to Trenton. Connections are made in both Camden and Trenton with the local street-railway lines, the total length of run of the cars being about 35 miles. Leaving Camden the following-named places are tapped en route to Trenton: Palmyra, Riverton, Riverside, Delanco, Beverly, Edgewater Park, Burlington, Florence, Fieldsboro, Bordentown and White Horse. These places, with the two terminal cities, aggregate a population of nearly 182,000. A fare of 45 cents is charged for the whole run. Connections are made at Burlington with the Burlington and Mount Holly Traction company, which operates a line south 7.15 miles to Mount Holly, and at Bristol, across the river from Burlington, with the Newton Electric Street Railway company, running 10 miles north to Newton.

The Camden and Trenton company, says the Railroad Gazette, from which these facts are taken, owns the entire capital stock of the Cinnaminson Electric Light, Power and Heating company, which lights the towns of Beverly, Delanco, Riverside, Riverton and Palmyra. It also owns 85 per cent. of the capital stock of the Bordentown Electric Light and Motor company, which supplies light to Bordentown and vicinity. The franchises for the railroad were granted to the Monmouth Traction company, which was incorporated March 14, 1893, and was operating five miles of road at the Trenton end when the name was changed to the present title in October, 1899. The authorized capital stock is $1,000,000, all outstanding. The company expresses its belief that at no distant day there will be a consolidation with the Camden and Trenton street-railroad companies and that the Camden and Trenton railway will form a link in a through electric line between Philadelphia and New York. Competition is now afforded by three steam lines which make direct connection between Philadelphia and Trenton.

The Camden and Trenton Railway company has two power houses of brick and steel, one being at Riverside, N. J., in which are installed two 250-kilowatt Westinghouse generators, direct-connected to two 350-horsepower, compound-condensing, slow-speed Green engines, made by the Providence Engineering Works. Steam is supplied by two 250-horsepower and one 175-horsepower water-tube National boilers. The other power house is located at Bordentown, and has a 200-kilowatt Westinghouse generator, a 350-horsepower belted engine and a 300-horsepower water-tube boiler. The power is generated at 600 volts at the power house and is transmitted a distance of eight miles each way from the power house. It will be possible to maintain a voltage of over 500 at any point along the line.

There are in operation two single-truck cars, 18-foot bodies, equipped with two 30-horsepower Westinghouse motors; also three double-truck duplex cars equipped with two 50-horsepower Westinghouse motors. There are being delivered eight double-truck cars, 42-foot bodies, steam-coach type, equipped with two 50-horsepower Westinghouse motors. These cars were made by the St. Louis Car company and are very elaborate in design and finish. Each car has a smoking compartment in one end, partitioned off from the body of the car by a glass partition. The interior finish is in mahogany. There are reversible cross-seats, upholstered in frieze plush.



MAP OF CAMDEN AND TRENTON ELECTRIC RAILWAY.

Chicago Elevated Railroads.

The annual meeting of the South Side Elevated Railroad company of Chicago was held on January 31st. The financial report shows that the net earnings of the company amount to 4.88 per cent. on the value of the capital stock. The passenger traffic showed an increase of 10.4 per cent. over that of the previous year. President Leslie Carter said that a meeting of the directors would be held on February 28th, when the question of the quarterly dividend would be considered. He stated that it was the wish of the directors to increase the yearly dividend rate to four per cent. if the business continues as prosperous as in 1900. The average number of passengers carried daily during 1900 was 68,155, against 61,995 for 1899. The increase of net earnings for 1900 over those for 1899 was 7.55 per cent. The percentage of operating expenses, including all repairs, to total earnings was 58.17. In the item of repairs is included the cost of renewing old cars, which amounted to $55,000.

The condensed financial statement is as follows:

	1900.	1899.
Total earnings	$1,286,638.63	$1,170,380
Operating expenses	748,402.77	669,932
Net earnings	$ 538,235.86	$ 500,448
Dividends and bond interest	340,515.00	340,422
Surplus	$ 197,720.86	$ 160,026

Chauncey J. Blair, George E. Adams and George D. Boulton were re-elected directors for four years. After the stockholders' meeting the directors re-elected the old officers.

A special meeting of stockholders of the Metropolitan West Side Elevated Railroad company of Chicago has been called for April 8th, to vote on the question of authorizing an issue of extension bonds to be used from time to time in defraying the cost of extensions and additions to the property. The company has at present two extensions partially under way, representing an expenditure of about $1,400,000, and the new issue will probably exceed this amount, to provide for further additions as they become necessary. As the bonds will necessarily be second-mortgage paper, it is stated that they will probably bear five per cent. interest.

Traffic on the Chicago elevated roads was indifferent during January, the mild weather preventing a normal increase in travel. The Northwestern elevated carried a daily average of 52,021 passengers, which is a gain of 1,777 over the record in December. January traffic on the South Side elevated road showed a daily average of 71,137 passengers, as compared with 69,504, for the corresponding month of last year, a gain of 2.3 per cent. Metropolitan elevated traffic during January amounted to a daily average of 89,699 passengers, as against 88,585 during January, 1900. This is an increase of 1.26 per cent.

The St. Louis and Belleville Traction company has been sold to Clark Brothers of Philadelphia. One hundred and fifty thousand dollars was paid to the three principal stockholders, John Day, Zach. Tinker and L. N. Downs. The purchasers assume the indebtedness of $1,000,000. The company will be reorganized on a $2,000,000 basis, and the Day and Suburban lines between Belleville, Ill., and St. Louis, and the Belleville local line will be consolidated. John A. Day retires as president and George J. Kobusch of St. Louis succeeds him.

Zénobe Théophile Gramme.

The death of Zénobe Théophile Gramme takes from the electrical world a pioneer in the development of the dynamo-electric machine, with all the changes that it has brought, and an inventor who has been characterized as an intuitive engineer.

Gramme was born in Belgium in 1826, and was for some years a carpenter's apprentice. Developing a talent for machinery while he was still a young man, he left the carpenter's trade and entered the "Alliance" factory in Paris as a mechanic. It was in this factory that the "Alliance" machine (described and illustrated in Mr. Pierce's article in the Western Electrician of January 5th) was built. As a young man Gramme also worked in the workshops of Ruhmkorff. Previous to the time when he gave his attention to the electric generator Fara-

Z. T. GRAMME.

day had made his discoveries of electromagnetic induction, and the magnetoelectric machine had been invented, followed by the generator with separately excited fields of soft iron, and finally by the self-excited machine.

Without any technical training in electricity excepting what he had gained in his work as a mechanic, Gramme, in 1870, brought out the armature which still bears his name. The Siemens shuttle armature, which preceded it, was defective in having only one coil, producing an intermittent effect. Gramme's armature was a continuously wound ring, and was at once successful, furnishing as it did a continuous uni-directional current.

In an article in the London Electrician, signed S. P. T.—probably written by S. P. Thompson—appears the following: "The rapid commercial success of Gramme's machine is due to a combination of causes. It was the first practical machine in which were combined the features of the continuity of commutation, the self-exciting arrangement, good lamination in the armature core, and reasonably good proportions in the magnetic circuit. No doubt, also, Gramme was fortunate in having behind him a good firm of mechanical engineers to undertake the construction of his machines. Be that as it may, there is no question that the 'Machine Gramme, type A' conquered the industrial world, and gave to its inventor a reputation which British engineers would be the last to belittle. It is not, moreover, without significance that a good deal of Gramme's success is due to that which at the present day English manufacturers are too prone to decry—the publicity gained in international exhibitions. At Vienna in 1873, at Philadelphia in 1876, and notably at Paris in 1878 Gramme's machines were in evidence. It is said that the Gramme machines at Philadelphia incited the invention of the Brush and of the Thomson-Houston machines for arc lighting."

For some years Gramme took an active part in the operations of the Société Gramme, but lately his connection was little more than nominal. In March, 1897, he was made a Knight Commander of the Order of Leopold, and was given a banquet in Brussels. He was also an Officer of the Legion of Honor, and a Chevalier of the Order of the Iron Crown of Austria. In 1871, when his first machine was submitted to the Academy of Sciences, Gramme was awarded the Volta prize of 20,000 francs, and the French government made him a grant of a like amount. He died at his home at Bois de Colombes, near Paris, on January 20th, at the age of 74, and is buried in the cemetery of Père Lachaise, Paris.

An electric-lighting plant will soon be started in Greenville, Ky.

New Magnetic Observatory of the United States Government.

The United States Coast and Geodetic Survey has recently leased a tract of land at Cheltenham, Prince George County, Md., and built thereon a unique structure in which have been placed wonderfully sensitive instruments for automatically measuring and photographically recording variations in the direction of the magnetic needle and the intensity of the magnetic influence which causes the variation.

The erection of the building, which was designed by the Division of Terrestrial Magnetism, was under the direction and supervision of Mr. J. A. Fleming, a member of the division.

The site for the observatory was chosen because it was near Washington, and yet sufficiently remote not to have the delicate magnetic instruments affected by such disturbing influence as an electric-car line. The geological formation about the site was also favorable, the distribution of the magnetic elements being uniform. Then, too, the locality is not likely to be built up for many years, or offer an attractive field of operation for trolley roads.

As Cheltenham is only 16 miles from Washington, the headquarters of the Coast and Geodetic Survey, it is accessible at all times, and instruments intended for use at other magnetic observatories yet to be established can be taken there for standardizing.

The observatory is, at present, the only building of its kind in the United States, and, with the exception of a similar building in Belgium, it is said to be the only one of its kind in the world. There are other magnetic observatories in other countries, but they are built underground.

The observatory, as shown in the group illustration (Fig. 1), consists of two buildings, and not one iron nail has been used in the construction of either of them. In fact, nothing which would have a magnetic influence upon the instruments has been used in the construction of the buildings. Consequently only copper nails have been employed. The door-knobs and hinges are all brass, and in one of the buildings, where there is an office room and where a stove is necessary, the difficulty has been overcome by having placed therein a stove made of soapstone, using wood as a fuel. The main building, in which have been placed the magnetographic instruments for the measurement of the variations of the needle, is practically several buildings in one. In this building a uniform temperature will be invariably maintained the year around, for the entire period of 15 years, during which it is intended to take observations.

The exterior measurements of the main building are 36 feet by 56 feet, with a height of 24 feet.

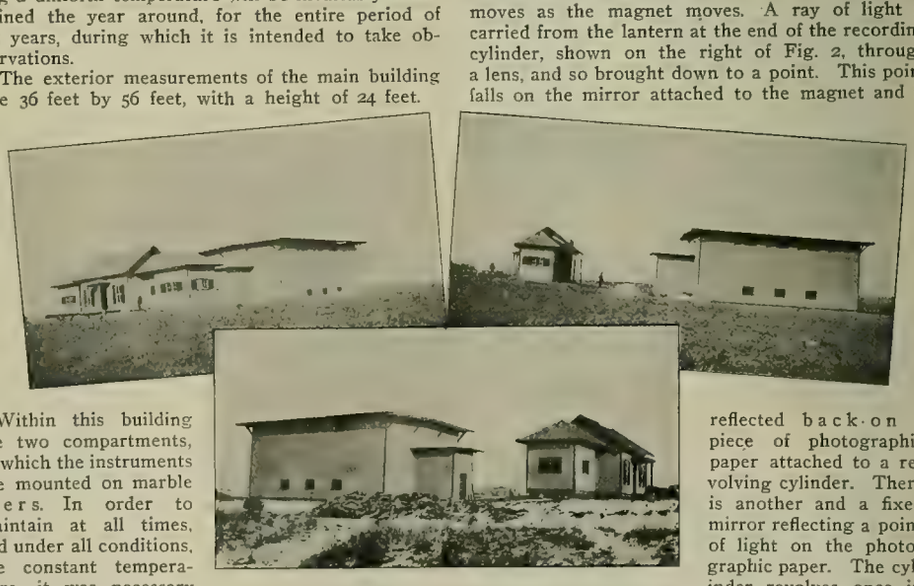


FIG. 1. NEW MAGNETIC OBSERVATORY OF THE UNITED STATES GOVERNMENT.—BUILDINGS AT CHELTENHAM, MD.

Within this building are two compartments, in which the instruments are mounted on marble piers. In order to maintain at all times, and under all conditions, the constant temperature, it was necessary to adopt the following method of construction: First, ordinary weather-boarding on eight-ply paper, then one-inch sheathing, then eight-ply paper, then three feet of sawdust, then eight-ply paper, then ceiling; then a passageway two feet six inches, which permits ingress to the two smaller compartments. These two compartments or rooms are constructed as follows: Ceiling, eight-ply paper, one foot of sawdust, eight-ply paper, ceiling. In entering the building one must pass through four sets of doors before gaining the passageway to the small rooms. The doors to these rooms are constructed like the walls enclosing the rooms, and are made like refrigerator doors. On the exterior of the building are small slides which act as air conductors into the passageway, and then the air from the passageway is let into the rooms by similar slides. In the construction of this building there were used 2,250 pounds of copper nails and 12 carloads of sawdust.

The importance of the observatory is quite apparent when it is known that it will aid very materially in the work of deciding the lost lines in land surveys and in furnishing mariners with the corrected lines of equal variation, with the aid of which they may determine the deviation of their compasses. It is well known that a compass bearing is not a constant function, and therefore the question presents itself as to how and by what amount it varies.

There seems to be a relation between the sun spots and magnetic disturbances. These disturbances are generally greater in the same proportion as the increase in sun spots. As the cycle of the sun spots is about every 11 years, the continuation of observations for about 15 years will cover one of those cycles. The declination of the needle is the angle between the true or astronomical north and south and the magnetic north and south line.

The magnetic intensity, horizontal and vertical, the variations of which will also be measured at the observatory, is the amount of pull or force exerted on the needle. All of the magnetic elements are subject to daily, annual and secular variations, and disturbance variations, such as electric storms and the passage of electric cars. Of course, in the present case, the latter disturbing element has been avoided.

The question, therefore, arises as to what laws govern these variations and what are their occasion. It is to answer these questions that the magnetic observatory has been erected. As the United States Coast and Geodetic Survey is a government establishment, the results of its determinations of magnetic changes in courses have a final standing in courts in the United States and all countries under its jurisdiction. A compass bearing taken, for instance, 25 years ago, to be re-run at a later date, would be corrected for variation at the date of the re-survey by the use of corrections for declination furnished by the Coast Survey.

The instruments used do not contain a particle of metal in their composition that will affect the magnetic needle.

The magnetometer consists of a magnet suspended by a quartz or silk fiber, and which is allowed to take up the position of the magnetic north and south line, and, of course, it changes its position as the elements change. There is attached to the magnet a mirror, so that the mirror moves as the magnet moves. A ray of light is carried from the lantern at the end of the recording cylinder, shown on the right of Fig. 2, through a lens, and so brought down to a point. This point falls on the mirror attached to the magnet and is reflected back on a piece of photographic paper attached to a revolving cylinder. There is another and a fixed mirror reflecting a point of light on the photographic paper. The cylinder revolves once in 24 hours by clockwork, and at the end of every hour a shutter automatically cuts off the light for a few minutes from the fixed mirror, making a slight break in the line recorded on the paper. The line recorded from the ray reflected from the fixed mirror is the base line, and, of course, it is a perfectly straight line. The ray from the mirrors attached to the needle gives a curved line running alongside the base line. Ordinates can now be measured, and the position of the needle for any hour of the day may be platted on a chart. The diurnal change is readily noticeable. The needle deflects slowly away from the astronomical north and south line, recovers this change and starts in the opposite direction. The maximum variations in declination are reached at about 8 a. m. and 1 p. m.

In case of violent movements, which occur dur-

ing electric storms and from other causes, additional mirrors are provided for recording these movements on another portion of the cylinder exactly parallel to the record made by the primary set of mirrors. This insures a perfect record, since the variation cannot be so great as to be reflected off the photographic paper and so lost.

The record for horizontal intensity of magnetic influence is recorded on the same sheet of photographic paper in a manner similar to that just described, except that this magnet system is brought by torsional force in the magnetic east and west line. For a given value of magnetic intensity equilibrium exists between it and the torsional force of the fibers. If now the intensity varies, then the magnet turns out of its position of rest and the amount of angular change measures the change in intensity. To the two instruments shown in the illustration (Fig. 2) will be added a third, measuring the changes in the vertical intensity. By a combination of the changes in horizontal and vertical intensity, the changes in magnetic dip are secured. The observations and calculations are made with the greatest care and refinement. Once the instruments are properly adjusted, they continue their work faithfully, eliminating all errors of personal equation of observers and producing

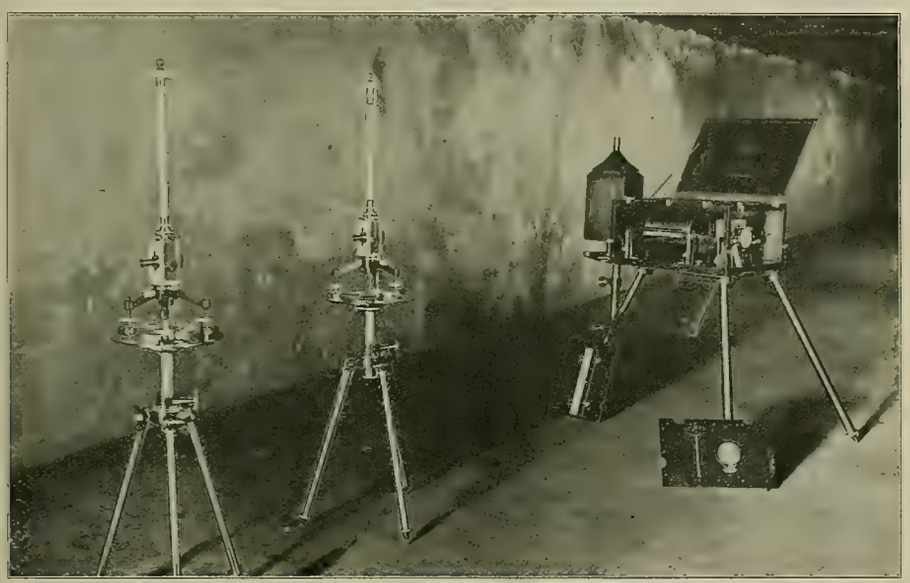


FIG. 2. NEW MAGNETIC OBSERVATORY OF THE UNITED STATES GOVERNMENT.—MAGNETOMETERS AND REVOLVING PHOTOGRAPHIC CYLINDER.

observations as nearly perfect as artificial observing and automatic recording instruments are capable of producing at this age of extreme mechanical exactness.

Dr. W. G. Cady, a graduate of Brown University and of the University of Berlin and a member of the Division of Terrestrial Magnetism, will have charge of the observational work of the Cheltenham observatory.

In view of the practical importance of the work, the late superintendent of the United States Coast and Geodetic Survey, Dr. Henry S. Pritchett, decided in 1899 to form a special magnetic division, thus putting the magnetic work on a firm basis. The present superintendent, Mr. O. H. Tittman, in recognition of the practical importance of the work to surveyors and mariners, is continuing on the same policy inaugurated by the former superintendent. In view of the expansion of magnetic work, it has been found necessary to employ such modern methods as to be able to complete the magnetic survey within a reasonable period of time, about 15 years. One of the most important improvements will result from the establishment of certain principal magnetic-base stations, all equipped with special instruments, made exactly alike, operated under precisely the same conditions, and carefully standardized at the base station at Cheltenham, which will record, photographically, the numerous fluctuations of the earth's magnetism.

With the aid of these photographic records, which will be sent to Washington for reduction, observations made by observers at any time of the day will be referred to the common epoch determined upon, to which all of the results of the magnetic survey are to apply. It will then be possible to construct the magnetic charts—that is, the isogonic chart (the lines of equal declination or variation as the surveyor or mariner knows them), the isoclinic map and the isodynamic map for a particular date of time, as, for example, on January 1, 1905, and thereafter, with the aid of the subsequent observatory records, the charts can always be corrected to date.

There will be four of these observatories established by the Coast Survey, one on the Atlantic coast, the one at Cheltenham, another on the Pacific coast at a point not yet determined, a third at Sitka and the fourth one near Honolulu, H. I. As previously mentioned, the observatory at Cheltenham will be the principal or standard station at which all instruments used in the magnetic survey will be standardized.

Co-operating with the Coast and Geodetic Survey will be a number of universities and other institutions at which observations will be made at specified periods, according to a definite plan followed by the government observers. The records kept will be forwarded to the Coast Survey for reduction, along with its own records.

The cost of the magnetic work is small, compared with the enormous saving of costly litigation over property boundaries, based on ever-changing magnetic courses.

To the mariner, as the compass is his sole guide by night or day, in wind or storm, the magnetic work is of incalculable value. Arrangements are being made by the Coast and Geodetic Survey to place special magnetic instruments on vessels for determining the magnetic elements at sea. Already the observations have pointed out to the mariner dangerous places in Alaskan waters where the compass is drawn out of its proper direction by local disturbing influences.

In this work, as in all others, it is thus seen that the United States government seeks to promote the interests and welfare of its citizens, adopting the most up-to-date and improved methods for obtaining the results sought. It has adopted methods and instruments that have already been thoroughly tested, and has placed the work in the hands of Dr. L. A. Bauer, who has made this subject a most careful study at home and abroad.

Chicago Firms Doing Central-station Business.

Notices were served on 25 business houses in Chicago on February 1st by City Electrician Ellicott, to the effect that the wires of the companies would be cut if they did not secure proper ordinances from the city within 15 days. The companies notified are, in the majority of cases, owners of large office buildings in which are located isolated electric-light plants. These plants, besides furnishing the owners' buildings with electricity, supply light and power to adjoining and neighboring buildings, and thus do a central-station business on a small scale. According to an opinion of the corporation counsel, this is in violation of the city's laws, and the council committee on gas, oil and electric lights has ordered that unless suitable franchises are obtained by the companies within 15 days to permit them to continue to sell current, the council will order the wires cut. Many of these plants have been in operation for some time, and it is estimated that the city has been losing from $3,000 to $4,000 a year in revenue from this source.

Ganz Three-phase Railway in Budapest.

The following article appeared recently in the London Daily Telegraph from its correspondent in Vienna:

"In view of the intention of the directors of the London District and Metropolitan railways to substitute electric traction for steam locomotives on their line, some account of the electric system installed by Ganz & Co. at Budapest may be of interest, because, in the view of many distinguished specialists in this branch of engineering, the method in question seems calculated to effect a complete revolution in railway working. On behalf of the English companies referred to, Budapest will, it is understood, be visited this week by experts, who will examine the system with a view to its possible adoption in London.

"Up to the present, electric railways have for the most part, in Europe, at all events, been operated by direct current at a pressure of 500 volts or so. But Messrs. Ganz use the three-phase alternating system at the high working pressure of 3,000 to 5,000 volts. In this way it becomes possible to carry on very long lines. For a long time the three-phase system has been the dream of electricians, but hitherto it has been found extremely difficult, if not impossible, to design and make transformers which shall reduce the pressure of 20,000 volts with which the special trolley [feeder?] wires are charged down to 3,000 or 5,000 volts. The latter current is conducted to the three-phase motors on the locomotives by a trolley. The trolley line consists of two copper wires, each only eight millimeters (.315 inch) thick, the third conductor being the rails themselves. The trolley arm and carriage comprise a wooden shaft or arm, upon which are placed two insulated copper cylinders, by which the current is passed through two contact wires. The high-pressure conductors are entirely inaccessible. A full technical description of the apparatus would hardly be intelligible without the aid of drawings; but, briefly, it may be said that the insulated wires, which are encased in metal tubes, are connected to the steel frame of the locomotive in such a way as to preclude the possibility of accident.

"Special attention is paid to the signal question. In consequence of the high voltage at which the line is worked, the volume of current is relatively small, and it is therefore feasible to combine the conductors with the sections of the block system, and careful arrangements are made for safety, whereby, in the event of a wire breaking, or the contact mechanism failing to act, the current is cut out, and the brakes applied to the train automatically.

"The inventors of the system claim for it extraordinary simplicity. Hitherto, in cases where three-phase alternating current has been installed, it is first carried from the central generating station to the transformer station, where it is converted to direct current at the lower pressure of 500 volts. But under this arrangement very large copper conductors must be used, whereas the Ganz system requires only thin wires, causing a great difference in the cost of construction, an economy which is also apparent in the working of the line, as sub-stations are not wanted, the transformers actually used needing no supervision.

"With regard to the ventilation of the Budapest line, there is practically no difference as compared with other railways, and the air is always pure.

"The system was first installed on the Valtellina line, belonging to the Italian Mediterranean company, where it is seen to great advantage. This railway runs, via Lecco, Sondrio and Colico, to Lake Como, where motive power for the dynamos is obtained from the River Adda to the extent of 6,000 horsepower. From the central station the wires, charged with a three-phase current of 20,000 volts, proceed to 10 converter stations, each of 300-kilowatt capacity, where the voltage is reduced from 20,000 to 3,000, the current being then led direct to the carriages. The wires carrying 20,000 volts are only seven millimeters (.275 inch) in diameter, the trolley wires being eight millimeters (.315 inch) thick. The latter are placed at a height of about 20 feet above the rails. Between Lecco and Sondrio there are 30 tunnels, of an average length of about 700 yards, and the fouling of the air by the smoke forced the company to abandon steam locomotives in favor of electric traction. The passenger vehicles in use on the line are elegantly appointed motor cars, each some 50 feet long, and each equipped with four three-phase motors of 150 horsepower. These coaches weigh 50 tons apiece, and carry 60 persons, and to each motor car are attached four trailers of equal size. The goods cars are also equipped with four motors, and are capable of drawing 250 tons at 30 kilometers (18 miles) an hour. The passenger cars are calculated to attain a speed of 36 miles an hour on the level and 18 miles an hour on gradients of 10 in 1,000.

"The firm of Ganz & Co. constructed the experimental railway at Budapest at their own expense. This is two kilometers (about a mile and a quarter) long, and has now been worked for a year with complete success. Although only a short one, the line demonstrates fully the simplicity and safety of the system, and is the subject of deep interest to electricians, many of whom arrive every week from abroad to study it."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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As a method of garbage disposal crematory plants may be all right, but experience shows that their utility as steam-raising plants for the production of electric current is very doubtful. The question is under discussion in Chicago, and Mr. Kerfoot, the city controller, secured some figures from the well-known Shoreditch plant in England. The reports show that during the year ended in March, 1900, there was a loss of $23,000 on the plant. The original cost was $118,945, and the cost of operation $29,155. The receipts were $5,533, made up of $860 from sales and destruction of trade refuse and $4,675 for steam provided to public baths and public library. Thus the plant showed a net loss of $23,620 on a capitalization of $118,945. It is, of course, possible that the garbage destroyed could not have been consumed or cast away so cheaply by any other method, but it is evident that the plant, as a plant, is not an economical success.

A New York legislator has introduced a bill in the Assembly at Albany providing that, with a few stated exceptions, all books and periodicals shall be printed in type not smaller than brevier, the letters to be of sufficient width so that a line made of the lower-case alphabet shall be not less than 14 brevier ems in length—that is, such a line must be at least one-ninth of an inch high and 1 5-9 inches wide. The lines in the column or page must be spaced with the ordinary 36-to-an-inch leads. The measure is designed to protect the eyesight of the people, and the state Board of Health is given discretion to modify its provisions where the essential purpose is not disregarded. It is, of course, extremely unlikely that such a bill will become a law in New York or any other state, for the legislation is parental in character and unnecessary. Persons who fear damage to their eyesight by fine print have simply to eschew it. All really important literature is now accessible in type as large as, or larger than, the size mentioned in the bill. Some reputable daily newspapers make a specialty of large body type, to say nothing of the "yellow journals," which offer an eccentricity of types sufficient to suit the most capricious taste. But a hard-and-fast law would give most newspapers the alternative of greatly decreasing the amount of matter printed or else raising the price to cover the increased cost for paper, presswork and other items. In other directions such a law would increase the cost of the literary pabulum of the poor. There is, however, no question that the long-continued reading of small type, especially by artificial light, is harmful, and it is a satisfaction to reflect that the Western Electrician does not lay this temptation before its readers. A somewhat more extensive use of leads would make this journal comply in every particular with even the impractical and extreme law of the gentleman from New York.

An electric railway to connect Detroit with Chicago is proposed by a group of Michigan and eastern capitalists recently incorporated under the name of the Detroit and Chicago Traction company. It is interesting to consider the factors entering into the successful construction and operation of an electric railway of this nature, which would connect two large cities separated at some distance, in this case between 290 and 300 miles, and which would enter into direct competition for local passenger, as well as freight and express, traffic, with a long-established and well-equipped steam railroad. If the Detroit and Chicago company, as it is proposed, secures control of the electric roads already built, or building, over different sections of the route, its rights-of-way will, in many cases, be restricted to prominent streets in the cities through which it will pass and to public highways in the country. These conditions will, in all probability, prevent the road from competing for long-distance and high-speed traffic, which is a field at present generally conceded to the steam railroads. But, for frequent and short-distance hauls between the eight or ten thriving little cities along the route, this electric railway would certainly receive considerable patronage.

Consideration of the operation of an electric road of this length naturally brings to mind the system of electrical distribution and the number and location of the power stations necessary for good economy and high efficiency. A prominent Chicago electrical engineer has made the statement that he believes an electric railway 300 miles in length, such as a Detroit-Chicago line, could be successfully operated from two power houses, transmitting three-phase, alternating current at about 30,000 volts to a number of sub-stations distributed at the proper intervals along the railway. In studying this problem it is also important to consider the recent introduction in different European cities of polyphase systems, using alternating-current motors without any conversion into direct current. Bearing the Chicago gentleman's statement in mind and also the possibility of using a purely polyphase system, it will be interesting to watch the development of the new Detroit and Chicago company's plans, as the company and its engineers certainly have the opportunity of carrying into effect new and bold engineering in electric traction if it succeeds in fulfilling the purpose of its organization.

One would hardly consider the Philippines as offering a field for the introduction of the electric automobile, but such appears to be the fact. The bicycle was introduced in the islands some years ago, but the pattern was defective and the material and workmanship inferior, so that most of the machines were discarded after a short service. Spain sent several thousand wheels to the Philippines, but nearly all of them were the rejected bicycles of the shops of the parent country, although some of them had been purposely made for the Philippines. The latter fell to pieces shortly after they were put into use. This sort of business discouraged the natives, and there was a lull in the bicycling trade on the islands until the Americans commenced to send superior grades of wheels. The rapidity with which the American bicycles sold encouraged dealers to put in some sample machines operated by motors. These motor machines proved great attractions for the richer class of natives, many of whom did not hesitate to order one or more. Recently some of the firms in Manila and Iloilo that carry lines of machinery and general supplies for the shops and manufacturing establishments have arranged for the sale of automobiles. Possibly there are not at the present time more than a dozen automobiles on the islands operated by electric power, but these machines are always in use, being owned, in some cases, by several persons jointly, each owner taking his turn at riding, thus keeping the machines in action most of the time. Since the introduction of these specimen machines in the islands there have been many inquiries for more, and the indications are that there will be numerous electric automobiles in service within the next year or so.

Some interesting, although scanty, details of the "British Electrical Superannuation Fund" are given on another page. The scheme is a broad one, seemingly planned on sound financial lines, and with the unusual provision that any electrical company may participate in it. The latter feature would seem to open the door to complication in the case of companies going out of business or consolidating with other companies, although this objection would have less weight in England, where business changes are comparatively few, than here. In Mr. Garcke's statement there are no references to settlements with the estates of members dying before reaching the age of 60, nor is it stated whether an individual member retiring to engage in other business receives any benefit from his contributions to the fund. It is probable, however, that these points are covered in the scheme as worked out and are simply omitted in Mr. Garcke's brief description.

The plan of pensioning life-long employes is attracting considerable attention in this country and is already in force in a number of instances. It makes for long and faithful service, certainly; but whether it will affect the vigor of individual initiative which has been the secret of American industrial success—whether it will in any measure introduce a time-serving routine to supplant the strivings of the youth ambitious for individual success—whether there will be a certain lack of incentive which will result in a leveling-down process among men—remains to be seen. We are not contending that these considerations of offset are more than mere conjecture. Perhaps the typical American will do his best work when upheld by the comforting assurance that faithful effort in one line will assure a sustenance in old age as well as provide for his present needs. But he is a wide-awake, energetic, ambitious sort of a person, and he may prefer to bend all his energies to the work in hand with the idea of being free to seize any opportunity that may arise, and in the end benefiting himself more than any pension would be likely to do. At any rate, the subject is one of great interest and importance and worthy of the careful attention of American electrical companies, which have not as yet, we believe, established the pension system to any great extent.

Thomson and Weston Instruments in Interference in the Patent Office.

Washington, D. C., January 30.—The commissioner of patents has just rendered a decision in the interference proceedings brought by Elihu Thomson against Edward Weston, with reference to the priority of an invention covering an electric measuring machine. The case was brought before the commissioner on an appeal entered on behalf of Mr. Weston from the decision of the examiners-in-chief by which priority of invention was awarded to Professor Thomson, on the third count of the interference proceedings, which reads:

"Two electric measuring instruments, each provided with an index needle operatively connected with the rotary or moveable part of its own instrument, said rotary or moveable parts being located in the magnetic fields between the opposite ends of a pair of energizing magnets."

Referring to this count Mr. Weston claimed in his preliminary statement that his invention was conceived on or about July 16, 1893, and was disclosed at that time. Working drawings were begun under his direction during November of 1896, and at least one complete, full-sized working instrument coming within the terms of the issue was constructed under his direction and was completed not later than October 21, 1897. In addition to this he exhibited a blueprint of the working drawing. The testimony failed to show definitely when the first instrument embodying the invention was made, but Mr. Weston stated that his books showed that an order for an instrument was received in September, 1897, and was shipped November 4th of the same year. In addition to this the testimony of his assistant went to show that the first instrument was designed in November, 1896; that the first orders for same were filed April 6th and filled in July of the following year. To sum up the evidence, it is sufficient to say that Weston proved a date of conception and disclosure on November 23, 1896, and a reduction to practice on October 21, 1897.

Professor Thomson alleged that the invention set forth in the declaration of interference was conceived by him about the last week of July, 1894, at which time he made sketches of it and explained the idea of the invention to one of his assistants, and instructed him to make an instrument in accordance with them; that the full-sized working device was made during July and August; that prior to September of that year the instrument was tested and calibrated in the instrument room of the General Electric company at Lynn, Mass., and that since that time it has been used for the purpose of testing electrical apparatus, and that no other instrument embodying the invention has been made or used.

In the evidence, on his own behalf, of Professor Thomson, he states that he had completed a form of voltmeter called an "astatic voltmeter" in May, 1894; that he undertook to apply this construction to an ammeter in June; that at about that time he conceived the idea of combining the ammeter and the voltmeter in one instrument and spoke to one of his assistants about the matter; that the idea was particularly in his mind because he proposed to remodel the lighting plant in his own house early in that fall; that the instrument was constructed according to his instructions during July, and was found by him completed when he returned from his vacation on August 6th. This was a working instrument, mounted on a switchboard in his model-room and was used for actual work in measurements; this model-room was not open to the public, in fact, was private, there being a notice on the door forbidding entrance to anyone not engaged in the shops, unless by permission. The only person who used the instrument, so far as known, was the assistant to whom it had first been explained.

Professor Thomson was asked why he did not patent this instrument at the time, and he stated that he was engaged in looking after the patenting of a voltmeter and an ammeter separately, and consequently had a good deal of patent business on hand at that time; further, that his attention was not called specially to this instrument as being suitable for patent, and that because he was doubtful of the patentability of the invention he took no steps toward the filing of an application; but when he noticed that Mr. Weston had obtained a patent for a similar device he took such steps and wrote to the patent department of the General Electric company about the matter.

In support of Professor Thomson's evidence was that of his assistant, to whom he referred as the first person to whom he disclosed the invention—Shand—who stated that his earliest recollection of the machine was in the summer of 1894, when Professor Thomson instructed him to make the instrument in question according to working models which were furnished. These he gave to a mechanic for his guidance, and the mechanic worked on the instrument during the month of June and subsequently; that when it was in shape to be calibrated he took it down to the instrument room at the factory in charge of Holden, where it was calibrated; that the instrument was then taken to Professor Thomson's mechanical laboratory, known as the model-room, where it was connected in a direct current and kept under observation for a few days, when certain defects were observed and corrected; that the instrument was completed and put in its present position previous to September 1, 1894, and that it had been in continuous use since its completion. He also stated that outsiders were not admitted to this room, although certain employes went in to make use of instruments and apparatus contained therein.

The result of this testimony was that the examiner of interferences found that Professor Thomson is entitled to a date as early as June, 1894, for the conception and September 1, 1894, as the date of completion of a full-sized device, and awarded the priority of invention to Thomson, but called the attention of the commissioner to the fact that he did not deem him to be entitled to a patent, upon the ground that he did not bring his invention to the Patent Office. The examiners-in-chief took the ground that the said delay should not act as a bar to the granting of a patent, and declined to call the commissioner's attention to the matter, giving their reasons as follows:

"We do not regard it as necessary at this time to take any such action, for the reason that we are not prepared to say that Thomson's delay was in this instance of such a character as to estop him from now asserting his right thereto. We know of no decision of the courts refusing a patent to the first inventor under the circumstances of this case., viz., where an inventor has completed an invention by an actual reduction to practice and has kept such invention in his possession and in actual use, and has promptly asserted his rights thereto as soon as he became aware that another inventor was making a claim thereto. The circumstances of the present case seem somewhat analogous to those in the case of Estey vs. Newton and others quoted."

Among his reasons for appeal Mr. Weston noted that the examiners-in-chief erred in finding that Thomson ever reduced the invention to practice and in not finding that what he did amounted to no more than an experiment, and that they also erred in awarding him priority, on the ground that Professor Thomson's proofs failed to show with the certainty required by law where the burden of proof rests upon the applicant, as it did in this case.

The commissioner decided that it was not necessary to determine whether Professor Thomson had discharged the burden resting upon him as to reduction to practice, but rather whether he was entitled to a patent. The circumstances that Professor Thomson made no move to patent the invention—that he kept it hidden away and that the public were unacquainted with the instrument, its use or its benefits, until after someone else had patented the device—would, in the opinion of the commissioner, render Professor Thomson not entitled to a patent under the authorities.

The examiner of interferences was held to be correct in calling the commissioner's attention to the fact that in his opinion Professor Thomson was not entitled to receive the patent, and the question arises whether priority should be awarded him over Weston because he made the device before Weston, and then, after such award of priority, whether his application could be rejected on the ground that he is not entitled to a patent.

The practice of the Patent Office has not been uniform in such cases, but after a careful consideration of the subject the commissioner expressed himself as of the opinion that it would be well to follow practice in other similar cases to the end that where an inventor has reduced an invention to practice, applied for and obtained a patent, and given the benefit of the invention to the public, a cloud should not be thrown on that patent by a pro forma award of priority to his rival, who comes into the Patent Office after seeing the patent and introduces as evidence of his claim to priority a device made long before the patentee's, but kept secret and not given to the public. It was, therefore, decided that Professor Thomson was not entitled to an award of priority.

A. F. T.

Acetylene Gun for Prevention of Hail.

In a recent consular report from Lyons, France, a cannon used for the prevention of hailstorms is described which is different from anything else heretofore used for the purpose. It is manufactured by an Italian firm, and is intended to obviate the necessity of keeping a supply of explosive material on hand for charging the gun. The explosive agent is a mixture of air and acetylene, and is fired by an electric igniter. The gun is connected with an acetylene generator, and is thus always ready for use. A charge of 65 pounds of calcium carbide serves for about 1,000 discharges, and will last six months. The valve between the explosion chamber and the acetylene generator is controlled electrically, and the operation of the gun consists in closing the gas-valve circuit for a few seconds, then opening it and closing the igniter circuit to fire the charge. As the generation of gas is automatic and there is no residue from the firing, a battery of guns may be installed, covering a large area, and be fired simultaneously from one station by a single operator. The system has proved so successful that the insurance agents whose business it is to insure crops against hail are fighting its adoption. In France and Italy hailstorms have wrought great destruction to the grape crops, and hence the new acetylene-gun system of protection is given careful consideration by the winegrowers.

British Electrical Superannuation Fund.

Mr. E. Garcke (whose address is Donington House, Norfolk street, London, W. C.) gives the following particulars of a pension fund for electrical men, in letters to the English electrical papers:

The British Electrical Superannuation Fund is now fully constituted, with Lord Vaux of Harrowden and Mr. George Herring as investment trustees, and with a representative committee of six acting as managing trustees.

The staff of the British Electric Traction company has given the fund satisfactory support, and our associated companies have now been invited to join. The rules of the fund have been drawn up expressly with a view to enable any electrical company to participate in the scheme should it wish to do so.

The broad lines of the scheme are as follows:

The funds will be invested in the names or under the legal control of the investment trustees. Careful consideration has been given to the investment clause with a view to secure as high a rate of interest as is compatible with safety. This object has been attained by giving the trustees a very free hand in regard to the character of the investments they may make, but strictly limiting their powers in regard to the proportion of the total funds which they may place in any one company or form of security.

The affairs of the fund will be under the immediate management of an elective committee equally representative of the contributing companies and the contributing members. A quinquennial valuation of the fund by two independent actuaries is provided for, stringent rules insuring that the report made by the actuaries shall not be disregarded.

Speaking generally, each contributing company must make monthly a contribution equal to three per cent. of the monthly salary of each contributing member on its staff, and the member himself must make monthly a contribution equal to 2½ per cent. of his monthly salary, plus, in the case of those over 24, a certain extra percentage, varying with age.

The "retiring age" is 60, and a member must be of at least 10 years' standing before he is entitled to a pension. Upon retirement a member will receive, for every year of service, one-fiftieth of the average annual salary received by him during the seven years preceding retirement, the maximum scale of pension being two-thirds of salary. It is important to note here that service with any and every contributing company counts toward pension, so that an officer can pass from the service of one such company to that of another without injury to his pension prospects.

"This scheme, I should add," concludes Mr. Garcke, "is intended to apply only to those who are on the monthly salary list and who are between the ages of 18 and 45. For the provisions which exist in regard to members who wish to reckon their back years of service, in regard to members whose percentage contributions are heavy by reason of their age, and in regard to the contributions of and on behalf of the present staff of a contributing company, I must refer any firm interested to the trust deed and rules, which are to be had on application at this address to Mr. W. G. Bond, the secretary of the fund."

Iowa Electrical Association.

The annual meeting of the Iowa Electrical association will be held in the clubrooms of the Savery Hotel in Des Moines, Iowa, on February 20th and 21st. A good programme has been prepared and an interesting meeting is anticipated. Papers have been prepared and will be read upon the following-named subjects: "An Analysis of the Cost of Supplying Electric Current and the Various Systems of Rates;" "The Regulation and Control of Wiring;" "Central-station Heating—Mechanically and Financially;" "The Renewal of Incandescent Lamps;" "The Gasoline Lamp;" "Experiences with Mechanical Draft;" "Pounds of Coal Required to Produce One Kilowatt-hour;" "How Can Delinquent Bills be Prevented Without a Net Loss of Business?" "The Massachusetts Laws." The present officers of the Iowa Electrical association comprise the following-named gentlemen: President, W. J. Greene, Cedar Rapids; vice-president, H. H. Caughlan, Ottumwa; treasurer, George S. Carson, Iowa City; secretary, W. B. Keffer, Des Moines; executive committee, W. J. Greene, Cedar Rapids; H. H. Caughlan, Ottumwa; W. B. Keffer, Des Moines; W. S. Porter, Eldora, and A. Edgecomb, Missouri Valley.

Chicago Electrical Association.

At the meeting of the Chicago Electrical association on February 1st an open discussion was held of the recent changes and revisions of the Board of Fire Underwriters' Rules. On February 15th, the date of the next meeting of the association, Charles A. Brown of Charles A. Brown & Cragg will present a paper on "The Present Status of Patents Affecting Electrical Industries." The meetings of the association are held at 1741 Monadnock block, at 8 p. m.

DEVELOPMENT OF THE TELEPHONE FIELD.

Indiana Telephone Items.

The city of South Bend has ordered the telephone and telegraph wires underground.

A petition, signed by many citizens of Putnam County has been presented to the City Council of Greencastle, asking the privilege of erecting poles and wires in the city for a new telephone system.

The annual meeting of the Home Telephone company of Elkhart County, owning the Independent plants at Elkhart and Goshen, with a number of diverging rural lines, was held in Elkhart recently, and the following-named officers elected: President, C. W. Miller of Goshen; vice-president, I. O. Wood of Goshen; secretary, G. H. Fister, and treasurer, H. B. Sikes, both of Elkhart.

Under the Indiana statute providing that telephone companies must furnish equal facilities to all, and providing a penalty of $100 for a violation of the act, the Indiana Appellate Court holds that where a prospective patron makes several demands in good faith, the company is liable for as many penalties as it has made refusals. But the court holds that a telephone company may discontinue service when bills are not paid, regardless of the fact that the subscriber claims that the company is indebted to him and seeks a set-off. The court said that when a subscriber sues a telephone company for a penalty for refusing to give him service and the company answers that the service had been discontinued because the subscriber had failed to pay his bill, a reply that other subscribers had failed to pay their bills is bad, on demurrer, both as a departure and because a refusal to pay is not equivalent to a failure to pay. In this case A. B. Irvin sued the Rushville Co-operative Telephone company to recover the statutory penalty. After his service was discontinued he demanded service 10 times and then recovered judgment for $1,000. The Appellate Court reversed this judgment, holding that a telephone company cannot be required to stop and adjudicate claims against it when collecting rental. The outcome of this suit has been watched with interest, and the reversal is gratifying to telephone companies throughout the state.

The Austin Brothers have purchased an interest in the Kokomo Independent telephone plant. When completed it will represent an expenditure of $50,000, and it is claimed that it will be the most-modern and best-equipped system in the state.

Fifty physicians of Anderson decided recently to order out the Central Union telephones and use only those of the local company. They pay $4,500 a year for telephones, and think they can save half this amount by agreeing among themselves to use but the one system.

The Commercial Club and citizens of Logansport generally demand that an ordinance be passed establishing a $12 and $18 rate. It is asserted that the Central Union company will accept the reduction rather than abandon the field, but, should it decline, the Indianapolis company will step in. The former, which now enjoys a monopoly, having killed off the Independent line, insists upon an open franchise with no rate restrictions. Under competition, service was had at $12 and $18, but the company asserts that the rate was a money-losing one.

The Indiana Supreme Court has handed down an important decision, involving the right of telephone companies to lay conduits under the sidewalk. Henry Coburn asked for an injunction and compensation against the New Telephone company for putting wires beneath the sidewalk in front of his house in Indianapolis. The court refused both, and held that laying underground telephone wires and the necessary conduits to contain them beneath the sidewalk of a street in a populous city, three feet from the property line, is not an additional servitude on the fee for which the owner of the abutting lot is entitled to compensation. "The dedication of a street to the public leaves in the owner of the fee a right to make any use of the land below the surface for vaults or other purposes, not inconsistent with the superior right of the public to use the land for street purposes. But such dedication gives to the public the right to make any use of the street that will facilitate communication in the daily transaction of business between citizens in different parts of the city or country, whether by traveling on foot, with horses or vehicles, or communicating with each other by some means that does not involve actual passage through or along the street."

The Central Union Telephone company announces that it will enter the Hartford City field for local business. Heretofore it has contented itself with the long-distance business, but the Independent company, which has a large list of patrons there, has been making inroads on the long-distance business, and the Central Union company proposes to retaliate by establishing a local exchange. F.

Ohio Telephone Notes.

The Citizens' Telephone company of Zanesville, which was incorporated recently, and the Zanesville Telegraph and Telephone company have made preparations to apply to the Town Council of Zanesville for directions in regard to the construction of plants. The exact position of these two companies cannot be ascertained as yet, but it is not probable that they will both construct plants in the town.

At a meeting held in Toledo recently the organization of the Toledo Telephone, Telegraph and Messenger company was completed by the election of the following-named officers: President, J. H. Bellows; vice-president and counselor, C. F. Watts; secretary, H. A. Merrill; treasurer, A. M. Hough. Within a short time an ordinance granting a franchise to the new company will be presented to the City Council, and if it passes, work on the new plant will be started at once. The central office will be patterned after the Pittsburg Independent office, and there will be a number of sub-stations at different points in and about the city. The officers say that they propose to give Toledo a service second to none in the country, and in order to show the people that they are fair and honest with them, they say they will allow their ordinance to be published in the local papers before it is presented to the City Council.

The annual meeting of the stockholders of the Sandusky Telephone company was held January 28th, when directors were chosen as follows: A. J. Giedman, John Whitworth, C. L. Engels, L. Duennisch, Henry Pfeil, Jr., Jacob Kuebler, J. A. Biehl, George Fieck, J. C. Hauser, L. L. Curtis, C. C. Curtis, J. W. Holland, Henry J. Beilstein, S. Kilbourn and John Sinnerson, Jr. The directors organized the board by the election of the following-named officers: President, Louis Duennisch; vice-president, Jacob Kuebler; secretary, Arthur C. Arend; treasurer, J. C. Hauser; manager, C. C. Curtis.

At the last meeting of the Elyria Telephone company, Elyria, Ohio, the following-named officers were chosen: President, W. E. Brooks; vice-president, F. H. Sudrow; secretary and treasurer, James A. Dake. The regular dividend was declared.

C. E. Yoder has sold his telephone plants at New London and Greenwich to a number of men of New London, who will probably organize a company and greatly extend the service.

Frank L. Beam, manager of the Citizens' Telephone company, Columbus, has sold his mercantile establishment at Mount Vernon to Kirby & Dowds. Mr. Beam has conducted the business since March, 1880, and he relinquishes it only because his interests in the telephone business are increasing, and he is no longer able to give it the personal attention that it should have.

The Winona Central Telephone company, incorporated a few days ago, has taken over the plant at Winona, which has been conducted on the co-operative plan for some time. It forms another link in the Columbiana system, and is very closely related to the Columbiana County company.

The Central Union Telephone company has asked for a new trial in the case against the Bryan Telephone company, Bryan, Ohio, which was practically dismissed from the courts by Judge Wanty. The costs now amount to over $500.

The Clinton County Telephone company, Wilmington, has issued a handsome new directory. This company now has 378 subscribers in the town and a total of 572 in the county.

The Cleveland Plain Dealer says the Everett syndicate is reaching out for the Independent telephone interests of the state, and that it will eventually control a large part of the property. There is no doubt that this is true of the long-distance business, but outside of the money already invested in the local plants over the country, there is being no great attempt made to secure others. It seems that the primary plan is to get all the local exchanges connected up with the long-distance lines, rather than to own the local plants. The United States Telephone company is rapidly building up its lines throughout the state, and is connecting with the lines of all the states bordering on Ohio. Where necessary, money is put in local plants to help them along, and at the same time further the interests of the parent company, but beyond this an attempt to secure them outright has not yet come to the surface. O. M. C.

Telephone News from the Northwest.

The Northern Minnesota Telephone company has been granted a franchise for a local exchange at Melrose, Minn.

The Central Minnesota Telephone company of Willmar, Minn., has absorbed the system of the Northern Minnesota Telephone company, including toll lines from Wadena, Park Rapids, Fergus Falls and other towns in that vicinity.

The Dell Rapids (S. D.) Telephone company will put in a new switchboard and make other improvements.

The Hennepin delegation in the Minnesota Legislature has been appealed to by members and ex-members of the Board of County Commissioners to work for the repeal of the gross earnings tax on telephone companies. The petition claims the tax is too low, and that it enables the companies to escape a share of taxes for permanent improvements, and that the state gets all the benefit of the tax, the county and city not participating.

The Inland Telephone company will make a number of extensions of its system from North Yakima, Wash.

The Tabor Telephone company is arranging to extend its lines to Farragut, Iowa.

The council of Des Moines, Iowa, has received unofficial intimations to the effect that the Iowa Telephone company is preparing to renew its request for a new franchise in that city. Since the change in the handling of stock in the Mutual Telephone company of Des Moines, there have been some fears that the Iowa company would absorb the Mutual.

Farmers near Stanton, Iowa, plan to build a telephone line to Bethesda from Stanton.

A rural telephone line from Wilton to Durant, Iowa, will be put in operation as soon as possible.

The city engineer of St. Paul will work to have all telephone and other electric wires in the business district underground by September 1st.

The Citizens' Telephone company of Mankato, Minn., has filed amended articles of incorporation, with $100,000 capital stock.

A mutual telephone company is projected at Hooper, Neb.

The council of Billings, Mont., has tendered the Rocky Mountain Bell Telephone company a franchise for 15 years, instead of the perpetual one asked by the company.

The Osseo (Wis.) Telephone company plans to extend lines to Mondovi and Eau Claire, Wis., if enough stock is sold to do so.

The Norman County Telephone company, at its recent annual meeting in Ada, Minn., voted to establish a 100-drop system for Ada, and build toll lines to Fargo and Crookston; also lines east to Faith, Flom and Ulen.

The Fergus Telephone company of Fergus Falls, Minn., has offered one free connection to all farmers through the county, on the company's toll lines, in order to give them a demonstration of its workings, and to educate them to the use of the long-distance service.

A meeting was held recently in Marshalltown, Iowa, of representatives of rural telephone lines of central Iowa, looking to closer connection with the cities. There are about 1,000 farmers' telephones in the central part of Iowa.

The Davenport (Iowa) office of the Iowa Telephone company answered 20,048 calls and 19,615 calls on two days recently, when a count was kept.

The Monroe (Wis.) Telephone company plans to place a local exchange at Blanchardville, Wis., and to make improvements to the Monroe system.

The Wood County Telephone company, at its recent meeting at Grand Rapids, Wis., discussed the matter of rebuilding its lines and making all-metallic circuits.

The subscribers of the Blue Earth Valley Telephone company, at Winnebago City, Minn., have petitioned to the company for continuous service and offer to have the cost increased to $1.25 a month.

The Edgar Telephone company has just opened an all-metallic exchange at Edgar, Wis. It starts with 20 patrons, and has accommodations for 50.

At its annual meeting in Appleton, Wis., the Fox River Valley Telephone company discussed plans for establishing local exchanges at Appleton, Kaukauna, Neenah, Menasha, and the extension of toll lines to Seymour, with a local exchange there. R.

The Zanesville Telephone Case.

An attempt is being made in Zanesville, Ohio, to secure a rehearing of the Zanesville telephone case in which the Supreme Court reversed itself some time ago. The grounds are that several propositions laid down by the court in the last syllabus are not sound. It is said that in case the rehearing is not granted the case will be taken to the United States Courts, if it is possible to make a federal case of it, which is doubtful. City Solicitor Griffiths and Attorneys Durban and McDermott have charge of the matter, the latter two in the interests of the Bell Telephone company which is aiding the city officials to keep out opposition. Attorney-general Sheets of Ohio has stated that if the interpretation of the laws as made by the Supreme Court in this case is correct, then a great many of the franchises granted in various towns of Ohio are invalid. This is on the theory set out by the court that a city does not have the requisite authority to charge any certain sum for the use of the streets and thoroughfares of a town by a telephone company, but may make a charge for keeping them in repair, which duty devolves upon the City Council. Where a city has made it one of the conditions of a franchise that a certain amount shall be paid for the use of the streets, the franchise would be rendered invalid, according to the belief of the attorney-general.

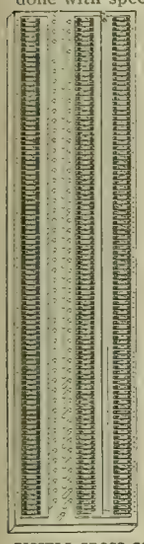
The work of constructing the telephone line which is to connect Paris and Rome is said to be making great progress. Connections with Paris on the French side of the Alps have already been completed, and on the Italian side the line is practically complete, the connections with Turin and Novi on to Genoa being all that remains in hand. It is expected that direct telephone communication between Paris and Rome will be established by April.

Bissell Cross-connecting Board.

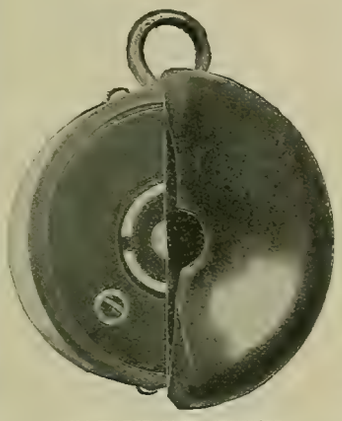
A cross-connecting board for telephone exchanges that combines among its most prominent advantages convenience in operation, compactness and low price has been brought out by the F. Bissell company, 114 St. Clair street, Toledo, Ohio, jobber of electric and telephone supplies and machinery. With this board, which is illustrated in the accompanying cut, the electrician has directly in front of him the contacts for cable wires, contacts for switchboard wires, fuses, lightning arresters and ground strips. He can therefore work with great advantage and rapidity. The usual size is for 50-pair, or 100-conductors, occupying only a space of 9⅛ by 38½ inches. A number of panels may be arranged side by side, and cross-connections from one to the other are easily made by carrying the wires above the top or below the bottom pins.

The manufacturer says that in an exchange for 1,000 subscribers, with metallic circuits, a cross-connection from No. 1 to 1,000 will take about 23 feet of twin wire and five minutes' time. No particular framing or supports are required with the board. The panels may be attached to the wall in any convenient manner, and should be set out far enough from it for the cables to run behind them, or the panels may go against the wall and the cables run between them, though this is not the most desirable method.

It is advisable that the contacts to both the outside cables and to the switchboard cables should be made permanently. When cross-connection is made it is done with special twin wire, and no permanent con-



BISSELL CROSS-CONNECTING BOARD.



NEW WATCH-CASE RECEIVER.

tacts are disturbed. The twin wire may be soldered to contacts with further advantage—unless changes are frequent.

The Bissell company, which manufactures these cross-connecting boards, also makes pole houses, iron pole seats, cable-distributing boards, fuses, cable heads, etc., and is prepared to make prompt shipments of all orders.

A Missouri Editor's Enterprise.

Omar D. Gray, editor of the Sturgeon (Mo.) Leader, within the last year has had erected, equipped and connected with his printing office in Sturgeon an extensive system of telephone lines, radiating not only to several of the other towns of that county, but to a large number of farm homes. He started the enterprise solely with the expectation that it would aid him in gathering the county news for his paper. But it has grown and developed with such unexpected rapidity that Mr. Gray and his present partner, ex-Postmaster Morris, find themselves owners of a valuable and extensive rural telephone system. Mr. Gray says that the telephone and newspaper business work nicely together. Every printer in the office is taught how to manipulate the switchboard, and the telephone operators know how to set type, so that in case an operator is taken sick one of the printers moves into the telephone office, and vice versa. Every telephone subscriber is a reader of the paper, and Mr. Gray thinks before many months all of his readers living tributary to the telephone lines will be subscribers to the telephone.

Apparatus Wanted at Huntingburg, Ind.

The consolidation of the Home Telephone Promotion company and the Dubois County Telephone company was effected at a meeting of both companies held on January 28th at Huntingburg, Ind. The consolidated company has taken the name of the Dubois County Telephone company of Huntingburg, Ind., and its capital stock is $10,000. The system has about 95 miles of farmers' and toll lines and two metallic exchanges in operation, and contemplates putting in a full-metallic (perhaps common-battery) exchange at Jasper as soon as the weather permits, and smaller exchanges at Birdseye and Ireland later on during the summer. Manufacturers are invited to send descriptions and prices of all kinds of telephone material to the secretary, H. C. Rothert, Huntingburg, Ind.

Citizens' Equipment in Terre Haute.

The Independent plant of the Citizens' Telephone company of Terre Haute, Ind., which was promoted and constructed by Henry A. Coit of St. Louis, will shortly be put into operation. Mr. Coit, who is at present general manager of the company, says that, when finished, the company will have one of the best equipped and most modern exchanges in the United States. It is expected that from 1,200 to 1,500 subscribers will be supplied at the start. All the apparatus and telephones are being furnished by the American Electric Telephone company of Chicago, the balance of the materials also being of standard manufacture. The common-battery system will be used. The franchise for the Terre Haute plant was originally granted in 1886, but the construction of the system did not assume definite shape till Mr. Coit took hold of it late in 1899. Since that time he has devoted most of his time to this work and must feel gratified at the excellent results accomplished. Mr. Coit does not expect to remain in Terre Haute definitely, but now that all the details of the installation there have been arranged, he will have time to devote to new enterprises, and it is understood that he has several large propositions under consideration.

New Watch-case Receiver.

The watch-case telephone receiver illustrated herewith is one manufactured by the Electrical Appliance company of Cincinnati, Ohio. It is of the double-pole type, though it has but a single coil. This coil is circular in cross-section, hence it has the lowest resistance for a given number of turns of wire. The magnetizing effect of such a coil when the pole-pieces are properly designed is most efficient. The company says that where two coils lie close together, side by side, as in the ordinary receiver, a considerable portion of the wire between the poles is dead resistance, the magnetic effect of one neutralizing that of the other. Other points of merit in this company's receiver are full strong thread, to hold the cap in place; absence of small wires that may be easily broken; strong and lasting magnets; uniform distance between the diaphragm and pole-pieces; cord-tip binding posts, which cannot turn, and have strong screws to hold the tip; supporting ring, insulated from the shell, and ample weight to properly operate the cut-out. These receivers are furnished in any desired finish, nickel-plate, oxidized copper, etc., and are wound to any resistance that will best meet special requirements. These points will be appreciated by anyone who has had experience with receivers. This receiver is remarkably efficient in reproducing articulate sound correctly, and it is not excelled by the standard-size receiver, it is said.

NEW COMPANIES.

The Edgar Telephone company of Paris, Ill., with capital amounting to $52,000, has been incorporated by L. O. Jenkins, Harry M. Vansella and E. E. Jones, to do a general telephone business.

The Galesburg Union Telephone company of Galesburg, Ill., has been incorporated, to operate a telephone system. The capital stock is $100,000, and the incorporators are John Pool, L. W. Cutler and L. R. Lockwood.

The Guyandotte Valley Telephone company of Huntington, W. Va., has been chartered, with an authorized capital of $25,000, to construct and operate telephones. The incorporators are T. S. Scanlon, C. B. Campbell, R. L. Archer and others.

The Southern Telephone Construction company has recently been organized at Knoxville, Tenn., by W. O. Rhode and Walter S. Roberts of Knoxville and Charles L. Meyers of Nashville. These gentlemen have, until recently, been with the Cumberland Bell Telephone company in executive capacities. They will now build Independent telephone systems, having secured rights for certain equipment for all the southern states and Mexico.

TELEPHONE MEN.

John F. Engle has resigned as superintendent of the Lancaster Telephone company, Lancaster, Ohio, in order to accept a good position with the United States Telephone company. Charles Sheriff of Columbus has been chosen to take the place thus made vacant.

At a meeting of the directors of the Southern Bell Telephone and Telegraph company, held in New York city on January 30th, W. T. Gentry of Atlanta, Ga., was appointed general manager of the company, with headquarters at Atlanta. Mr. Gentry succeeds Charles H. Wilson, formerly of Chicago, who resigns to accept the position of general superintendent of the American Telephone and Telegraph company, with headquarters at New York.

GENERAL TELEPHONE NEWS.

The Norwegian government has purchased the private telephones of the country, and the telephone service of the kingdom is now in the hands of the government.

New Louisville, Ark., has granted a franchise to a telephone company, permitting it to charge $2 per month for the use of all telephones; or, $2.50 for business telephones and $1.50 for private residences.

W. C. Handlan, Jr., secretary of the new National Telephone company of Wheeling, W. Va., states that his company has booked 1,240 subscribers for the system that will be opened about May 1st, and claims that this is more than the Bell company has at present.

The Southern Bell Telephone company, of which W. T. Gentry, Atlanta, Ga., is general manager, will make extensive improvements to its system in Jacksonville, Fla., including putting wires underground and erecting a three-story brick building for its exchange.

The Missouri River Telephone association was organized at St. Joseph, Mo., on January 10th. About 20 exchanges and toll lines in northwest Missouri, southern Iowa and eastern Kansas are represented. The officers are: President, H. E. Ralston, Maryville, Mo.; vice-president, G. A. Haynie, Savannah, Mo.; secretary and treasurer, L. N. Fry, Granite City, Mo. These, with F. S. Travis of Tarkio, and J. T. Norman of Stanberry, constitute the executive committee.

Suit has been brought against the Delaware and Atlantic Telephone company by a property owner of Elmer, N. J., to enjoin the company from running wires across his land. The poles supporting the wires are not on his ground, but are on adjacent land, where they were placed with the consent of the land owners. The complainant's contention is that he owns the space above his land as high as he chooses to go, and that the exercise of the right by anyone else without his consent is a trespass.

A special meeting of the directors of the Erie Telegraph and Telephone company was held January 31st in New York city. The number of directors was reduced from 25 to 15. The following-named directors were elected: For one year, Henry R. Wilson, Frank A. Cutting, Frank M. Riter, Frederick A. Farrar, Albert A. Chandler; for two years, Francis R. Hart, William J. Latta, Walter Abbott, Charles S. Tuckerman, James J. Storrow; for three years, Philip Dexter, William Endicott, Jr., Reginald Foster, Gordon Abbott and Charles J. Glidden.

Dr. T. Tommasina, an Italian physicist, has recently made some experiments with the purpose of developing a method of studying and obtaining warnings of distant storms. His apparatus was extremely simple, consisting merely of a sealed coherer made up of granulated carbon in a glass tube with platinum electrodes, a cell of dry battery, a telephone receiver and a short length of insulated wire exposed to the outer air. With such an apparatus the electrical disturbances accompanying a storm as much as 100 miles away became distinctly audible as crackling and roaring noises in the receiver.

On the Toledo, Fremont and Norwalk electric railway in Northern Ohio, now in operation for a length of 53 miles, the train dispatcher controls the movement of trains by telephone. There are five intermediate offices and 16 other places where there is a telephone in a box, to which each conductor has a key. Printed forms are used for orders, so that only a few words have to be transmitted. Each conductor repeats every order that he receives, and, as in telegraph despatching, orders are sent simultaneously to two conductors when both can be got to the telephone at the same time. Similar systems are now in use on many of the recently constructed interurban electric railways throughout the country.

MANUFACTURERS AND DEALERS.

W. F. Warner, representing the Warner Electric company, Muncie, Ind., manufacturer of the well-known Warner generator for telephone-switchboard calling purposes, was in Chicago last week, in the interests of his company.

The Chicago Telephone Supply company of Chicago has been incorporated, with a capital of $25,000, to manufacture telephones and supplies. The incorporators are George A. Briggs, Henry L. Briggs and Blanche W. Briggs.

The Electric Appliance company, Chicago, is out with a new hotel telephone, which it claims has many points of advantage over other makes on the market. The company is sending descriptions of this instrument to dealers and contractors throughout the country.

The North Electric company of Cleveland, Ohio, announces that it has opened an office at 1511 Monadnock block, Chicago, for its western trade. George W. Conover is in charge of the office and will be pleased to see all the Chicago friends of the North company.

Synchronous Converters.

By W. E. Goldsborough.

Part II.

As presented thus far, my paper may seem to treat particularly of the single-phase converter. It is not my desire, however, to limit the discussion to any special type of converter, but had it been, I should not have chosen the single-phase type. Of all synchronous converters, the single-phase converter is commercially the least useful, and although it is well adapted to the illumination of explanatory matter, it is not well suited to the needs of practice. However, what has been said regarding the single-phase converter is equally true of the polyphase converter; in fact, it is true of it in an even greater measure. In the polyphase machine, such reactions as do exist are less abrupt than in the single-phase machine; they follow one another in a smoother and milder fashion, and as with people of similar characteristics, are easier to get along with.

With this conception of what goes on beneath the surface of the all-important armature, we can profitably turn to a review of some of the important characteristics that make the converter so valuable an auxiliary in the distribution of power.

Mention has already been made of the fact that, if a given alternating-current voltage is impressed at the collector rings of a converter, we do not get the same voltage between adjacent sets of brushes that we do between adjacent collector rings. The direct-current voltage will always be greater than the alternating-current voltage. This is because the crest of the wave of alternating electromotive force cannot have a greater value than the maximum electromotive force generated in the armature conductors that act in series between phase connection taps. Moreover, since the effective value of the alternating electromotive force wave is only √2 times the maximum value, it is not possible for the effective alternating electromotive force ever to equal the direct-current electromotive force, the direct-current electromotive force being equal to the maximum electromotive force which can possibly be generated in the maximum number of armature conductors which it is possible to have acting in series at any one time.

The table given below shows just what the theoretical voltage and current ratios are in different types of converters. They are the results derived mathematically by Mr. Steinmetz, and illustrate with accuracy the conditions that obtain in practice. The constants given assume harmonic voltage and harmonic current waves, and no allowance is made in the voltage ratios for the copper losses in the windings. In practice, therefore, a variation of as much as 15 per cent. may be found from these values, although the departure is not often more than five per cent.

Comparative Capacity Ratios of Different Types of Synchronous Converters.

	Direct Current.	Single Phase.	Three Phase.	*Four Phase.
Volts between adjacent collector rings	1	0.707	0.612	0.5
Amperes per line	1	1.414	0.944	0.707
Ratio of copper loss in rotary converter to copper loss of same machine operated as a direct-current generator at the same output	1	1.37	0.555	0.37
Relative capacity of rotary converter, and same machine operated as a direct-current generator at the same temperature	1	0.85	1.34	1.64

*Called two-phase.

One of the most important characteristics of the rotary converter, and one which it shares in common with the synchronous motor, is the ease with which it lends itself to the regulation of the power factor of the circuit from which it is operated. If the rotary is "under-excited" it will act like an impedance coil connected in the line, and produce a lagging current. As its excitation is increased, if the load is kept constant, the current comes more nearly in phase with the impressed electromotive force, and at the same time is reduced in value. Finally, a point is reached at which the armature current is in phase with the impressed electromotive force, and the armature current is then a minimum for the given load. Any further increase in the field excitation causes the converter to act as a condenser in the line. "Over-excitation," therefore, causes the armature current to increase again, as well as to attain an angular advance over the electromotive force. The machine can therefore be adjusted to counteract the inductive effects of induction motor and transformer loads, and when once set for a given power factor by a given adjustment of the field current, it will maintain this power factor practically constant for all loads. When operated from generator mains supplying power to well-loaded transformers, a synchronous converter should be adjusted to a power factor of 100 per cent., as the power factor of the transformers will closely approximate this value. When so adjusted, a good rotary will maintain this condition at all loads. This statement refers primarily to uncompounded machines, or to the simplest form of synchronous converter connected up and operated in the simplest manner.

With such an adjustment the converter will not maintain a constant pressure at its direct-current terminals, if the shunt-field current remains constant. Under this condition, with constant generator impressed electromotive force, since the speed remains constant, the alternating electromotive force induced in the converter windings remains constant. The alternating electromotive force at the collector-ring terminals will, however, usually fall off slightly as the load comes on, owing to the relative phase position of the impedance armature-drop electromotive force and the induced alternating armature electromotive force. The direct-current voltage at the commutator brushes diminishes, with constant field excitation, as the load comes on, due to the loss of voltage in the armature and commutator resistances.

If it is desired to maintain a constant voltage at the commutator, or to have the direct voltage increase with the load, provision must be made either for increasing the impressed alternating voltage or increasing the excitation of the converter fields.

In the first instance induction regulators can be successfully employed to increase the impressed electromotive force, or if automatic regulation is needed, booster transformers can be inserted in the circuits. These should have their primaries connected across the alternating mains and their secondaries connected in series with the mains.

The regulation for constant or increasing voltage at the commutator that is effected by varying the field current can either be accomplished by hand adjustment of the shunt-field resistance, or automatically by placing a number of compounding turns on the field spools and connecting these in series with the direct-current leads from the commutator brushes. To make this regulation effective, there must be considerable self-induction present in some part of the alternating circuit, and if this is not inherent in the machines or characteristic of the line from which the converter is operated, impedance coils must be connected in the mains to make up for the deficiency in the inductance of the system.

When proper line constants are assured, the field excitation should be so adjusted at light loads as to promote lagging currents in the system, i. e., the converter fields should be under-excited. With this adjustment, as the load comes on, the series winding, by strengthening the field, will cause the low initial power factor of the system to increase and the line current to come more nearly in phase with the electromotive force. Finally, the electromotive force and the current will be in phase and the power factor have reached a value of 100 per cent. If it is desired to maintain constant voltage at the converter brushes, the adjustment should be such as to produce the 100 per cent. power factor at full load. If upward of 10 per cent. compounding is desired at full load, the initial excitation should be adjusted to promote the in-phase condition at about three-quarters load.

Frequency considerations are very important when synchronous apparatus is to be used. In the case of converters it is very difficult to produce machines that will operate with satisfaction at high frequencies. Machines designed for 125-cycle working have such high commutator peripheral speeds, such narrow commutator bars, and consequently such short commutating periods, that it is hard to bring their mechanical construction into harmony with the electrical requirements. Synchronous converters working at 60 cycles represent the upper limit of successful operation, and at 40 cycles and 25 cycles the best results are obtained. Machines constructed for 25 cycles differ in but slight details from the lines followed in the construction of standard direct-current machinery.

For successful working, it is necessary that a synchronous converter be equipped with an armature having rather high inductance. This means that the coils are placed in deep slots, and that teeth with projecting heads are not objectionable. Machines with small armature self-induction do not compound so readily and are prone to "hunt." By "hunting" is meant a variation in the speed of the converter that is frequently induced by instability in the frequency of the source of supply. In trying to adjust itself to the changing conditions of frequency, an armature having little inductance does not possess the same power of "holding on" that is inherent to an armature having high inductance, and consequently it is liable not only to develop large idle currents, but to fall out of synchronism.

In starting up synchronous converters from the alternating-current side, the exciting circuit should be opened, and it is also advisable to disconnect the field spools one from another, as an undesirably high voltage is likely to be induced in the field windings. Without this precaution, the induced voltage may break down the field-spool insulation.

Owing to the fact that the starting current often exceeds by 50 and even 100 per cent. the full-load-running current of the machine, it is likely to produce serious voltage fluctuation in the distributing system. Auto-transformers are, consequently, often used in starting. They reduce the line voltage and consequently the starting current, and can be cut out when the speed of the machine has risen an appreciable amount.

When a converter is started from the alternating-current mains, an alternating electromotive force is apparent at the commutator brushes, the frequency of which diminishes as the speed increases. Near synchronism this electromotive force pulsates very slowly, and if lamps are connected across the brush leads, by their pulsating light they give an indication of the per cent. of synchronism attained. When synchronism is reached, the field circuit should be closed. The load can then be put on the converter.

A synchronous converter can also be started from the commutator end of the machine. In this case the same precautions must be taken that are observed in starting a shunt motor, and the machine must not be thrown in with the alternating-current generator until the right phase relation of the currents is attained, as indicated by synchronizing lamps or other appropriate devices.

Discussion.

H. J. Gille, St. Paul, Minn.: I would like to ask the professor if he knows whether the figures given as the ratios of the voltage, as given in table No. 1, vary with the load, or whether that ratio remains constant under all loads? The second question is perhaps not proper in connection with the converter itself, but we have found trouble in the cables on our rotary converters, with 800 amperes, running very hot, and I cannot account for it.

Professor Goldsborough, Lafayette, Ind.: As to the first question: That ratio depends upon one of two variable factors in the machine, which depend upon the design of the machine. The figures given in the table assume that the currents which are developed in the winding are sine currents. Now, depending upon the design of the machine as to whether or not the pure harmonic waves are flat-topped or peaked waves, you will have variations in that ratio. If you have a wave, for instance, that is fairly flat and at the center has a fairly sharp peak, that type of wave will give a higher ratio, owing to the peak, than would a pure sine wave which would follow the theoretical values given in the table. Again, as the load comes on the machine, the direct-current voltage falls off. That is due to the fact that there is a certain ohmic resistance on the conductors of the armature. Therefore, as the current passes from the alternating to the direct side, it has to overcome the drop of the armature conductors, and therefore as the load comes on the machine there is a lowering of pressure, if the electromotive force remains constant. Therefore, you have those two factors in variable electromotive-force ratios. As far as current is concerned, the ratios will vary from the table, because they have a constant electromotive force at the brushes of the alternating-current side of the converter. The alternating current has to take care of the hysteresis and eddy-current losses in the core. Consequently, the amount delivered on the direct side will be smaller than on the other side.

As regards the matter of the heating of the cables, that is something that I can only account for in a measure. The current which goes to the rotary armature should not differ in wave form, in general character, from the wave which is delivered to the rotary by the generator. Supposing the natural wave of the generator and the rotary are the same, then the heating of that conductor ought not to be more than you would naturally expect from any other form of alternating-current surface. In other words, if that current were put in the streets for lighting purposes, where there was no synchronous machinery connected in with it, and the distortions would be simply those that usually occur in operating static transformers, you would have a greater heating of the cable, due to alternating currents, than would occur with the same direct current. That is for the reason that the alternating currents themselves develop a magnetic field around the current which tends to repel the current to the outside layers of wire. The current being repelled, the current density in the copper increases at that point, and therefore, as the power loss varies as the square of the current, the heating of the cable may result.

An additional cause would be this: If the wave form of the generator were differed from the wave form of the converter, there would be idle currents flying between the two machines, simply to fill in the gaps of the wave forms of the two machines, and it may be that you have found a case in which your generator wave form is materially different from the rotary wave form. If your rotary has a distributed winding, which, of course, it must have, and if the generators have toothed armatures—a relatively small number of teeth which are large—the chances are that your rotary will develop nearly a sine curve and the generator will develop a more or less distorted form of wave, and, owing to the differences then of the two wave shapes, idle currents will be induced which would flow between the two machines and cause a heating of the cables.

H. Almert, Chicago: In the particular case which is cited the current goes on the rotaries from alternating current to direct current for distribution on low tension?

Professor Goldsborough: Yes, sir.

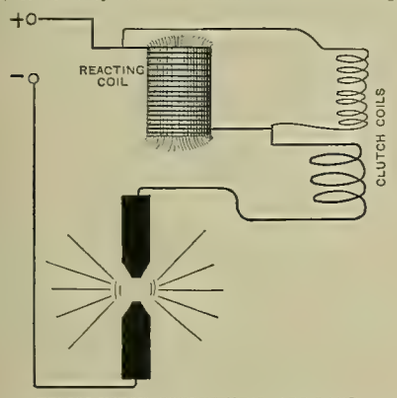
Professor D. C. Jackson, Madison, Wis.: I would like to call the professor's attention to one thing, as I imagine he would have warned you himself against misconstruing the paper, and that is where he speaks ideally of bringing the rotary transformer to 100 per cent. power factor. That can only be done ideally, not practically, for two reasons, and one is that a very small amount of current, an amount perhaps which would not interfere with the pressure, will reduce the power factor. You

understand, of course, what "hunting" is; that is, a wabbling of the rotary armature with respect to the pressure impressed. That is a reason why the rotary transformer cannot be brought up to 100 per cent. power factor. Another thing that will reduce the power factor below 100 per cent. is the fact that it is almost invariably the case that the form of the current wave and the form of the converter wave are not exactly alike, and therefore you cannot get a 100 per cent. power factor. So I say it is practically an impossibility to reach a 100 per cent. power factor with a rotary transformer or any synchronous type of machine run under ordinary conditions.

[*The end.*]

Helios-Upton Continental Arc Lamp.

The difficulties attending the designing of a really good and efficient arc lamp to operate on constant-potential, continuous-current circuits have been recognized for a long time by almost every manufacturer of electrical apparatus. However, at a recent test of the new Higham lamp in the Philadelphia laboratory of the Helios-Upton company, a 3¾ to 3⅞-ampere arc burned steadily with 108 volts around the lamp and with 95 to 96 volts at the arc, and there was also shown an arc, strong and steady, of 1½ amperes. With reference to the 1½-ampere arc, although at the time this particular test was made it was not possible to measure accurately every condition under which it was produced, owing to lack of a voltmeter of high enough resistance to admit of the measurement without lowering too much the potential around the arc, still, it is easy to understand the Helios-Upton



HELIOS-UPTON CONTINENTAL ARC LAMP.

company's assertion that in a lamp built on the principle described in Higham's patents, with certain minor modifications, using carbons about one-quarter inch in diameter, an arc consuming only 1½ amperes at 98 volts was successfully maintained on a 108-volt circuit. The arc itself was described as about three-quarters inch long, very white in color and remarkably steady, and attention is called to the valuable point in practical service that the same mechanism successfully burned an arc under the same conditions of current and voltage in the open without the enclosing vessel, although so long and thin an arc necessarily is easily made to flicker by air currents.

From hurried tests made by Superintendent Thomas Spencer of the Helios-Upton company it would seem that the desideratum of a high-efficiency arc lamp of small candlepower has been obtained. In addition, a professor of the highest standing in one of the leading institutions of technology in the United States makes this report:

The lamp was arranged to run at just 110 volts on the mains, and a rheostat was adjusted so that by a quick movement the volts at the arc could be changed from 95 for the long arc to 78 for the short arc. The extremely quick adjustment of the lamp mechanism permitted this, which was of great advantage in making the comparative tests, as at each position of the arc readings could be quickly taken for both the long and the short arc before the arc had time to travel about the carbons to any great extent. The test was very free from the usual difficulties generally experienced in testing the light and efficiency of arc lamps. I have expressed the efficiency of the arc in the usual commercial way; that is, in the number of watts required to produce a light of one spherical candle.

	Long Arc.	Short Arc.
Volts at mains	110.0	110.0
Volts at arc	95.3	78.1
Amperes	4.19	4.12
Watts to lamp	461.	452.
Watts to arc	398.	322.
Mean spherical candlepower	128.	91.3
Watts per spherical candlepower (lamp)	3.59	4.96
Watts per spherical candlepower (arc)	3.11	3.50
Gain in efficiency in lamp	27%	....
Gain in efficiency in arc	11%	....

One spherical candlepower costs 27 per cent. less from the mains. One watt taken by lamp will give 35 per cent. more light. Clear inner and opal outer globes were used.

The simplicity of this arc lamp is remarkable and is easily understood with the help of the accompanying diagram of the lamp's circuits.

In series with the arc is an open core or "hedgehog" reactance coil of low resistance but high inductance. In series with the arc is also a coarse-wire solenoid, acting upon the clutch and serving to strike the arc and to maintain the weight of the carbon, clutch and solenoid core. The core and its attached clutch and carbon "float," so to speak, in the magnetic field of this solenoid and another of fine wire which acts in conjunction with it. The fine-wire coil is shown in the diagram, just over the coarse-wire solenoid. It is in shunt around the reactance coil, and is constructed so as to have as little inductance as possible.

If this arrangement is considered as traversed by an absolutely constant current, it will be understood that there will be little or no current in the fine-wire coil. The fall of potential across the reactance coil will be only that due to its resistance, which is small, and the current through the fine-wire coil will be only that due to the small "drop" thus produced. If, however, a sudden fluctuation in the feeding current takes place, whether through outside causes or through change of resistance of the arc, there is caused an immediate potential difference of considerable amount at the terminals of the reactance coil, by virtue of its inductance. This acts instantly upon the solenoid of fine wire, moving the whole delicately balanced system, with the carbon, suspended from its core to correspond. In this way, it is said, small fluctuations tending to make the arc unsteady, or, when the current used is small, to extinguish it, are instantly compensated.

Since the arc is longer in this type of lamp, it is not difficult to see that minor fluctuations of its length due to the oscillation of the regulating apparatus are also rendered of comparatively little importance. After bringing out a commercial type of lamp to work on a current of only 3½ amperes with about 100 volts at the arc, the company thought that the limit of reduction in current consumption in such lamps had been reached. Recently, however, Mr. Spencer has been at work on the problem of producing a lamp to exhibit the same high efficiency in small units of candlepower that is claimed for the Nernst lamp.

Central-station managers, in fact, all users of arc lamps, will without doubt appreciate what it means to make the arc "strong" and "tough," enabling the dead resistance in series with the arc to be greatly reduced, or, better, practically cut out, thereby reducing the usual dead losses and at the same time enabling arc lamps to be run with greatly reduced currents, as small even as 1½ amperes. This latter improvement has been very greatly desired for a long time. Moreover, the addition of this new and simple improvement enables the amount of light given out for the same current to be increased, one of the reasons for this being the fact that less light is cut off by the tip of the lower carbon; or, what is the same thing, the same amount of steady light can be obtained with less current—an important matter for central-station managers.

Large Consolidation of New Jersey Lighting Properties.

What is considered to be the most important consolidation of electric interests ever brought about in the history of New Jersey was effected on January 31st at Newark. By means of this combination practically the entire control of the electric-lighting plants in Essex, Union and Morris counties was centered in the United Electric company, which was recently organized, with a paid-up capital of $20,000,000, and which absorbs all the subsidiary companies in the three counties named and creates a practical monopoly. The interest back of the project is the United Gas Improvement company of Philadelphia, a company controlled by the Widener-Elkins-Dolan syndicate, which for months has been reaching out for electric-light, gas and traction properties in the vicinity of New York. The companies included in the combination are as follows:

Newark—Newark Electric Light and Power company, People's Light and Power company, Essex County Electric company.

Jersey City—Jersey City Electric Light company, Central Power company, Excelsior Electric company, Hudson County Electric company, Newark-Schuyler Electric company, Consumers' Electric company, Hudson County Electric company, North Hudson Light, Heat and Power company.

Elizabeth—Union County Electric company, Suburban Electric Light and Power company, Consumers' Light, Heat and Power company, Elizabeth-Schuyler Electric company.

Morristown—Morris County Electric company.

The work of organizing this great electric company has been in progress many months, and the final union of the 21 concerns was accomplished without any serious hitches. The electric-light companies in Hudson County were absorbed by the People's Light, Heat and Power company a year ago, together with several Newark concerns. There was a halt in the negotiations to merge with the United Electric company, by reason of the refusal of several stockholders to sell out. The promoters of the United Electric company kept at work, however, and finally got control of all the People's Light, Heat and Power company stock, making the big consolidation plan possible.

The present officers of the United Electric company are as follows: President, A. B. Carlton, comptroller of Elizabeth; treasurer, Louis Lillie, treasurer of the United Gas Improvement company of Philadelphia; secretary, Thomas J. George; manager, D. Farrand. It is stated that some of the officers of the People's company of Newark will succeed to positions in the United company.

Olds Electric Vehicles.

The Olds Motor Works of Detroit, Mich., are now putting upon the market electric carriages with a number of points of excellence which, it is expected, will be appreciated by automobilists in general. Looking forward to a time when electric vehicles must undergo the same rigid inspection as is now given stationary work, the Olds Motor Works have perfected a carriage in which the construction is said to be not inferior to that found in a modern central station. The controller is decidedly new, inasmuch as it both breaks and makes contact instantaneously. It is said to be impossible to operate the lever in such a way that an arc can form at the contacts. Every circuit upon the vehicle is properly fused, and wherever slate or porcelain can be used, no pains have been spared to do so. No wire or connection touches upon wood, and neither side of the circuit is grounded in any way.

One steel casting, which covers the rear axle and all running parts, forms a very graceful portion of the running gear, and is marked by simplicity. This steel case contains the bearings, compensating and driving gear and brake band. It acts as a motor support and also a support for the rear springs. The class of workmanship upon all of the vehicles of this concern is of a superior quality, a fact which is noticeable in every part of the vehicle.

OLDS ELECTRIC VEHICLES

The accompanying illustration shows two of the recent models of the Olds vehicles in Belle Isle Park, near Detroit.

The Olds Motor Works are building a neat switchboard, made of slate, 20 inches by 30 inches in size, for charging purposes. The instruments are of special construction and built by the firm. The safety switch is of special design and very sensitive. In all of the products of the company the same effort to produce thoroughly high-grade goods is apparent. The Olds people report many orders booked and prospects good for a busy season. They are also building a small gasoline runabout, weighing only 580 pounds, which is said to be meeting with excellent success.

Electric Fountain at the Pan-American Exposition.

By Orrin E. Dunlap.

The expectation is that the electric fountain of the Pan-American Exposition will surpass every feature of this kind that has yet been presented for the public entertainment or consideration. The fountain will be located in the North Bay, which is a beautiful sheet of water 800 feet wide by 900 feet long, a part of the Buffalo Park lake system. The average depth of water in the bay is 10 feet, the depth at the center being about 16 feet. The surroundings form an ideal setting for such a picture as will be displayed when the electric fountain is in operation. The banks of the bay are about 28 feet high, and run in a gradual slope down to the water. There is a forest growth all about, and it is easy to conceive the beauty of the scene when the fountain effects are displayed against the background formed by the banks and their wooded covering.

The plans provide for the construction of an island for the accommodation of the electric fountain in the center of the bay, extending southwest by northeast. This island will be 160 feet long and 80 feet wide, while its surface will rise 10 feet above the level of the water. The island will be built of rock, in order that by day its appearance will be in thorough harmony with the lake and woodland scene. There will be no wires nor pipes in sight to indicate that the island is a fountain. The rocks will be whitened to give a better light effect as the water falls over them, but even this will not be out of harmony with the setting.

This island will be so built that throughout its entire dimensions it will form a submerged chamber, in which there will be pumps, a motor, switches, levers and valves, together with pipes and wires in great quantity. It is from this chamber that the light and water effects of the electric fountain will be controlled by operators stationed there during the evening exhibition. According to the present plans, the electric fountain will play each evening for a period of about 25 minutes. It will be possible to display from 100 to 150 combinations.

In all there will be nine different piping systems, each controlled by operating levers, which will allow the various combinations. There will be about 102 fountain effects and 22 holophote orifices. The individual jets that will make up the several combinations will be known as the grand geyser, ring curtains, ring jets, wheat sheaves, geysers, lily jets, pulverizers, fan jets and mist banks. When in operation the grand geyser will throw a 1½-inch, solid, unbroken stream of water perpendicularly 250 feet in the air. Its location will be approximately at the center of the fountain, and in certain portions of the programme it will be the center of a mammoth pyramid of water in motion. In other figures the grand geyser jet will form in itself a jagged outline not unlike a pine tree in shape. The ring curtains, when in operation with other jets, will form a cylindrical figure of water cut off evenly at the top by the limit of force given to the streams by the operating valve. The ring jets will be somewhat similar to the ring curtains, with the exception that the individual jets are further apart, and each orifice maintains its pillar of water to the highest point of projection without breaking, thus permitting, when illuminated, an appearance of threads of light thrown vertically. The pulverizers will throw water in pulsating vertical streams to a height of 25 feet. These streams will be intermittent in their action and will be automatically operated. The fan jets will form a fan-shaped figure, 15 feet high and 20 feet wide in extent, the streams of which will radiate from a common center like the ribs of a fan. The mist banks will be jets that will completely cover the surface of the whole electric fountain with a dense mist formation.

The lighting effects that will accompany the fountain display will be obtained by the use of 22 searchlights, which will be furnished by the Charles J. Bogue company of New York city. These searchlights will be the regular fountain lamp of 20-ampere capacity, so arranged that they can be diaphragmed and focused at will. The lights will show through the holophote openings, and at each holophote there will be a color screen with disks having the primary colors, through which the light will be projected.

The operating chamber proper will be located below the central portion of the fountain deck. In this chamber there will be two pumps made by P. H. & F. M. Roots company, Connersville, Ind., one of which will have a capacity of 3,000 gallons a minute, with a pressure of 50 pounds. The other pump will have a capacity of 600 gallons a minute, with a pressure of 150 pounds. The smaller pump will supply the grand geyser jet, while the larger pump will supply the other fountain orifices. The water supply will be taken direct from the bay.

In this chamber there will also be a 500-volt, direct-current motor, made by the Westinghouse Electric and Manufacturing company, which will operate the countershaft that will be belted to the pumps. The energy for operating this motor will be taken from the 500-volt circuit provided for use of motors on the exposition grounds and which will come from the service plant. The current for operating the lamps will be obtained from a motor-generating set to be installed in an artistically designed booth, situated on the west bank of the North Bay.

To Luther Stieringer, electrical engineer, and Henry Rustin, chief of the mechanical and electrical bureau, must be given credit for the plans and details of this electric fountain. In reviewing the plans, Mr. Rustin was enthusiastic over the creation and is greatly impressed with the belief that it will be one of the most pleasing effects of the Pan-American Exposition.

Comparative Incandescent-lamp Tests.

The quality of the high-grade incandescent lamps of to-day is largely the result of refinement in processes of manufacture and of accuracy in marking the candlepower and voltage according to the actual readings on a photometer and voltmeter. It is impossible, even with the utmost care, to make all lamps exactly uniform in voltage and candlepower, and hence it is customary for manufacturers to sort their lamps according to a predetermined standard. The permissible range for good lamps affects directly the factory cost of the lamps, hence the selling price, and has a direct bearing upon the quality of the product. These considerations led the Western Electric company recently to make exhaustive tests upon a large number of lamps now in commercial use, and the results of these tests are given in an elaborate publication just issued.

Fifty lamps were obtained from each of 12 manufacturers and were submitted to careful and impartial tests. For each lot of lamps is shown a target diagram based upon the watts per candle. The target, which was meant to include all good lamps, permitted a range from 3¼ to 3¾ watts per candle, a total candlepower of from 14½ to 17½ candles and a total wattage of from 52 to 60. All lamps falling outside of this target were not considered good, their inferiority being in proportion as they lacked the required elements of candlepower or wattage.

In conducting the life test, which was 600 hours in length, 12 lamps were selected from each of the sets from within the target. The results of these tests are shown by lines in large diagrams, having hours as abscissas and candlepowers as ordinates. Diagrams are also given showing the preliminary averages of the 12 lots, average lines of life tests of the 12 lots, efficiencies in watts per candle for the 12 sets and an illustration of the tests reduced to a dollars-and-cents basis. All of the data have been carefully compiled and the results obtained are very interesting and should prove valuable to all central-station managers in whose special interest the bulletin has been issued. At the conclusion is given a description of the new type Sunbeam lamp which is manufactured by the Western Electric company and which was one of the 12 makes of lamps selected for the tests. Illustrations are given of different styles of the Sunbeam lamps and of the photometer used in the tests. The bulletin, which is 12 by 14 inches in size, has been printed on fine paper, with handsome illustrations, and is a fine publication.

Chicago Aldermen Recommend a Municipal-lighting Law.

A bill reported by a joint committee of the gas legislation committee appointed by Mayor Harrison and the Chicago council committee on state legislation, which provides for the municipal ownership of gas and electric-light plants, has been passed by the council and thus recommended to the Illinois Legislature for passage. The bill as recommended is as follows:

Be it enacted by the people of the state of Illinois, represented in the General Assembly:

The city council in cities and the president and board of trustees in villages shall have the power to provide for the acquisition, maintenance and operation of gas, electric-light, heat and power plants and for the sale of gas, electricity, heat and power, produced by such plants, to the inhabitants of such cities and villages, respectively, and to make all needful rules and regulations in regard thereto; also, to provide by lease for the operation of any such plant when acquired and for the sale of the product of any such plant by a lessee.

The acquisition, maintenance and operation of such plants are hereby declared to be corporate purposes.

The laying of mains and the providing of other methods of conducting the product of any such plant through or under the streets and public places of such cities and villages are hereby declared to be local improvements.

For the purpose of establishing any such plant, any city or village may acquire property by purchase and shall have the power to take and condemn all necessary lands or property therefor in the manner provided for the taking or injuring private property for public uses.

In case of the operation of any such plant by any city or village, the taxes, rates or assessments charged to the inhabitants for supplying to them the product of any such plant shall be, from the time the same become due until paid, a lien upon the real estate on which the product of any such plant is consumed, such lien to be enforced in such manner as the city council or board of trustees may by ordinance prescribe.

In addition to all other lawful modes of providing the means to pay the expense of acquiring any such plant, the corporate authorities of any city or village may issue debentures secured by a mortgage upon such plant and a pledge of the net income to be derived from the operation or leasing thereof, but not otherwise pledging the credit of the corporation; such debentures shall bear interest at a rate not exceeding five per centum per annum, payable semi-annually, and shall not be sold or issued for less than par value; the terms and conditions of such debentures and such mortgage shall be fixed by ordinance.

All acts, or parts of acts, in conflict with the provisions hereof are hereby repealed.

H. C. Higgins of Marinette, Wis., and his brother, Thomas Higgins of Neenah, Wis., are contemplating the construction of an electric railway from Mishicott, Wis., to Green Bay, during the summer.

Grand Rapids and Lake Michigan Railway.

Work is being pushed upon the extension of the Grand Rapids, Holland and Lake Michigan Rapid railway, which is to connect the city of Grand Rapids, Mich., with the summer resorts near and along Lake Michigan. For some time about 18 miles of road has been in operation, interconnecting Saugatuck, Macatawa Beach and Holland. The extension toward Grand Rapids will require 25 miles of new construction, and will pass through Zeeland, Vriesland, Jamestown, Jenisonville and Grandville, connecting with the city railway tracks in Grand Rapids. It is expected to have the complete road in operation before July. A new power plant for the operation of the extension is to be located at Jenisonville. This plant, for the present season, will have an output of 1,000 kilowatts. The alternating-current system of generation, with a 20,000-volt distributing system and rotary converter sub-stations, has been adopted. The power house will eventually be increased to supply power for the entire road, and also contemplated extensions, at which time the present power plant near Holland will be replaced by a sub-station. The Arnold Electric Power Station company, Chicago, has been awarded the contract for the complete power equipment of the road, including power and sub-stations, upon designs submitted by the company. The power plant is to contain two vertical, cross-compound, Ball & Wood engines, running at 150 revolutions per minute, directly connected to 500-kilowatt, Westinghouse, revolving-field alternators. The boilers, condensers, pumps, crane, mechanical-draft fan and other power-station equipment have not yet been purchased. The Arnold company assumes the entire responsibility for the operation and economy of the complete plant. The road is owned and is being built by the Detroit Construction company of Detroit.

Patent Insurance.

The Patent Title and Guarantee company of New York and Washington, of which Allan C. Durborow is general agent at Chicago, has devised a system of patent protection or patent insurance. It proposes, in consideration of the payment of two per cent. per annum of the amount of protection applied for, to protect its clients against infringement, conducting at its own expense all suits necessary to establish its clients' legal rights; and in case of loss by infringement, to pay to its clients damages in such amounts as may be determined by the United States courts, to the full limit of the guaranty furnished, and 90 per cent. of all damages collected in excess of that limit, reserving the remaining 10 per cent. to indemnify itself for the cost of litigation. In other words, the company assumes the risk of infringement and incurs the cost of all litigation necessary to enforce patent or copyright protection, and give its clients indemnity against loss by infringement on payment of two per cent. of whatever amount they may estimate the damages resulting from such infringement. Mr. Durborow, the general agent of the company, was well known to the electrical fraternity of the West several years ago, when he was business manager of the Western Electrician. Since then he has served four years in Congress as the representative of a Chicago district. He has given careful consideration to the new proposition and is confident that it will appeal to inventors on its merits. Mr. Durborow's office is in the Tacoma building.

An Illustration of Municipal Ownership.

The city of Baltimore having built, at great cost, a system of subways for the purpose of renting the same to the telegraph, telephone and electric companies to carry their wires underground, one fine day an explosion takes place, and a few blocks of the city's paved streets take an aerial flight. Then comes an investigation by a committee of engineers, which committee criticises the quality of the conduit material and the concrete, and recommends "that the subway be carefully examined wherever excavations are made which expose it, and if the concrete is found imperfect at such points it be removed by the Subway Department and replaced with good concrete; that a system of mechanical ventilation, similar to the one now in use on the Empire City subway in New York, be installed for our subway, and that such arrangements for drainage be provided that in no case can water get to the cables or into the ducts." In other words, that the conduits have been built without due regard to material used, and that no provision has been made for drainage or ventilation. Now, who is responsible? Why, nobody, of course. It is the city's own work, and no one can be held responsible. Now, supposing these conduits had been built by private enterprise, would not the owners have been held to strict accountability, and would not the city compel them to perfect the same by all the safeguards possible? Well, rather.—Hambleton's Circular.

The Mankato (Minn.) Electric Street Railway, Lighting and Power company has been sold to eastern capitalists, who agree to extend the street railway from Mankato north to LeSueur Center. A southeasterly extension is also planned.

CORRESPONDENCE.

New York Notes.

New York, February 2.—The State Board of Railroad Commissioners has rendered a decision that the Brooklyn Heights Railroad company must furnish service on the Cypress Hills branch between the hours of 10 a. m. and 4 p. m., daily, but does not specify what the service must be.

The Brooklyn Rapid Transit company has announced that no more free passes will be issued, and that every passbook issued will be canceled when it is turned in for renewal. It has recently developed that there were about 12,000 people holding passbooks, and it was estimated that the company could increase its revenues about $100,000 a year by calling in the passes. Only members of the Police and Fire departments will still be carried free when in full uniform. It is understood that the new order applies even to the officers of the company. All the former officers of the company, including President Clinton L. Rossiter, have been re-elected.

It is reported that the private electrochemical laboratory of Charles Proteus Steinmetz, the well-known electrician of the General Electric company of Schenectady, was destroyed by fire recently. Part of the apparatus was saved.

Assemblyman Cooley has introduced a bill providing that no elevated or surface line shall charge more than five cents for a continuous ride within New York city. The purpose of the bill is to cut down the rates now charged on the New York, New Haven and Hartford railroad within the city limits from the maximum charge of 20 cents and the rate of 10 cents now charged on a horse-car line running from Bartow Station to City Island. The bill will also prevent the Brooklyn Rapid Transit company from charging two five-cent fares from the Brooklyn Bridge to Coney Island.

The Court of Appeals has rendered a decision sustaining the lower courts in ordering the removal of an incline on Liberty avenue, Jamaica, which was built by the Long Island Electric railway to connect the trolley tracks with those of the Kings County Elevated railway at the Crescent avenue station. About three years ago suit was brought to have the incline removed on the ground that the company did not possess a legal right to build it. The incline is 1,000 feet in length and cost $70,000. About 200 feet are solid masonry and the remainder steel framework.

William Uberoll, superintendent of the Sag Harbor Electric Light company, was recently killed by coming in contact with a high-tension wire.

The first run of the century held by the Automobile Club of America was scheduled for the evening of February 1st, and eight vehicles started at nine o'clock. The pace was set by A. C. Bostwick in an electric road carriage, and the run was to Claremont and return. It is reported that the club will make an effort to bring about the construction of an automobile road between New York and Albany, and that Col. John Jacob Astor has offered a country clubhouse to the Automobile Club.

The Long Island Automobile Club is to hold a 100-mile endurance test for motor vehicles over macadamized roads on Long Island. Prizes will be offered for electric, steam and gasoline carriages. A hill-climbing contest will be held on the 20 per cent. grade between Flushing and Jamaica, which is about a quarter of a mile long.

Francisque Crotte, the Frenchman who conducted the electrical consumption-cure experiments at St. Luke's Hospital, and who has a laboratory at 65 Central Park, West, claims to have discovered a method of electrically purifying water by means of a high-tension current. M. L. G.

From the Buckeye State.

Columbus, Ohio, February 2.—At the annual meeting of the stockholders of the Toledo and Western Railway company, held a few days ago, the former directors were re-elected. The following-named officers were chosen: President, Luther Allen; vice-president, J. R. Seagrave; secretary and treasurer, F. E. Seagrave.

The Pan-American Electric Porcelain company of East Liverpool, Ohio, has been incorporated in West Virginia, with an authorized capital stock of $100,000, of which $30,000 is paid up.

The Western Union Telegraph company is putting in its messenger service at Toledo.

It is said that negotiations will shortly be opened by the Everett syndicate for the purchase of the Canton City electric line and the line between Canton and Massillon.

Fred. Jones is negotiating with eastern capitalists for capital to build a line between Mount Vernon and Marion.

Work has begun on the power house of the Dayton and Troy Electric Railway company at Tippecanoe City.

M. Garl of Akron has invented a mechanism which is intended to expose a person when he puts a fake coin in a slot machine or telephone toll box. It is so arranged as to explode a cap when a bad coin is dropped in. Mr. Garl says a strong company will soon be organized at Akron for the manufacture of the articles on which he holds patents, including hotel and street-car telephone systems.

The Canal Commission, in its annual report made to the governor a few days ago, says that the law under which canal banks may be leased for electric-railway purposes was rushed through the Legislature with such haste last winter that but few of the members understood it. The commission has, therefore, hesitated in granting leases for this purpose.

The Board of Legislation at Cincinnati has passed an ordinance limiting the speed of automobiles to eight miles an hour, and requiring machines to carry lights at night that will cast rays 200 feet in front of them.

The Wadsworth Light and Water company, Wadsworth, has been incorporated, with a capital stock of $50,000, by William Artman, J. H. Richards, G. G. Gelsinger, Charles A. Curtis, C. M. Wertz, W. B. Huntsberger and others.

Robert Cline, who has been chosen superintendent of construction of the Central Union Telephone company, Chicago, is a former Mansfield (Ohio) man, and has risen to his present position by hard work and close attention to duty.

The long-distance line between Cleveland and Pittsburg will be completed within a very short time. Only a few miles of wire remain to be strung. O. M. C.

Information from Indiana.

Indianapolis, February 2.—The Union Traction company has voluntarily increased the wages of 200 conductors and motormen. Eleven and one-half hours constitute a day's work.

A bill is pending in the Legislature providing that the street-car lines and interurban electric roads shall be taxed by the state board in the same manner as railway companies are. The electric lines are now governed by the tax provisions of cities and counties. The effort to give the state board original jurisdiction over this kind of property is meeting with a strong protest.

The city of Hagerstown has taken steps to erect a $14,000 municipal electric-light plant.

A bill will be introduced in the Legislature to license telegraph operators and to provide a commission to pass on qualifications and issue licenses. The bill is prepared by the operators' union, and provides $2,000 salary and fees to the commissioner. If an operator becomes drunk his license may be revoked and cannot be renewed for a year.

Plans are now being formulated for connecting Indianapolis and Cincinnati by a chain of interurban electric lines. It is proposed to run a connecting link between the line from Cincinnati to Harrison, Ohio, and the Indianapolis, Morristown and Rushville road, which is now assured. Brookville is southeast of Rushville, and a company has been organized to build a road there. DeHoven then proposes to extend his line from Harrison, Ohio, to Brookville, thus completing the chain route.

The question of interurban-line franchises is an all-absorbing one in Indianapolis. The comptroller belittled the council's idea of charging two cents a trip for each car, or the original proposition of $15 a year for each car. "It ought to be at least $100 a car annually," said he. Litigation is likely to follow if a heavy charge is made. The city's contract with the local company provides that it shall allow interurban companies to use its lines into the city; the contention is that it pays for its franchise and that the city is already compensated for the use of that part of the street used by street cars, and can therefore make no further charge; that the question lies wholly between the local and interurban companies. The comptroller, however, believes that the city can exact a further charge for a further use of the streets.

A bill has been introduced in the Senate proposing an important increase in the powers of interurban electric roads. It gives such companies the right to enter on private lands to make surveys, and if the companies want land for right-of-way, which they cannot secure by agreement, they shall deposit with the county clerk a description of the land intended to be appropriated, and it shall be appraised. When appraised the interurban companies may deposit the value fixed and take possession of the land. The bill contains an emergency clause.

A Senate bill introduced in the Legislature makes the interlocking-switch law apply to interurban electric companies as well as steam roads. Another provides that the circuit judge may require one road to pass under another if deemed advisable. It applies to electric and steam roads alike.

The Wabash River Traction company, which proposed to build the electric line between Wabash and Peru, failed to file bond within the prescribed time, and the company officials have appealed to the county commissioners to permit them to file the bond now. In the meantime other petitioners are seeking a franchise, and delay is promised.

J. V. Edwards and others have filed with the commissioners of Hendricks County a petition for a franchise for an electric road along the Rockville pike, from the eastern edge of the county to the western border. Floyd Woods and others are asking for a franchise over the same route from Indianapolis to Danville. The former line is proposed to run to Rockville and the latter to North Salem, Ladoga and Crawfordsville.

A bill has been prepared for the Legislature providing that any street-railway company operating in cities of 100,000 inhabitants or over, which shall fail to provide each and every passenger with a seat immediately upon entering the car, if the passenger shall require a seat, shall be fined in any sum not less than $10, nor more than $100 for each offense. An emergency clause is attached.

The City Council of Richmond, undaunted by the injunction proceedings filed, has directed that the contract with the Varney Construction company to build a municipal electric-light plant be closed. In the meantime the fight has been transferred to the Legislature, where a bill is pending to create a board of electric-light commissioners for Richmond that will take the light question out of the hands of the council.

David O. Hockett, 13 years old, has been awarded $3,000 damages against the Indianapolis Street Railway company for the loss of a leg by being run over by a car. The boy was selling papers and was pushed off by the conductor.

W. H. McCurdy, president of the Brighton Buggy company of Cincinnati, one of the largest of its kind in the middle West, is in Indianapolis, negotiating for a site for his factory, with the intention of removing to Indianapolis. The firm will ultimately manufacture automobiles. F.

Northwestern Notations.

Minneapolis, February 2.—Joseph King has been appointed chief electrician of the new postoffice building in St. Paul. He is ex-superintendent of the police-alarm telegraph.

John B. Meagher has resigned as president of the Gas and Electric Light company of Mankato, Minn., and has been succeeded by H. A. Patterson.

Joseph Kountz and Sam Mendenhall of Bozeman, Mont., contemplate establishing a steam-power electric-light plant for Livingston, Mont. The present plant is operated by waterpower, and its service is not the best.

The Gas and Electric company of Waterloo, Iowa, which has just purchased the franchise of the Citizens' Heat, Light and Power company, and absorbed the business of the Gas and Electric Light company, has decided to ask the council for a new franchise.

Business men of Iowa City, Iowa, plan an electric line from that city to Williamsburg.

It is suggested at West Superior, Wis., that the Duluth-Superior Traction company utilize the old rails, which are being replaced on the system, with heavier, by building a line to the Falls of Black River from South Superior. The falls could also be utilized to furnish electric power.

The Park Commission of Des Moines, Iowa, is unanimous in its refusal to allow the street-railway company to run its tracks through South Park for the projected army-post line. The company sought to avoid a heavy grade by running through the park.

The officials of the state of Minnesota and the Twin City Rapid Transit company have reached a compromise whereby the company will be allowed to file its articles of incorporation upon payment of a fee of $2,325, based on the valuation of the company's property, as made by the State Board of Equalization.

There are persistent rumors to the effect that an electric car line will be built from Minneapolis to Excelsior and the south shore of Lake Minnetonka. It is believed that the Twin City Rapid Transit company will do it, at the line to Hopkins could be extended by an addition of but nine miles. The company has announced that there will be no extensions built this season.

A bill has been introduced in the Minnesota Legislature providing that cities of 15,000 to 50,000 inhabitants shall be permitted to buy electric-light plants. It is introduced in the interest of Winona.

The dean of the engineering college at Madison, Wis., has been called upon by the Legislature for an estimate of cost for a lighting plant to furnish light for the state capitol, university buildings, State Historical Library and State Hospital for Insane.

The mayor of Tacoma, Wash., recommends that the city build its own power station for the electric plant. He thinks the city has been paying too much for its power.

It is understood that the council of Indianola, Iowa, will reverse its action, in which it refused to consider a franchise for an interurban car line from Des Moines. Citizens of the town complained of the action of the council so vigorously that it is believed the matter will be submitted to popular vote in the spring.

The Seattle Electric company of Seattle, Wash., has adopted a new system of charges, which provides for a reduction in rates of 10 to 40 per cent. The schedule is 20 cents per kilowatt-hour for the first hour's average daily use of lamps, eight cents for the next four hours and four cents for all in use in excess of five hours. The company will also replace, free of charge, all burned-out and blackened lamps for meter customers.

The Duluth-Superior Traction company has revised its running schedule, and shortened the time on the line between Duluth and Superior.

A mysterious blaze in the operator's room of the police headquarters, Duluth, Minn., destroyed $1,000 worth of electrical instruments, which greatly hampers the force in the matter of making arrests.

C. J. Dixon of Milwaukee is interested in securing a right-of-way for an electric car line, to run from Green Bay, Wis., to Manitowoc. He is supposed to be acting in behalf of eastern capitalists.

An electric-light plant and Independent telephone system will be installed at Merrill, Wis. R.

PERSONAL.

Mr. Carl Hering, president of the American Institute of Electrical Engineers, announces that he is not a candidate for re-election, as he is opposed to immediate re-elections to the presidency.

A. P. Hanson, formerly of Milwaukee and at present connected with a large electric company in Berlin, Germany, has recently been decorated by the kaiser, in recognition of meritorious work done there.

John J. Eagan, who was one of the first operators to enlist with John C. Fremont's telegraph corps during the civil war, and who acted as Gen. W. T. Sherman's chief operator until the war's close, died at Dallas, Texas, on February 4th.

Mr. James R. Chapman of the Chicago Union Traction company, who is to become electrical engineer of Mr. Yerkes' tunnel road in London—the Charing Cross, Euston and Hampstead line—will leave Chicago on March 1st or 2d, sailing from New York for England on March 13th.

George P. Low, editor of the Journal of Electricity, Power and Gas, has been appointed local honorary secretary at San Francisco for the Pacific Coast members of the American Institute of Electrical Engineers. Mr. Low succeeds Dr. F. A. C. Perrine, who recently resigned from the position.

John D. Gerlach of Chester, Ill., is an applicant for appointment to the office of commissioner of the Southern Illinois penitentiary, located at Chester. Mr. Gerlach, who is cashier of the First State Bank in his city, is well known throughout the state among the electrical fraternity. In 1893 he organized the Chester Light, Water and Ice company, and is now its vice-president and general manager. Mr. Gerlach is also president of the Illinois State Electric association, having been re-elected to his office at the recent annual meeting of the society.

ELECTRIC LIGHTING.

Bids will be received until February 15th by F. Youngquist, J. Kay and H. Jall of Sherrard, Ill., for a 50-kilowatt generator, 12 1,500-candlepower arc lights and 500 16-candlepower incandescent lights with necessary appliances.

ELECTRIC RAILWAYS.

The Murphy third-rail system recently installed on the belt line in Baltimore was given a final and severe test on January 31st, when a train of 28 loaded coal cars, together with engine and caboose, was pushed from the Camden station to the belt-line terminal. The maximum current consumption was 900 amperes, and as the test was made during bad weather, it was considered highly satisfactory in its results.

PUBLICATIONS.

The Star Brass Works, 67 Canal street, Chicago, has issued a neat booklet illustrating and giving full particulars of its whitewash and cold-water paint spray pumps and also Binks' dry, non-flame, cold-water paint for inside use only. Full directions are given for using the pumps, and also formulas for whitewash.

A 12-page bulletin (No. 1013), published by the Fort Wayne Electric Works, Fort Wayne, Ind., describes the Wood type A oil transformers. This is a new line of transformers which the company is confident meets all the requirements of modern central-station practice. The features of construction of the transformers are given in detail, together with illustrations and diagrams.

In its "Green Book of Hardware Specialties" the Smith & Hemenway company of New York city does not trace its Irish ancestry, but seeks to present in compact and attractive form its well-known line of cutlery and hardware specialties, such as glass-cutters, knives, razors, shears, pliers, linemen's tools, hammers, etc. The catalogue also illustrates the goods of the Utica Drop Forge and Tool company. In the Smith & Hemenway company's handy pocket diary, also issued in green cover, are contained a number of tables and collections of important matter that are of general use and convenience.

Graphite as a lubricant, scientifically and practically considered; also its manifold usefulness as an accessory for engineers and mechanics, form the subject-matter of the revised seventh edition of a pamphlet published by the Joseph Dixon Crucible company, Jersey City, N. J. Only Dixon's pure flake graphite is considered, and the 44 pages of the pamphlet describe its most important and significant uses and advantages.

The 1901 edition of the handbook on "Standard Wiring" for electric light and power, by H. C. Cushing, Jr., of New York, is now ready for delivery. The book has been entirely revised and has been greatly added to in the way of new and useful tables, formulæ and data. The "General Wiring Formulæ" on pages 101 to 115, for all systems of wiring, should be of value to central-station men, engineers and wiremen. The suggestions contained in this book are in accordance with the fire underwriters' rules.

TRADE NEWS.

The Elwell-Parker Electric company of Cleveland has bought the former plant of the Pelton Engineering company in that city.

The Non-polarizing Dry Battery company, manufacturer of the O. K. dry battery, announces that it has removed from 625 Broadway to 447 Broadway, New York city.

The Dixie Electric Motor company of Memphis, Tenn., has been incorporated, with a capital stock of $30,000, by Walter Goodman, T. G. Galbreath, William Richardson and others.

The Electrical Engineering and Developing company of New York city has been incorporated, with a capital stock of $10,000. The directors are H. S. Cooper, Ithaca; W. S. Gurnsey, 3d., New York city, and B. Y. Frost, Nyack.

The National Electric Security company of Peoria, Ill., has been incorporated, to manufacture burglar alarms and electrical appliances. The capital stock is $30,000 and the incorporators are John H. Bontges, William Donaldson and C. E. Unland.

The H. Krantz Manufacturing company of Brooklyn, N. Y., has been incorporated by H. F. Krantz, A. H. Nielsen and W. M. Moore of Brooklyn. The company is capitalized for $150,000, and will deal in switchboards and electrical appliances.

The American Rail Bond company of Chicago has been incorporated to manufacture rail bonds and electrical apparatus. The capital stock of the company is $10,000, and the incorporators are Montraville M. Wood, George W. Conover and Wells Goodhue.

The Columbus Battery and Specialty company of Columbus, Ohio, has been incorporated to manufacture storage batteries and other electrical devices. The capital stock of the company is $10,000 and the incorporators are P. B. Chaney, J. W. Frost, E. E. Bridgman, G. W. Frost and Samuel Scott.

C. O. Baker, Jr., of Baker & Co., Newark, N. J., says that platinum has never been so high in price as at the present time, and this notwithstanding the fact that the demand has never been greater. He says that all indications, as a result of this condition, point to an early and substantial increase in the present quotations.

The Electric Storage Battery company of Philadelphia, manufacturer of the Chloride accumulator, announces that, owing to the large increase in its business in the middle western states, it has established a branch office at St. Louis, Mo. This office has been placed in charge of R. H. Klauder, formerly of the Philadelphia staff, and will be located in the Wainwright building. Mr. Klauder's extensive experience, gained during his connection with the Electric Storage Battery company, has made him thoroughly familiar with up-to-date storage-battery practice.

BUSINESS.

The Western Electric company, Chicago, has a large stock of pins, brackets and cross-arms which it is offering, it says, at attractive prices.

The New York Central and Hudson River Railroad company has contracted with the American Bridge company for two drawbridges which are to be operated by gasoline engines. One of them is to be located near New Hamburg, N. Y., and the other one near Little Ferry, N. J. Both are through-plate-girder bridges with double track.

The Central Electric company, Chicago, is the selling agent for Bullock apparatus, including the new line of alternating-current generators and motors of any size which the Bullock company is now prepared to furnish. The Central Electric company also announces that the great demand for the Hylo baby filament lamp which it handles convinces it that it fills "a long-felt want."

The General Electrical Repair company, 141 South Clinton street, Chicago, announces that it is in a position to repair or buy burnt-out transformers. The company states that it has special facilities for making repairs and rewinding armatures, fields and transformers. It also makes a specialty of rebuilding dynamos and motors, refilling commutators, and buys and sells electrical machinery.

Theodore Smith, 151 Throop street, Chicago, manufacturer of Smith's incandescent-lamp adjusters and controllers, states that these devices are meeting with ready favor among the trade and users. They are said to possess features not found in other similar devices. With their use the reflection from a lamp can be placed just where it is wanted. Mr. Smith will be pleased to send information to those interested.

A unique system of code words is used in a price-list recently issued by W. N. Matthews & Bro., St. Louis, Mo., exclusive sales agents for Stombaugh guy anchors. In this code the names of the principal parts and organs of the human body are used. For instance, for the 3½-foot anchors without rod the word is "skull;" to describe the same anchor with rod the word "brain" is employed. The idea is carried out similarly for other parts. The new catalogue descriptive of Stombaugh guy anchors will be ready for distribution within a few days.

There are, without doubt, few people among the electrical fraternity who have not heard of the Hartford Steam Boiler Inspection and Insurance company, Hartford, Conn.; but it takes a personal visit to the office of this old and long-established institution to bring one to the full realization of its scope. There is only one word to describe the influence of this company in the business of protecting steam-boiler users; it is simply "great." As explained by Secretary J. B. Pierce of the Hartford company, this institution not only makes thorough inspections and insures against loss or damage to property and loss of life and injury to persons caused by steam-boiler explosions, but it lays out plans and prepares specifications which, if followed by the insured, practically guarantee him the minimum of risk and the greatest possible amount of safety, to say nothing of securing him a most efficient boiler plant. The Locomotive, the monthly house organ of this company, gives many practical hints on the care of boilers.

The Bridgeport Brass company has, within the last few months, made shipments of its Phono-electric wire to Ireland, Australia, Nova Scotia and Canada. The success of this wire is already well known in so far as the United States is concerned. One point in particular relative to Phono-electric trolley wire has been greatly appreciated by the electric-railway people of this country. The Bridgeport Brass company asserts that with ordinary hard-drawn copper the hardened skin is quickly destroyed and the wire rapidly succumbs, and the strong claim is made that Phono-electric wire is free from this serious difficulty for two reasons: It does not maintain an arc readily and there is nothing about it to anneal. Samples of Phono-electric and hard-drawn copper wire were exposed 10 times during the space of 20 minutes to brief arcing from the surface, with the voltage kept constant and all the samples treated as nearly alike as practicable. The tensile strength was then carefully measured, and it is said that the results were remarkable in their clear demonstration of the effect above mentioned.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued January 29, 1901.

666,655. Electric Motor Controller Frame and Method of Constructing Same. Thomas W. Eaton, Chicago, Ill., assignor to the Eaton & Prince company, Chicago, Ill. Application filed October 8, 1900.

The frame described is made in sections having registering engaging parts formed in uniform relation whereby when the sections are assembled they occupy fixed and definite center relations with respect to each other. One of the sections is provided with supporting seats arranged, when the sections are assembled, to co-operate with corresponding seats on the other section.

666,656. Mounting for Electric Motors. Thomas W. Eaton, Chicago, Ill., assignor to the Eaton & Prince company, Chicago, Ill. Application filed October 8, 1900.

The exterior surface of the frame is cylindrical, turned to concentric relation with respect to the motor-shaft axis, and has bearings for the motor shaft. The bearings are also concentric with the motor-shaft axis. A supporting ring is adapted to receive the cylindrical exterior turned surface of the motor frame, whereby the motor may be readily inserted in or removed from the supporting ring.

666,658. Electropneumatic Organ Action. William B. Fleming, Detroit, Mich. Application filed January 15, 1900.

An organ is provided with an electromagnet and a battery in electrical connection therewith. A contact bar is provided with a contact finger in electrical connection with the magnet. A contact plate is bifurcated at its rear end and has the bifurcated extremities connected with a metal cross-piece forming a sliding contact with a rib on the contact finger when the key is depressed. (See cut on next page.)

666,660. Lubricating Trolley Wheel. Alfred W. Gabrio, Hazleton, Pa., assignor of one-half to Josiah T. Berryman, Hazleton, Pa. Application filed June 12, 1900.

The hub has an annular central flange and a disk rotatably mounted upon it at each side of the flange and projecting radially. The disks lie against the end faces of the flange, and have ducts leading from the chambers to the end faces of the flange, against which they contact to supply oil thereto and also to the periphery of the wheel to coat the trolley wire.

666,675. Telephone. George L. Hogan, New York, N. Y., assignor of one-half to Julian S. Carr, Durham, N. C. Application filed March 9, 1900.

A secondary circuit constitutes the line wire and contains an electromagnet which operates a diaphragm. A number of variable contacts are mounted on the diaphragm, and several primary circuits, one for each contact, embrace a secondary circuit common to all the primary circuits. The receiver is in the common secondary circuit.

666,677. Microphone. Alfred G. Holcombe, Southampton, Mass., administrator of Alfred Goodrich Holcombe, deceased. Application filed May 16, 1900.

A diaphragm adapted to vibrate under the influence of sound waves is mounted in connection with a self-contained microphone, capable in itself of taking up vibrations from the diaphragm, but being independent of

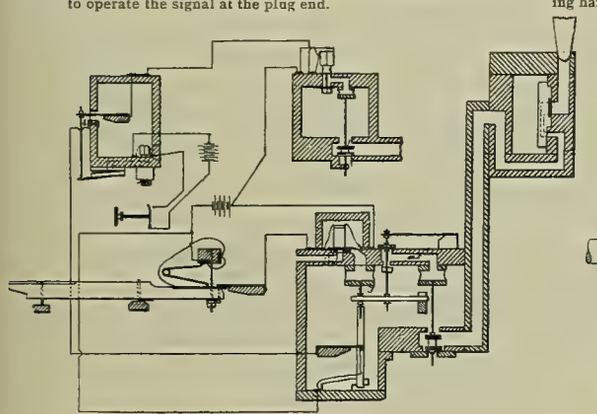
it. The microphone comprises positive and negative members of electrically conductive material, held out of contact with each other, and an independent pressure device and granulated electrically conductive material arranged between the pressure device and the members.

666,691. Electric Motor. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed February 2, 1900. Renewed December 18, 1900.

The armature rotates within an annular magnet, and the depending shaft is exterior of the casing and connected to the end of the armature shaft. The suspending yoke is pivotally connected to the sides of the magnet below the horizontal center, permitting the easy movement of the motor on its pivots.

666,698. Telephone-exchange Circuit and Signaling Apparatus. Malcolm C. Rorty, Dedham, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed October 4, 1900.

A trunk circuit extends between two central stations and terminates at one of them in a switch plug and at the other in a switch socket. A relay in the trunk circuit controls a signal in a local circuit. Apparatus at the socket end of the trunk comprises a source of current. A relay controls a connection between the two poles of the source of current and the two main conductors of the trunk circuit, and is adapted when excited to break the connection, and when unexcited to establish it. A local circuit contains the electromagnet of this relay. A switch-cord terminal plug co-operates with the switch socket of the trunk, and when inserted therein unites registering severed contacts of the local circuit, and when withdrawn reestablishes the separation of the contacts. The withdrawal of the plug at the socket end of the trunk is enabled to operate the signal at the plug end.



NO. 666,658.

666,699. Electric Elevator. Harold Rowntree, Chicago, Ill. Application filed February 17, 1900.

The controlling mechanism for the hoist operates to start the car and to arrest it automatically at any predetermined landing. There is a signal corresponding to each floor or landing at which the car is to stop, arranged in convenient relation to the controlling mechanism to indicate to the attendant before the controller is operated the proper manner of control of the motor. Push buttons arranged at each landing control the circuits of the signals.

666,706. Selective Signaling and Registering Apparatus Circuit. Herbert E. Shreeve, Dedham, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed September 18, 1900.

Two main conductors of a metallic-telephone circuit connect two sub stations with a central station containing a grounded source of intermittent current. Four keys control the connection of the circuit and source, and connect the two main conductors with the two poles of the source, and also respectively connect one or the other of the main conductors with either the positive or negative commutator brush of the source. Four normally detached earth branches, a pair for each main conductor, contain respectively a polarized electromagnetic bell in one and an oppositely polarized electromagnetic call-register in the other branch of each pair. The branches may be connected to their respective main conductors on the operation of any of the keys, and the appropriate current may be transmitted over either main conductor for the selective operation of the bell or call-register associated with the branches thereof.

666,731. Electromedical Eyeglasses. Philibert Balme, Izieux, France. Application filed March 26, 1900.

The frame of the eyeglass has its halves made of copper and zinc. There is a suitable projection on each half of the frame, and a thin wire also made up of different metals connects the projections.

666,737. Burglar-alarm System. Clyde Coleman, Chicago, Ill., assignor to George B. French, Boston, Mass., and Frank L. Hall, New York, N. Y.. Application filed May 6, 1899.

For protection of a vault or other like structure, the walls of which are impervious to waves of radiant energy, a sensitive electrical device is arranged within such vault adapted to operate upon the admission of radiant energy in the form of heat rays through an opening or entrance in the walls, and an electrical signal appliance is controlled by this device.

666,744. Terminal for Electric Conductors. Alvirus L. Ellis, Chicago, Ill. Application filed February 12, 1900.

This terminal has a socket or receptacle for the reception of an electrical conductor and a wedging device adapted to be inserted between the conductor and the wall of the socket. A screw extends substantially parallel to the conductor and has a part for engaging the wedging device to force it between the conductor and the wall of the socket.

666,764. Electric-circuit Controller. Nils O. Lindstrom and Allan Cowperthwait, New York, N. Y., assignors to Alonzo B. See and Walter L. Tyler, New York, N. Y. Application filed July 6, 1900.

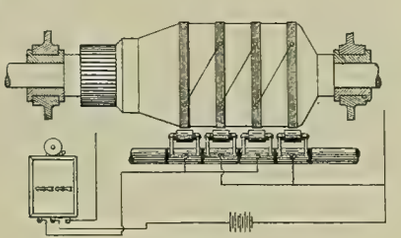
Two pole-pieces extend through a base plate and project beyond each face. Electric coils surround one end of each pole-piece, and a soft-iron plate is clamped against the ends with a sheet of insulating material interposed between the ends and the plate. An electric circuit is connected with the pole-pieces, and an armature is adapted to bridge the pole-pieces.

666,831. Device for Indicating Disarrangement of Armatures of Electric Motors or Generators. Joseph T. Watson, Philadelphia, Pa., assignor of one-fourth to Jacob E. Fritz, Camden, N. J. Application filed August 16, 1900.

A shaft is arranged below and in alinement with the axis of the armature, divided into sections insulated from each other. A roller is supported above and in electric connection with each section of the shaft. A battery circuit includes an indicator or alarm, the sections of the shaft and the respective rollers being alternately connected with opposite poles of the battery. Protective bands are wound around the armature and electrically connected to each other, the bands being arranged respectively adjacent to the rollers and adapted when the armature is depressed to be supported thereon and thereby to connect alternate sections of the shaft to complete the battery circuit. (See cut.)

666,848. Driving Gear for Printing Presses, Etc. Minor Harvey, Philadelphia, Pa., assignor to Morse, Williams & Co. of Pennsylvania. Application filed August 1, 1900.

An electric motor has its shaft in alinement with and secured to a worm shaft carrying a worm which meshes with a worm wheel on the driving shaft of the machine. A bed plate carries the bearings of the worm shaft, the power shaft and the motor secured to the lower part of the main frame of the power-driven machine. A wheel is secured to the power shaft by which it may be manually rotated, and in which the worm and worm-wheel gearing have a pitch sufficiently great to enable the worm, the worm shaft and the motor shaft to be revolved by applying handpower to the wheel.



NO. 666,831.

666,849. Dynamo-electric Machine. Arthur E. Jenney, Boston, Mass., assignor to the Holtzer-Cabot Electric company, Brookline, Mass. Application filed May 5, 1899.

The armature core has its surface next to the pole-pieces continuously cylindrical and free from projections, holes, teeth and the like, armature conductors at or upon the surface, and parallel to the axis of the cylinder, and pole-pieces each of which is of a predetermined width at its central portion and tapered to approximately a point in a direction substantially parallel to the circumference of the armature of the dynamo in such a manner that the projection of the pole-piece upon the armature conductors covers a less and less length of the conductors from the central portion of the pol.-piece to the horns thereof.

666,861. Printing-telegraph Instrument. Louis M. Casella, London, England. Application filed October 20, 1899.

Electromagnets control a vibrating armature which operates a rocking pallet. A star-wheel on the type-wheel arbor is operated step by step by the rocking pallet. A non-polarized sluggish armature is acted upon by the control magnets, and a recoil spring acts on the sluggish armature. An armature is provided for the printing electromagnets connected with the printing devices and trip-contact means whereby the non-polarized sluggish armature controls the relay circuit.

666,883. Communicating System. Isidor Kitsee, Philadelphia, Pa., assignor to Charles E. Wilson, Philadelphia, Pa. Application filed February 20, 1896.

One or more sending and one or more receiving stations are connected together with a metallic circuit. A local source of current of rapidly recurring or alternating impulses is connected, through one terminal with the ground and through the other terminal with the interposition of a sending key and condenser, to the telephonic circuit.

666,900. Automotor Trolley for Electric Currents. Louis Lombard-Gerin, Lyons, France. Application filed November 10, 1900.

An electric motor and contact rollers driven thereby are fitted with a third contact roller to run on a third conductor. Pivoted levers carry the axle of the third roller, and a cross-bar supported by the frame of the trolley supports the levers.

666,912. Ship's Telegraph. Leon S. Thompson, Washington, D. C. Application filed May 25, 1899.

The instruments are composed each of a series of electromagnetic devices, with conductors between certain of the devices of the same instrument that connect them electrically in sets. A conductor leads from one of the devices of a set in one instrument to one of the devices of a set in the other instrument, whereby a single conductor serves to connect all of the devices of a set in circuit with a suitable return conductor.

666,920. Automatic Cut-out Device for Use in Connection with Electrical Generators. Monroe S. Clawson, Weehawken, N. J. Application filed May 21, 1900.

This cut-out is intended for regulating the flow of current between a dynamo-electric machine and a storage battery, and consists of an electromagnet having two sets of windings, one of which is permanently in circuit with the main circuit only of the dynamo, and the other provided with circuit connections to both the dynamo and the battery. An armature lever provided with circuit contacts carries a permanent magnet for an armature, the arrangement of the circuits and circuit connections being such that for a normal or predetermined voltage of the dynamo the armature lever is held against its circuit-making contact and the battery is charged, and for an abnormal drop in the voltage a backflow of current passes through one of the coils and the armature is repelled, the circuit between the dynamo and the battery being interrupted.

666,933. Electric Belt. John Moore and James Murray, Providence, R. I., assignors to the Champion Electric Belt company, Providence, R. I. Application filed June 30, 1900.

Battery cells are connected together by links. There are zinc cores in each cell and absorbent filling between the copper casing and zinc plates, with a supply tank for holding the energizing solution attached to the under side of each cell. A wick extends down into the tank and comes into contact with the absorbent filling forming means to supply each individual cell continuously with the energizing solution by capillary attraction.

666,940. Static Electric Machine. Jens Sorensen, Grand Rapids, Mich. Application filed January 19, 1900.

Metallic brushes and combs are enclosed within a cylindrical case having sheet-glass sides, and two or more metallic plates secured to the inner surface of the glass sides of the case, with corresponding metallic plates on the outside of the glass. Wires connect the outer plates with the poles of the machine.

666,956. Electric Connecting Handle for Automobiles. Edward N. Dickerson, Stovall, N. C. Application filed November 5, 1900.

The subject of the patent is a handle bar for vehicles operated or controlled by the electric current, the breaking and making of which electric current stops and starts the vehicle. A movable part is provided with an electric connection normally out of contact with the electric connection through which the controlling or operating current flows thereby arresting the motion of the vehicle, but capable of completing the electric circuit by the pressure of the hand of the operator, thereby again putting the vehicle in motion. This connection is, however, automatically broken when the pressure of the hand is removed, thereby arresting the motion of the vehicle.

666,958. Selective Signaling. Frank C. Ewing, Acadia, Va. Application filed February 8, 1900.

A number of stations are located on the main line, and each contains a clockwork mechanism controlled by a magnet. A polarized relay at each station controls the magnet, the relays being connected to the main line. A signaling mechanism is normally connected to the back stop of the relay at each station. A selective plate operated by the clockwork mechanism at each station is successively brought into contact with the signaling device, and means are provided at each station for operating the relays at the other station or stations.

667,016. Automatic Corrector for Step-by-step Mechanism. Charles O. Janney, St. Louis, Mo., assignor of one-half to Adolph Wissler, St. Louis, Mo. Application filed December 26, 1899.

A rotary switching member is located at a central station and has a normal zero position. An automatic circuit-breaker located at an outlying station has a normal zero position and limiting stops, an electric circuit connecting the circuit-breaker to the switch. Mechanism is interposed in the circuit whereby the operation of the circuit-breaker operates the switch, and means are provided for holding the switch in its zero position for a time after the completion of its rotation or operation, thus allowing the circuit-breaker to come to its zero position, so that the circuit-breaker and switch may start simultaneously upon new circuits.

667,028. Electric Meter. Alexander D. Lunt, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed October 31, 1900.

A series winding is fed by the current to be measured. Means are provided for causing a rotation of the magnetic field due to current in the winding. A rotatable body of conducting material is placed in inductive relation to the magnetic field, and a counter is provided for registering the number of revolutions of the body.

667,054. Prepayment Meter. Edmund Allo, Lynn, Mass., assignor to the General Electric company of New York. Application filed April 20, 1898.

This meter comprises a mechanism controlled by a coin or other token and capable of receiving a number of such coins or tokens, in which the coin or token forms a part of an electric circuit. A pivoted holder receives the coin or token, and a cam, which is actuated by a moving part of the mechanism, releases the coin or token after the mechanism has performed a certain operation.

667,066. Prepayment Electric Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric company of New York. Application filed September 13, 1897.

A dial is mounted for rotary step-by-step movement independent of the indicator, and a spring-actuated slide moves the dial. A handle is arranged to move the slide a certain distance away from the dial against the action of a spring, after which the slide is automatically released from the handle and the spring advances on the dial one step. The mechanism is responsive to a deposited coin or token.

667,067. Prepayment Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric company of New York. Application filed April 14, 1898.

An armature is mounted for movement within the influence of a field magnet. Terminals for a relay magnet, arranged to be bridged by a coin or other token to complete the circuit of the relay magnet, form with the coin a part of the relay circuit at all times while the motor is in operation. A switch is controlled by the relay for closing the motor circuit.

667,068. Prepayment Mechanism. Frank P. Cox, Lynn, Mass., assignor to the General Electric company of New York. Application filed October 8, 1898.

A prepayment mechanism is situated at any desired point. A magnet controls the release of a manually actuated switch, the operation of which is controlled by the prepayment mechanism for closing the circuit of the meter and also that of the consumer. A meter mechanism records the consumption of energy in an electric circuit which is connected electrically with the prepayment mechanism, and a contact actuated by a moving part of the meter closes the circuit of the magnet when the prepaid amount of energy has been consumed.

667,069. Prepayment Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric company of New York. Application filed October 12, 1899.

A receiver for the coins or tokens is arranged to hold them during the greater portion of the time that the apparatus is in operation, but discharges them before the operation o

the apparatus is completed. The weight of the coins or tokens closes an electric circuit, and the coin-receiver maintains the circuit closed for an interval of time after the operating coins or tokens have been discharged.

667,070. Prepayment Electric Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric company of New York. Application filed October 12, 1899.

An electrolytic cell has an open tubular neck, the electrolyzing electrodes being in circuit with the consumers' translating devices. An auxiliary electrode at a definite level in the cell is included in a branch circuit controlling a circuit-breaker. Toll-controlled devices replenish the electrolyte when consumed by decomposition. (See cut.)

667,079. Traveling Contact for Underground Electric Railways. John Floyd, Washington, D. C. Application filed April 27, 1900.

Two longitudinal oppositely disposed groove bars carry contact buttons connected by wires to contacts in a third longitudinal bar. Sliding in the grooves is a coupling having contact faces and wires leading to the car motor. Independent leads are connected to the contacts in the third-mentioned bar, and a sliding coupling between them has an automatic circuit-breaker adapted to connect the leads with the contact block. (See cut.)

667,089. Coin-controlled Meter. Charles E. Holmes, Lynn, Mass., assignor to the General Electric company of New York. Application filed March 26, 1898.

A coin-holder is composed of a moving and a stationary part respectively connected to opposite sides of the circuit and arranged to be electrically connected by the coin or token. An actuator for the moving part of the holder is so arranged that the circuit is maintained through the coin until it has traveled a certain distance irrespective of the exact size of the coin.

667,095. Electrical Traction on Closed-conduit Systems. Howard Lane, Birmingham, England. Application filed August 18, 1900.

This system comprises a closed conduit, made up of sections joined together, soft-iron pole-pieces mounted in and insulated from the conduit and a conductor passing through the conduit. The conductor is adapted to be attracted by the pole-pieces. A traveling magnet passes over and magnetizes the pole-pieces successively, and a secondary magnet of opposite polarity and less strength than the adjacent pole-piece of the traveling magnet also passes over the conduit pole-pieces after the pole-pieces of the traveling magnet have passed over. Brushes carried by the magnet conduct the current from the conduit pole-pieces.

667,103. Insulator. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed August 31, 1900.

A supporting loop has one end open for the reception of the conducting wire, the free ends of the loop being elastic. An insulator is formed with a hole into which the free ends of the loop are forced so that they expand against the walls of the hole to hold the loop in the insulator.

667,106. Electric Arc Lamp. Elihu Thomson, Swampscott, and Charles E. Harthan, Lynn, Mass., assignors to the General Electric company of New York. Application filed October 19, 1897.

The regulating mechanism comprises a vertically movable carbon-carrying rod, a horizontal lever pivoted to a fixed part of the lamp, and a magnet core suspended from one end of the horizontal lever and movable endwise on its support. Springs control the endwise movement of the core. A magnet coil is mounted on a yielding support. A vertical rod suspended from the other end of the horizontal lever is connected to one of the jaws of the clutch, whereby upon the descent of the vertical rod the clutch releases the carbon-carrying rod.

667,107. Electric Arc Lamp. Elihu Thomson, Swampscott, and Charles E. Harthan, Lynn, Mass., assignors to the General Electric company of New York. Application filed November 4, 1897.

A clutch mounted on a movable clutch carrier comprises a collar having two downwardly extending arms which are united at the lower end to form a guide for the carbon moving with the clutch carrier. Shoes are pivotally secured to levers loosely pivoted to the arms, and a support is provided to which the levers are pivoted, the support being loosely mounted so that it is capable of a certain amount of movement with the clutch.

667,110. Electric Railway. Granville T. Woods. New York, N. Y., assignor to the General Electric company of New York. Application filed September 29, 1897. Renewed October 15, 1898.

A movable contact is connected to the source of supply and to one of the car motors, and a second contact is movable simultaneously with the first and connected to the other side of the same motor. Resistance contacts are connected through the other motor to ground and traversed by the second movable contact to connect the motors in series. Other resistance contacts connected to ground are traversed by the second movable contact to connect the first motor to ground while the first movable contact is traversing the first series of resistance contacts to connect the second motor to ground, whereby the motors are connected in parallel.

667,113. Safety Device for Dynamo-electric Machines. Harold W. Buck, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 11, 1899.

In a system, such as that of a railway substation, consisting of alternating-current and direct-current mains, a circuit-interrupting device is placed in one of the mains, with a local circuit for its control. A circuit, operative upon change of frequency of the electromotive force on the alternating mains but inoperative upon change of voltage, acts to close the local circuit when the frequency of the alternating electromotive force reaches a predetermined value.

667,114. Means for Preventing Hunting of Dynamo-electric Machines. Harold W. Buck, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed April 28, 1900.

A device is described for use on a circuit of regularly pulsating frequency which varies the exciting current and torque of the machine synchronously with the variation in frequency. (See cut.)

667,115. Burglar-alarm System. Clyde Coleman, Chicago, Ill., assignor to the Bankers' Electric Protective company, Chicago, Ill. Application filed July 12, 1898.

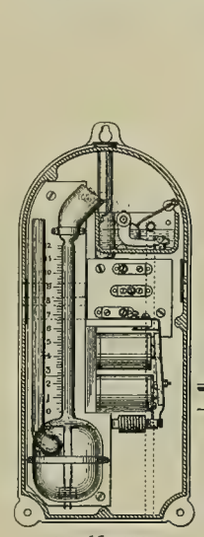
An alarm mechanism is controlled by the main protective circuit of an alarm system. An electrical barrier for the alarm structure consists of a series of conductors, arranged one back of the other in close and insulated relation, and a supporting base for such conductors formed of two sections or portions of frangible material between which the conductors are arranged and provided with apertures.

667,119. Electric Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed August 29, 1898.

A rectangular frame carries certain of the working parts of the lamp. A tubular frame, screw-threaded to the rectangular frame, has a shoulder formed on it against which the spool of the magnet abuts. A magnet wound on a spool is mounted on the tubular frame. Radial arms are formed integral with the tubular frame. A resistance coil mounted on the lamp is supported by the radial arms, with insulating bushings between the arms and the coil.

667,120. Electric Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed November 9, 1898.

A floating friction clutch regulates the feeding of the carbons. A magnet for controlling the clutch is capable of causing the carbon to feed, and a second magnet is normally out of circuit during the operation of the lamp, but is energized at or about the instant the clutch strikes the tripping means, for causing a quick release of the clutch.



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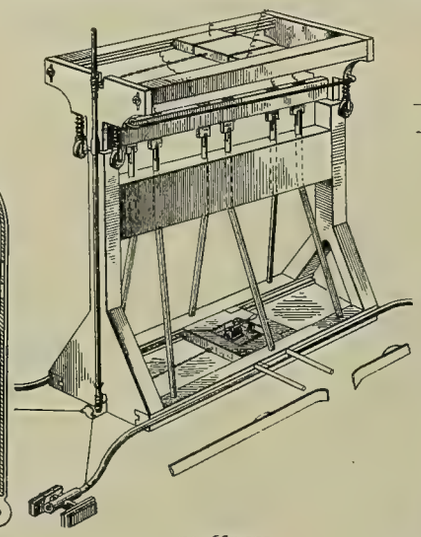

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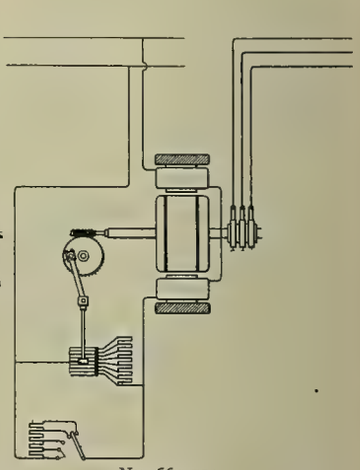


No. 667,114.

667,121. Electric Arc Lamp. Richard Fleming, Lynn, Mass., assignor to the General Electric company of New York. Application filed March 2, 1899.

A side tube or rod is rigidly secured to and depends from the frame, a metal head having an opening therein through which the side tube or rod freely passes so that the head may be moved toward and away from the frame-piece. Rods extend parallel with but independent of the side rod or tube to secure the head and the frame together and at the same time hold them at the proper distance apart.

667,122. Electric Arc Lamp. Richard Fleming, Swampscott, Mass., assignor to the General Electric company of New York. Application filed November 12, 1900.

This lamp, designed for use on alternating-current circuits, has two regulating windings, both of which are mounted on the same spool and are in inductive relation to each other. These windings are never included in circuit at the same time. Means are provided for interrupting the circuit of one of the magnets before the circuit of the other is completed.

667,123. Electric Protective System. Henry F. Freed, Harrisburg, Pa. Application filed August 31, 1900.

Electromagnets are included in a closed circuit, and an open circuit is closed by the demagnetization of the armature of one of the electromagnets. An automatic circuit-breaker is included in the closed circuit and has an electromagnet connected in the open circuit. An open signal circuit is closed by the breaking of the closed circuit, and a short circuit is branched into the closed circuit and provided with a dummy switch for short-circuiting the main circuit.

667,125. Electrical Connector. Henry F. Freed, Harrisburg, Pa. Application filed September 27, 1900.

An open signal circuit is closed by the armature of an electromagnet included in a closed circuit when the electromagnet is demagnetized. An automatic circuit-breaker and an automatic circuit-connector are included in the closed circuit. Branch wires connect the closed circuit and the circuit-connector through a switch. A shunt wire is electrically connected to one side of the closed circuit also through a switch, and branch wires are electrically connected to the circuit-connector and to the first-named branch wires.

667,128. Electric Arc Lamp. Charles E. Harthan, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 27, 1898.

A canopy consists of a split cylindrical body having a restricted neck and two outwardly flaring end portions, one of which surrounds the hanger board, the other the lamp, the latter end being provided with ventilating holes and a collar or flange secured to the inside of the canopy for directing the hot air from the lamp out through the ventilating openings and preventing it from passing up to the hanger board.

667,129. Electric Arc Lamp. Charles E. Harthan, Lynn, Mass., assignor to the General Electric company of New York. Application filed October 2, 1899.

A framework supports certain of the operating parts of the lamp, and a framework secured to the first supports certain other parts. A body of felt is located between the two parts of the frame and is secured in place by the frame-clamping means, the felt being provided with a perforation. The carbon carrier is connected to the holder and extends through the perforation and is wiped by the felt as it moves up and down.

667,130. Load-equalizing Apparatus for Dynamo-electric Machines. Edward M. Hewlett and Hermann F. T. Erben, Schenectady, N. Y., assignors to the General Electric company of New York. Application filed March 27, 1900.

A multipolar electric generator has independent armature windings, two independent commutators connected therewith, adjustable brushes for the respective commutators, an ammeter in an electric bridge between the leads of the two commutators, and means for adjusting either set of brushes.

667,133. Pneumatically Controlled Trolley. John B. Linn, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed November 13, 1899.

The trolley pole is pivoted for movement in a vertical plane, with a fluid-pressure cylinder for moving it in one direction mounted close to the pole base and mechanically connected to the pole frame. Ducts lying wholly within the trolley support control the application of fluid pressure. A spring moves the pole in the opposite direction.

667,134. Form for Winding Armature Coils. Julius W. Lundskog, Lynn, Mass., assignor to the General Electric company of New York. Application filed November 12, 1900.

The base has a terraced strip along one edge. Sliding bars have their middle portions crossed and their end portions lying side by side, and carry an inwardly faced hook on opposite ends, and an outwardly faced hook on the other ends. A clamping screw moves along a bridge spanning the bars and links connect the screw with the bars.

667,135. Rheostat. George F. Martin, Corydon, Ind. Application filed June 5, 1900.

A Leyden jar has an adjustable outer coating, and a cylinder encloses the jar and outer coating and has a slot therein. An arm secured to the outer coating extends through the slot and is secured to a rack bar with which a pinion meshes.

667,138. Prepayment Meter. Eustace Oxley, Lynn, Mass., assignor to the General Electric company of New York. Application filed October 28, 1899.

The claims describe a meter comprising a coin-duct within a casing and a coin-pocket adapted to introduce a coin thereto. Means are provided for moving the coin-pocket to the outside of the casing. A barrier is placed in the coin-duct, with a circuit-controller below it. An electromagnet operated by the meter through a lost-motion device withdraws the barrier when the value of the coin has been paid. An electromagnet is in circuit with contacts controlled by the passage of the coin, and a lost-motion device completes the circuit of this electromagnet.

667,139. Prepayment Meter. Eustace Oxley, Lynn, Mass., assignor to the General Electric company of New York. Application filed March 14, 1900. Renewed October 18, 1900.

The prepayment device comprises a spring-actuated service controller between the source of supply and the consumption devices. A lock normally holds it open, and a coin or token releases the lock. A handle accessible from the outside closes it against its spring and a latch holds it closed. A measuring apparatus controls release of the latch, and a reserve coin when paid disables the release until the energy represented by the reserve coin has been delivered.

667,144. Static Electric Machine. Charles H. Cook, Indianapolis, Ind., assignor to the Electro-therapeutic Manufacturing company, Indianapolis, Ind. Application filed January 2, 1900.

A suitable framework carries a series of disks and a central shaft on which the disks are mounted. A bracket secured to the frame on each side of the disks supports bearings surrounding the central shaft. An equalizer includes a frame extending diametrically about the series of disks. A bearing ring on each side of the series of disks to which the equalizer frame is secured turns on the stationary bearing on each side, one of the bearing rings being provided with gear teeth.

Designs.

34,014. Incandescent Burner Cap. Max Herskovitz, Chicago, Ill. Application filed December 31, 1900. Term of patent, seven years.

34,015. Demagnetizer. Otto M. Knoblock, South Bend, Ind. Application filed January 7, 1901. Term of patent, seven years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, FEBRUARY 16, 1901. No. 7

Power Plant of the McCormick Twine Mills.

The McCormick Harvesting Machine company of Chicago has recently erected large twine mills, which not only form a model plant for the manufacture of binder twine, but also contain many interesting engineering features, both of an electrical and mechanical nature. The twine works consist of two five-story-and-basement brick buildings, one for manufacturing and one for storing, shipping, etc., and a power-house building. They are located on the corner of Blue Island and Oakley avenues, both structures lying parallel with Blue Island avenue and the Chicago, Burlington and Quincy and Santa Fe railroad tracks. The buildings have a length of 311 feet on one side and 461 on the other, the streets not being at right angles, and a frontage on Oakley avenue of 223 feet. The manufacturing or mill building and the warehouse are separated by a 25-foot court. Each floor of the factory building constitutes a complete mill, with 220 spindles, thus giving a total capacity of 1,100 spindles, while plans have been completed for doubling the size and capacity of the works. The present buildings comprise eight acres of floor space, and employment is given to 750 hands. The plant is practically distinct from the harvester works of the McCormick company, which adjoin on the east and south.

The raw material used in the preparation of binder twine consists of sisal fiber obtained principally from Yucatan, and manila fiber from the Philippine Islands. The bales of raw material are first received in the warehouse. They are taken into the preparation rooms of the mills, opened, and the bunches of fiber untied and straightened, and then fed through the combing machines. The fiber comes from these machines as a continuous ribbon called "sliver" and is taken into the spinning rooms, where it is spun and wound on to bobbins by the spinning jennies. The twine is then made into balls by the balling machinery. The balls are packed in bags and taken to the warehouse for shipment. The capacity of the present plant is about 16,000 tons annually and an interesting item in connection with the output is that about 20 miles of twine is turned out every minute during the operation of the mills. As a ton of twine is sufficient to bind a thousand acres of grain, one easily gains an idea of the volume of the production of the plant, when it is seen that the annual product will bind 16,000,000 acres.

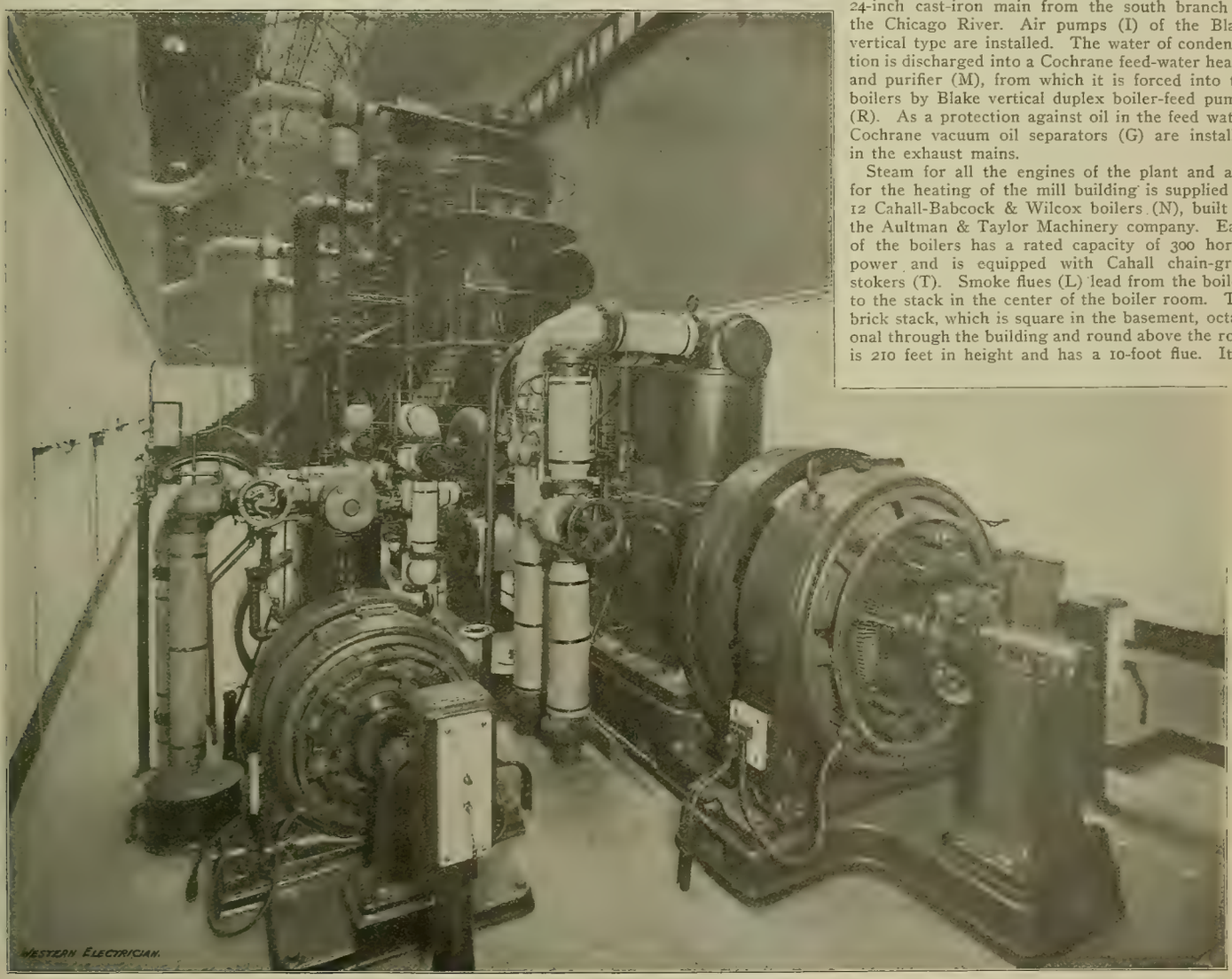


FIG. 1. POWER PLANT OF THE M'CORMICK TWINE MILLS.—ENGINE ROOM.

In the construction of the twine works special attention was paid to the design of the power plant, which has been located in a building immediately adjoining the warehouse building on the east. In Fig. 2 on the next page is shown a plan of the plant, while Fig. 3 is a cross-sectional elevation through the boiler and engine rooms and basement. The power for operating the mill machinery is obtained from two vertical cross-compound condensing engines manufactured by the Edward P. Allis company. Each engine has cylinders 28 and 60 inches in diameter, with a 48-inch stroke, and is rated at 1,500 horsepower under normal operation. In the plan drawing (Fig. 2) these engines are marked (A). A rope drive transmits the power to the mill building. But one engine is in use at present, the other one being held in reserve for the proposed addition to the works. In the main rope drive there are 33 two-inch ropes that operate a main shaft in the basement of the mill building through a subway under the court between the two buildings. From this main shaft drives run to a head shaft on the first floor, and from this latter shaft all the upper floors are driven by smaller rope drives. In Fig. 1 is given a general view of the engine room, showing the two large engines in the background, behind the smaller electrical generating units.

The two main engines exhaust into Wheeler surface condensers (F), Fig. 2, located in the basement. Condensing water is supplied by 10-inch centrifugal pumps (H) connected to six by six-inch vertical engines. The water is drawn through a 24-inch cast-iron main from the south branch of the Chicago River. Air pumps (I) of the Blake vertical type are installed. The water of condensation is discharged into a Cochrane feed-water heater and purifier (M), from which it is forced into the boilers by Blake vertical duplex boiler-feed pumps (R). As a protection against oil in the feed water, Cochrane vacuum oil separators (G) are installed in the exhaust mains.

Steam for all the engines of the plant and also for the heating of the mill building is supplied by 12 Cahall-Babcock & Wilcox boilers (N), built by the Aultman & Taylor Machinery company. Each of the boilers has a rated capacity of 300 horsepower and is equipped with Cahall chain-grate stokers (T). Smoke flues (L) lead from the boilers to the stack in the center of the boiler room. The brick stack, which is square in the basement, octagonal through the building and round above the roof, is 210 feet in height and has a 10-foot flue. It is faced with pressed brick and lined with firebrick for a distance of 110 feet.

The coal-handling apparatus, which was installed by the Macdonald Engineering company of Chicago, consists of a set of track scales, Hunt coal crushers and conveyors (S), storage bins, hoppers and spouts leading direct to the boilers. Each spout supplying coal to an individual boiler is also provided with a hopper suspended on a scale beam and of sufficient size to hold about 1,000 pounds of coal. By the use of this apparatus every pound of coal used is weighed immediately before going to the fire. The conveying apparatus used in handling coal also elevates the ashes to an overhead bin, from which they are spouted directly to the cars outside the building for removal. The coal-handling apparatus and stokers are steam driven. Run-of-mine coal is used for fuel, the waste and refuse from the mills also being burned. In Fig. 4 is shown the east half of the boiler room, with

weighing hoppers, spouts, chain grates, etc., in place.

The steam-piping system of the power plant has been carefully designed and is believed to be one of the most complete ever installed. It has been nearly all installed in duplicate and all of the workmanship and materials were of the best. The main header system, marked (V) on the plan, is constructed of extra strong wrought-iron pipe, fitted with extra heavy flanges, shrunk and peened to place. All the fittings are of extra heavy cast-iron. The main header, which is 18 inches in size, is divided into two sections connected by a 12-inch U bend (W) around the stack. All expansion is taken care of by bends and all the pieces of apparatus are protected from condensation by the use of Cochrane steam separators. On either side of the stack are installed Metropolitan double-tube steam injectors (P).

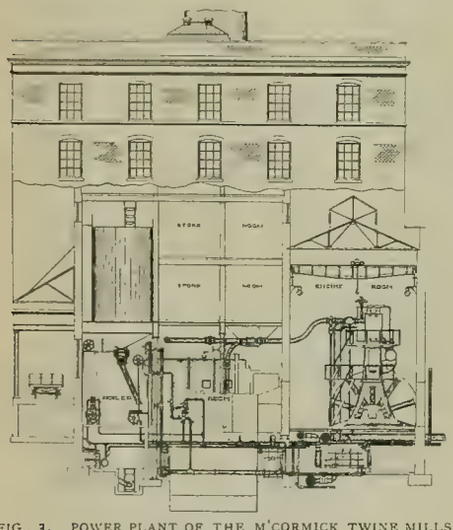


FIG. 3. POWER PLANT OF THE M'CORMICK TWINE MILLS —ELEVATION OF POWER HOUSE.

All parts of the buildings, except the storage and shipping departments, are heated by direct radiation. The radiation in the mill building is by means of overhead coils and in the pattern shop, machine shop and staircase halls by wall coils, all built of cast-iron branch T's and 1¼-inch wrought-iron pipe. Live steam at from two to three pounds is used, all condensation being returned to the feed-water heater.

To provide for the electric lighting of the works three direct-connected generating units (C) and (D) have been arranged for. The generators are direct-current, compound-wound, 250-volt, Westinghouse machines and are connected to vertical compound, automatic, Westinghouse engines. The engines can be operated condensing or non-condensing, with the exhaust used for the heating system. The two units already installed are shown in the foreground of Fig. 1, and consist of a 30-kilowatt machine connected to an eight and 13 by eight-inch engine revolving at 350 revolutions a minute, and a 125-kilowatt dynamo, connected to a 14 and 24 by 14-inch engine of 275 revolutions. The third unit will be of 125-kilowatt capacity and of similar type.

These generators are connected to the switchboard (E), illustrated in Fig. 5, by cables run in iron-armored conduit. The switchboard, which was built by the Western Electric company, consists of eight panels of blue Vermont marble, two inches thick, mounted on a steel framework. Each of the three generator panels contains a rheostat for the shunt field of a generator, a double-pole switch on the main generator circuit, a voltmeter and an ammeter of the Weston round pattern and a cutting-in galvanometer of the Queen & Co. type, arranged so as to indicate the potential across the generator terminals and the bus-bars. This is to enable the attendant to determine more readily when a generator is ready to be cut into service. On the main-load panel are mounted a Weston illuminated-dial ammeter, a Thomson recording wattmeter, and a ground detector, connected to read on the voltmeter on the third generator panel. Each of the four feeder panels contains switches and fuse blocks for controlling four circuits. The switches are of the double-pole, quick-break, Western Electric type. All fuse blocks are mounted on the rear of the board, and enclosed fuses are used throughout. The board is suitably illuminated by incandescent lamps fitted with half-round white shades.

The distribution system consists of seven sets of feeders (with provision for six additional sets) that lead to cabinet boards placed in various departments throughout the works for controlling the various lights in each department. The cabinet boards in each of the spinning and preparation departments are fed by two sets of feeders, each controlled independently at the main switchboard in the engine room, and the light distribution is so arranged that the engineer is enabled to cut off the major portion of the load immediately after the closing hour at night, leaving only such lights in each department as are absolutely necessary to permit the employes to make a safe exit from the building. By this arrangement the larger generator can be shut down and the small load carried on the smaller dynamo, thus effecting a considerable saving in power.

The cut-out boxes are built of three-fourths-inch blue Vermont marble slabs, which are set in oak cases fitted with glass doors. The insides of the boxes are lined with asbestos and the marble is highly polished. Switches of the Hart pattern and fuse blocks specially designed for D. & W. fuses are mounted on the marble, while all the bus-bar and circuit connections are made from the rear. In this manner no connections are exposed on the face of the board. Each department on each floor has its own cabinet board, the one in the machine shop on the fourth floor of the power-house building being shown in Fig. 6.

All the wiring, except the feeders, throughout the engine and boiler rooms and basement is run in iron-armored conduit. The feeders are run in raceways of oak with covers screwed in position, so that all the copper distribution is readily accessible. The lighting circuits from the cabinet boards in the different departments are run on running boards of pine, surfaced on all sides and screwed in place. Grimshaw wire is used throughout, and 16-candle-power incandescent lamps operated at 220 volts are suspended from porcelain rosettes by rubber-covered lamp cord.

In the engine room the general illumination is supplied by six six-ampere, enclosed-arc lamps, operated two in series on 220 volts, while each of the main engines has incandescent lamps so arranged as to illuminate directly the vital parts of the engines. The wiring for these lamps is run in iron-armored conduit, fastened directly to the engine frames. In the boiler room, besides four arc lamps, special illumination is provided for the water columns and gauges on all the boilers. In the machine shop, where a great part of the machinery used in the works is made, incandescent lamps are used for direct illumination on each machine tool, while the benches are lighted by lamps placed on Faries adjustable lamp holders, thus giving each workman an independent light, easily adjusted to suit his work. General illumination is provided in this shop by four arc lamps. In the pattern shop, on the fifth floor of the power-house building, as in the other parts of the works, incandescent lamps are used exclusively. On the shipping platform the lamps are placed on brackets formed of conduit with waterproof sockets and convex, porcelain-lined shades. Locked plug boxes with extension cords are also provided for lighting the interiors of the freight cars, when necessary. The total lighting installation includes about 1,600 16-candle-power incandescents and 14 arcs. In each of the two scale houses on the shipping platform is provided an electric graphite heater of 1,500 watts' capacity. These houses are of very small size and are separated some distance from a steam supply.

Three direct steam-driven elevators and one ele-

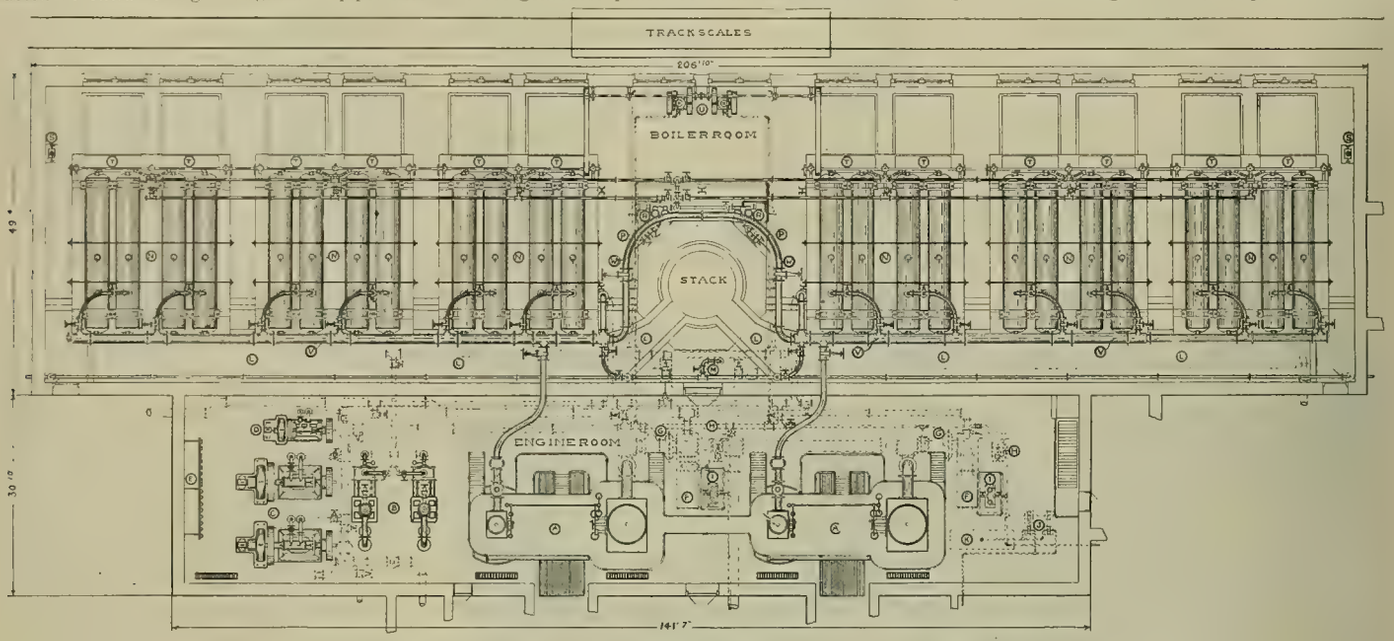


FIG. 2 POWER PLANT OF THE M'CORMICK TWINE MILLS.—PLAN OF POWER HOUSE.

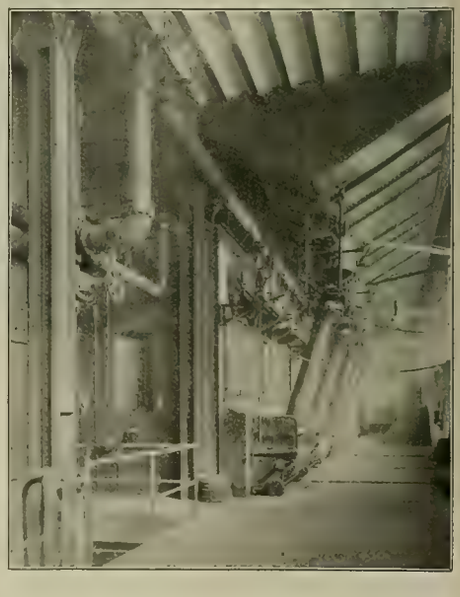


FIG. 4. POWER PLANT OF THE M'CORMICK TWINE MILLS. —BOILER ROOM.

vator belted to line shafting are installed in the works. The steam-driven elevators are lighted by incandescent lamps and have a door on each side of the shaft. Push-buttons on each floor at each door register on an annunciator with a double set of drops.

For protection from fire a complete system of automatic sprinklers has been installed. In the mill building a wet system is used, while in the ware house is installed a dry system. This latter system, in which water is forced through the pipes only in case of fire during cold weather, is required in the warehouse, as this building is not heated. As an additional safeguard, standpipes with hose connections on each floor are provided throughout the establishment. Water for the fire system is supplied by two Underwriters' fire pumps (B, Fig. 2), drawing

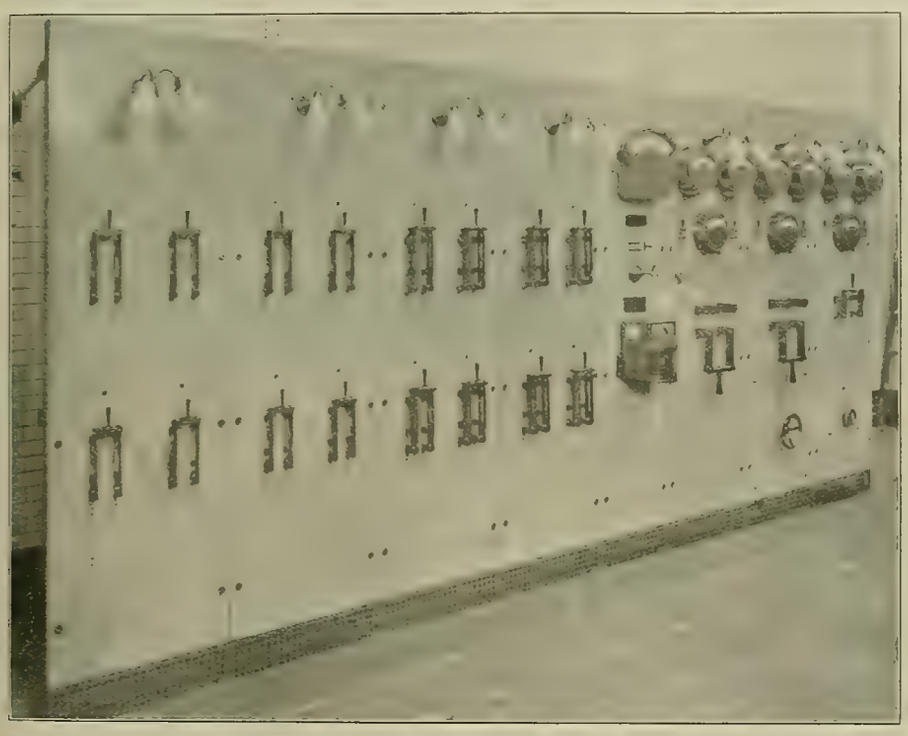


FIG. 5. POWER PLANT OF THE M'CORMICK TWINE MILLS.—MAIN SWITCHBOARD

water from the river, the supply being supplemented by large tanks on the roof.

A very complete fire-alarm system is installed, consisting of a large fire gong and two fire-alarm pull boxes in each room, connected to the system by means of relays. The system is divided into five sections running vertically through the building, with a relay for each section. The pull boxes are on closed circuits and the gongs on open circuits, thus insuring positive action of the system at all times, as any accident at any point would be immediately detected by the ringing of one or more of the gongs. Each pull box is mounted inside of a second box having a glass front, which is broken in case of necessity. For testing purposes the outer door can be unlocked by the inspector.

A signaling system connects the engine room with the mill building, with two stations in each department, by means of which signals, according to an established code, can be sent to the operating engineer instantly. There is also a tell-tale signaling system connected with the rope drives. In case a rope in any drive breaks a strand, that strand strikes the signal apparatus as it flies out in passing around a sheave, and the engineer is immediately notified by a gong and an annunciator of the trouble and its location. By this means the possibility of accident caused by the breaking of a rope is obviated, as a rope never breaks entirely in two at once, and a strand breaking can be detected and bound until a new rope can be placed when the mill shuts down at night.

The twine works of the McCormick company have been erected under the direction of the company's own architect and twine-mill experts. Charles A. Chapman of Chicago was the consulting mechanical and electrical engineer on the power and lighting plant.

A recent strike on the underground railway in Paris resulted in a complete surrender to the men on the part of the company. According to the new agreement, men will be attached to the permanent staff after 12 months' service with the company, which guarantees that a 10 per cent. increase in wages will be paid.

Death of O. W. Meysenburg.

Otto William Meysenburg, one of the best-known business men in the West and a prominent factor in the industrial growth of Chicago, died on February 11th on his ranch and fruit farm at Alma, Cal., where he had been staying for the last two months. His death was due to an attack of typhoid fever, with which he was stricken 10 days previous.

Mr. Meysenburg was born in Bonn, Germany, on March 17, 1849, and came to this country with his father at the age of five years. The family settled in St. Louis, and after completing his education in this country and abroad young Meysenburg became identified with the St. Louis Bolt and Iron Works, of which corporation he was made president a few years later. He early evinced a mechanical turn of mind, and it was largely due to his efforts that the cable street-railway system was first introduced in St. Louis, he having visited San Francisco and made a study of the cable system there.

In 1886 Mr. Meysenburg came to Chicago and, with A. W. Wright, built several of the first cable lines in this city. He early became interested in the Wells-French Car company and was its president up to the time it was absorbed by the American Car and Foundry company in 1899. Since the organization of the Rodgers Ballast Car company in 1891 he was associated with its management and retired from the presidency of the company but a short time ago.

Mr. Meysenburg's connection with the electrical industry dated from 1892, when, in March of that year, he organized the Siemens & Halske Electric Company of America, a company formed to manu-

FIG 6. POWER PLANT OF THE M'CORMICK TWINE MILLS. —CABINET BOARD

facture and sell in this country electrical machinery controlled by Siemens & Halske of Berlin, Germany. Associated with Mr. Meysenburg in this enterprise was Mr. Augustus W. Wright, the two gentlemen having been previously engaged in Chicago as street-railway contractors and engineers under the firm name of Wright & Meysenburg. Mr. Meysenburg was made president of the Siemens & Halske Electric company and continued actively to direct its management until 1896, when he relinquished his position. For the last two years the deceased had retired from the active management of his business enterprises, and last December he went to California to seek a well-earned rest.

Mr. Meysenburg was a man of remarkable foresight, and he amassed considerable wealth in the course of his business career. He was one of the most hospitable of men, and at his beautiful summer home in Wisconsin, as well as his residence, 141 Astor street, in Chicago, he delighted to entertain his friends. He is said to have been one of the finest amateur pianists in the United States and was a landscape painter of great ability. He was a member of the Chicago Club and of different social organizations in San Francisco. Mr. Meysenburg is survived by five children.

Automobile Show at Philadelphia.

The first annual automobile show, under the auspices of the Pennsylvania Automobile Club of Philadelphia, was opened on Monday, February 4th, at the Second Regiment Armory, Broad and Diamond streets. The armory was especially fitted up for this event. The decorations of flags and bunting and the costly electrical display formed a combination with beautiful effects. The usual division of floor space followed at similar exhibits held in other cities was observed, and, as customary, a track for vehicles surrounded the exhibits located in the arena. There were more than 70 exhibits, displaying the various motor vehicles used for business and pleasure and automobile parts and accessories.

The display of the Pennsylvania Electric Vehicle company was the largest, occupying seven of the largest spaces at the show, and was very complete, showing many different styles of electric and gasoline vehicles. The Motor Carriage company also exhibited a splendid line of vehicles.

The attendance was very large, and everyone seemed greatly pleased with the exhibits. The track was thronged to its limit at all times with motor vehicles of every description, and afforded the spectators excellent opportunities to judge their respective merits.

Among the prominent exhibitors were the Electric Vehicle company, Locomobile company of America, Mobile company of America, De Dion-Bouton, Steam Vehicle company of America, Skene American Automobile company, Thornycroft Steam Wagon company, the Overman, the Orient, the Winton, Motor Vehicle Power company, the Knox Gasoline Motor company, National Electric Automobile company, Diamond Rubber company, New York Belting and Packing company, Rose Manufacturing company and a host of others. W.

Report of Chicago Automobile Examiners.

The first annual report of the board of examiners of automobile operators for Chicago has been prepared by City Electrician Ellicott for submission to the City Council. "The results thus far obtained," states the report, "indicate that the automobile vehicle is a safe means of transportation if operated by a reasonably intelligent and careful operator. The enforcement of the ordinance has had the effect of securing careful operators, and has required that they obtain their experience under proper conditions and in company with a competent instructor." The first license was granted to Arthur J. Eddy, after an examination held January 28, 1900. It has been found necessary to refuse licenses to eight applicants and to revoke one license. The total number of licenses issued during the year is 377, and the report says that this indicates there will be at least 1,000 automobiles in use before January 1, 1902. Ten licenses were issued to women. A tabulated statement of the classes of licenses issued shows that of private automobiles 90 are electric, 55 gasoline and 44 steam; the total of electric vehicles, private and business, is 118.

Patent Office Report for 1900.

The report of the commissioner of patents for 1900 shows that during the year there were received 39,673 applications for patents, 2,225 applications for designs, 82 applications for re-issues, 2,099 applications for registration of trademarks, 943 applications for registration of labels and 127 applications for registration of prints.

There were 26,418 patents granted, including designs, 81 patents reissued, 1,721 trademarks registered, 737 labels and 93 prints. The number of patents that expired was 21,190. The number of allowed applications that were forfeited for non-payment of the final fees was 4,215. The District of Columbia was credited with the greatest relative number of patents, Colorado was second and Connecticut third.

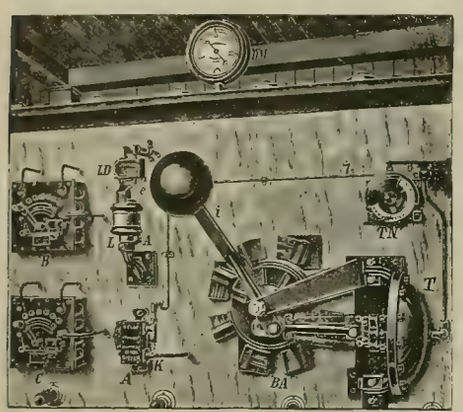
The total expenditures were $1,260,019 and the receipts $1,350,828, leaving a surplus for the year of $90,808. The total balance to the credit of the Patent Office in the Treasury of the United States on January 1, 1901, was $5,177,458. During the year 1,070 patents were granted to residents of Germany, 987 to residents of England, 367 to residents of Canada and 341 to residents of France.

It is reported that the New York, New Haven and Hartford Railroad company will install the third-rail system on its Boston suburban lines.

Electrical Illumination of the Largest Clock in the World.

Many attempts have been made to illuminate large tower-clock dials without producing shadows, and it is very seldom that the desired result has been attained. One essential requirement is a subdivided light, and one that is uniformly distributed throughout the area of the dial, for even if there are no actual shadows thrown on the back of the dial by its supports a varying degree of intensity of illumination in different regions is quite as objectionable. In the case of the large clock in the tower of the Philadelphia City Hall the difficulty has been successfully met, and the installation furnishes several points of interest. The four dials of this immense timepiece are the largest in the world, being 25 feet in diameter, situated over 350 feet from the ground, and the tower mechanism which actuates the hands is operated by means of compressed air, controlled by an astronomical clock at the base of the tower.

Hanging from an upper beam in a plane parallel to that of each dial and at a distance of about two feet back of it is a sheet of metal 25 feet square which serves as a reflector. This reflector is stiffened with angle irons, and is perforated for the insertion of 150 incandescent lights, and as there are four dials, it requires 600 lights, consuming between 40 and 50 horsepower, to light the whole clock. The sockets are of special design, permitting the renewal of the lamps from the rear. The reflector was given one coat of red lead, two of white lead and one of white enamel, so that it presents a smooth surface capable of diffusing as well as reflecting the light from the lamps, and it was found possible to avoid placing any supports between the reflector and the dial. The control of the lights is entirely automatic, the controlling apparatus, which is actuated by the master clock, being shown in the accompanying illustration. (B A) is a four-pole rotary knife switch, having a capacity of 500 amperes. The four knives are fastened rigidly to the same axis as the lever (i), which carries on its end a heavy weight. (T) is an expansible chamber with flexible diaphragm. The piston operated by this diaphragm is fastened to the lever (i), through a connecting rod, which is slotted to give lost motion, as shown. When air enters the chamber (T) it pushes open the piston until the lever with its weight is brought to the vertical position. As it passes from the vertical position the weight makes it fall to the right, which suddenly makes the four connections. When the compressed air is exhausted from the expansible chamber, the lever is again brought to center and in like manner falls suddenly, breaking connection at the four points. The air is admitted and released from (T) by the device (T N), which is operated each minute by the same air pressure which operates the four dial movements. The index shown partially in black, partially in white, is for 24 hours, the lighter portion representing day. The relative lengths of day and night are adjustable and are changed each week by the revolution of this index. The chamber (T) is filled and exhausted once in 24 hours; in other words, the 600 lights are thrown on in the evening and off in the morning automatically, and the clock is lighted according to the city schedule. The cut also shows the controllers for the electrically driven air compressors, and the pressure governors for the air mains.



ELECTRICAL ILLUMINATION OF THE LARGEST CLOCK IN THE WORLD.—AUTOMATIC SWITCHING APPARATUS.

The facts in the foregoing description and the illustration are taken from a paper read before the Franklin Institute by Warren S. Johnson.

A Queer Mistake in Telegraph Surveying.

It is reported that the two parties engaged on the building of the Yukon telegraph line from Quesnelle, B. C., to Telegraph Creek have failed to make connections. The line was built from the northern and southern ends simultaneously, and it is asserted that the work of construction has overlapped and the two ends are in different valleys with two ranges of mountains between. It is thought that one of the sections will have to be abandoned.

Mica, Zinc and Copper in the Philippines.

By R. G. Mayse.

Mica may be seen cropping out of the earth in the jungle in the Philippines in many places. There is without doubt a large field of operations for electrical-supply people in the mica lands of the country. I have been over hills where, upon looking down and across the country for miles, one can see the glistening mica reflecting the sun. Mica has been taken from the hills of Mindanao, Cebu, Negros, Luzon, Panay and other islands of the Philippine archipelago for the last 100 years. Some of the oldest settlers have informed me that the Spanish formerly made considerable money out of the mica mines by supplying England and Japan with the material. But the depredations of many wars put a stop to the operations, and during the last quarter of a century there has not been much done in mica interests. Some of the American miners who arrived here a year or two ago with the purpose of getting some of the gold and silver of which they had been told have turned their attention to the large mica deposits, which promise smaller returns, perhaps, for their labors, but which are more reliable.

Some of the electrical parties who are engaged in furnishing electrical power and supplies in Manila have announced that they will buy large quantities of good grades of mica for shipment to America, and this has encouraged the prospectors to begin active operations.

Zinc is also found in the islands of the Philippines, usually at a depth of about 35 feet below the surface of the earth. The miners have already taken out some valuable specimens, and the indications are that, in course of time, the zinc mines will be turning out important supplies. Americans form in parties of from four to six and go into the mountains and prospect until they locate a paying lead. This is dangerous, in that the party is liable to be attacked in the interior, when away from garrisoned posts, for there are even now bands of guerrillas running about for purposes of loot and destruction. I know of several ambitious little mining parties which have been cut to pieces by the bandits. The Spanish do not seem to have mined for the zinc deposits, and the natives are also ignorant of their value.

As long as 200 years ago, say the Spanish records at Iloilo, the Spanish and Filipinos secured copper in small lots from the rocks of southern Luzon, from Panay and from Gimeras. The writer has seen some of the old, crude devices employed in the past for getting the copper material from the rocky deposits. The first thing the natives do is to gouge out solid rock with metal points—a labor which requires a great deal of patience. This bed forms the base in which the pieces of copper-bearing ore are placed for heating and grinding. The natives build fires over the ore, and the intense heat softens the rock somewhat. The fire is then removed and the process of pounding follows, further reducing the rock. Then the rock is placed in crucibles and heated until the copper separates. More modern modes of getting the copper are being introduced, and before long the fields of the Philippines which are copper-bearing will have some place in the metal-producing countries of the world.

Copper is used a great deal on the islands for weapons. The bands of weapons of all sorts are usually of copper. It is hard to distinguish the copper from gold very often, as the natives have a habit of melting the copper and mixing with it certain other metals which tend to impart a yellow cast to the metal. The added metals also make the copper harder. I have seen copper articles made so like gold in this way that the jewelers sometimes sell them as gold. On the other hand, some of the real gold metal of the country looks very coppery, owing to the way that the natives treat it. I recollect that on one occasion a broken end of a spear was given to me by a native. I noticed a little band of yellow and coppery-looking metal at one end, but supposed it was not of much value, and so sent the broken spear end to a friend, who reports to me that the little band is gold, worth $18.

The copper miners of the Philippines, with the exception of some of the American and other foreign miners who have recently arrived, are not well posted in the science of getting and treating copper, and until there are some improvements made in the processes and some machinery sent here for mining, the copper fields of the country cannot be expected to be much of an item in the world's copper supply for electrical and other purposes. Mining machinery is needed and also more competent miners. The Spanish and native miners are ignorant of the art of mining, and can secure products only through chance. They lack the necessary training for developing a mine of any sort.

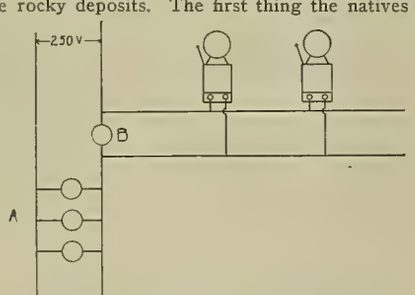


Fig. 1.

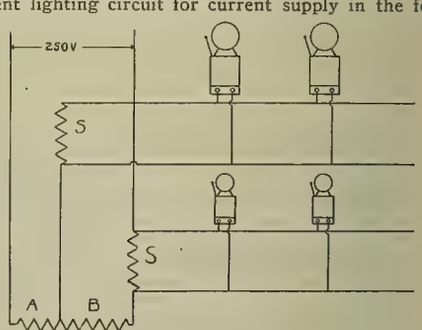


Fig. 2.

BELLS ON 250-VOLT CIRCUITS.

COMMUNICATIONS.

A Case of Sparking.

To the Editor of the Western Electrician:

Please publish this in your paper, so that your readers may be able to give me some light as to the cause of my trouble.

I am running a General Electric A. S. 10 alternator of 60 kilowatts, operating at 1,500 revolutions per minute and wound for 1,150 volts, and the rectifying brushes spark from the time it starts with 30 amperes, and very badly at full load of 52 amperes. The brushes at points of contact are smooth and at the right angle. You can polish the commutator, and in one night's run it will be very rough, especially at the edges of segments. The indications are of a poor contact or short-circuit, but I have tested the machine out and have failed to find anything. I put in a new armature, and that failed to stop the sparking. Now, if any of the readers of the Western Electrician can give me any light it will be fully appreciated.

P. H. HULL.

Beloit, Kan., February 2, 1901.

[Sparking at the brushes is usually capable of easy remedy, but in a brief statement, such as the foregoing, correspondents often fail to give data sufficient to locate the "bug." However, we give the writer the benefit of the publication of his letter.—Ed.]

Bells on 250-volt Circuits.

To the Editor of the Western Electrician:

I submit the following, thinking it may be of some use to the readers of your paper:

Having about 40 bells on which the service was so heavy that common open-circuit batteries would not stand the wear, we used the 250-volt, direct-current lighting circuit for current supply in the following manner: A bank of three 16-candlepower, 250-volt lamps (A), Fig. 1, was connected in series with one 32-candlepower, 50-volt lamp (B), and the bell circuit put in multiple with the latter, as shown in Fig. 1.

Fig. 2 illustrates a more general application of the above principle for use with bells and gongs of different sizes. A resistance of about 350 ohms is connected across the circuit, the tap for the gong circuit dividing it into two sections (A) and (B), of about 150 and 200 ohms, respectively. The shunts (S), (S) are in each case of from 20 to 30 ohms' resistance.

We find that with this arrangement the contact points do not become burnt as quickly as with batteries for a source of current, and the bells require very little attention.

E. J. WHITSON.

Leavitt, Neb., January 13, 1901.

An Opening in Cottonwood Falls.

To the Editor of the Western Electrician:

Cottonwood Falls and Strong City, Kan., would be good places for someone to serve by an electric-light and power plant. The plant could be run by waterpower. The street-car line which connects the two towns could be run by this power. The towns are about a mile apart, and have a population of about 3,000.

G. W. STEPHENSON.

Cottonwood Falls, Kan., February 2, 1901.

Polyphase Electric Traction Abroad.

By Frank C. Perkins.

It seems hard to realize that the horse car is in operation to-day only in the largest cities of the world, such as New York, London and Paris. In New York and Brooklyn recently the advances in electric propulsion have been rapid, indeed, and the electrically operated lines to-day include trolley, accumulator, elevated and conduit roads, and soon will embrace a great tunnel system. In Paris and London the buses are still drawn by horses, and the trolley, accumulator and conduit systems of electric traction are not used. The underground or tunnel systems, with cars operated by electric motors, are in operation and will be increased rapidly from now on. Trolley lines are also being projected and installed, and the London County Council has definitely decided upon an electric conduit system for certain central thoroughfares. It is also understood that there is to be another trial of accumulator cars in London.

The great question in electric traction now before the leading manufacturers of electric locomotives in this country and abroad is whether the existing polyphase locomotive is equal or superior to the direct-current locomotive for underground traffic, or whether the combination of a three-phase system using rotary converters and direct-current locomotives can compete successfully with the ac-

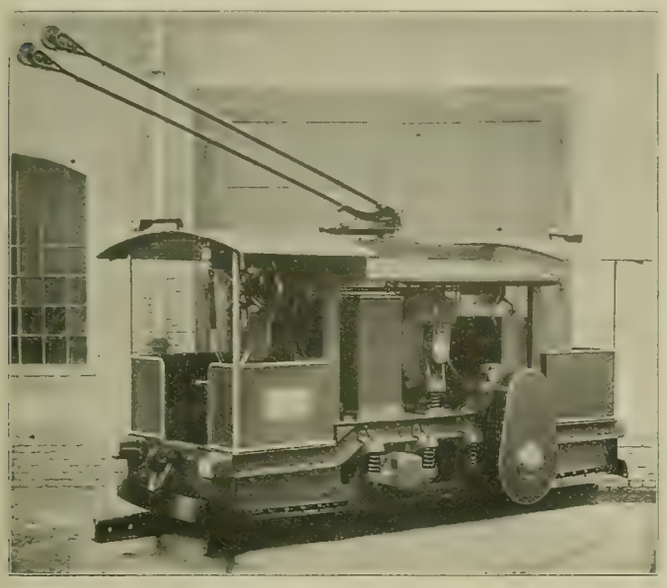


Fig. 1. Ganz & Co.'s Locomotive at Vajda Hunyad

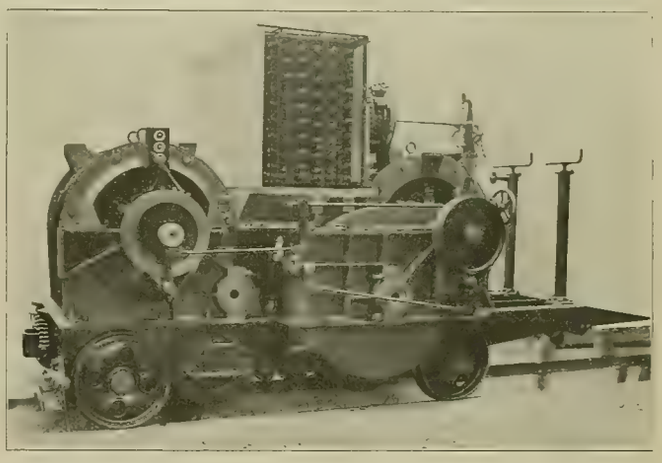


Fig. 2. Oerlikon Double-motor Equipment on Jungfrau Railway.

POLYPHASE ELECTRIC TRACTION ABROAD.

knowledged cheaper system using polyphase motors direct upon the cars or locomotives, thus doing away with the rotary converter, as championed by leading European engineers.

The Metropolitan underground system of railways in London is to be equipped with electrical equipment. It is understood the leading American firms have submitted bids, using the combined direct-current and polyphase system, while several prominent European firms, including Ganz & Co. of Budapest, adhere to the cheaper polyphase system. The latter-named firm, which is of acknowledged reliability, has underbid other companies, and the matter under consideration is being awaited with eagerness.

It may be of interest to note the details of the polyphase electric locomotive as manufactured by the firm of Ganz & Co. of Budapest, even though the exact type of machine as placed in competition for the London underground road is not known. It is understood that the cost of equipment, as estimated by this firm, was below, not only the English, French and other German firms, but also the General Electric and Westinghouse companies of this country, the amount being a million and a half dollars. The four-ton locomotive shown in Fig. 1 has a drawbar pull of 600 pounds and a speed of only seven miles an hour, but it illustrates one type of Ganz polyphase locomotive. It was built for the Hungarian State iron mine at Vajda Hunyad. The polyphase motor has a capacity of about 20 horsepower and operates at a speed of 800 revolutions a minute, the frequency being 42 cycles a second. The revolving armature is supplied with a 300-volt current, the field being stationary. Two trolleys are used, and the current passing through the controller and rheostat reaches the armature by means of carbon brushes and three collector rings.

The Oerlikon locomotive, operated on the Jungfrau (Switzerland) three-phase electric railway shown in Fig. 2, has a weight of 32,000 pounds and draws two cars, which are capable of seating nearly 100 persons, up a grade at places equaling 25 per cent. The frequency is 38 cycles a second and the normal speed five miles an hour. The current is taken from two trolley wires by single slide contacts and is conducted to two 150-horsepower motors whose normal speed is 800 revolutions a minute. The cars are pushed up the hill, but follow the locomotive down. These machines are designed to operate as generators going down the mountain side and may either send current back on the line or be regulated as to speed by sending the current generated through resistance and varying the direct current sent through the stator winding used as a field. A small direct-current dynamo is used on the locomotive, operated from the motor shaft. By varying the direct current one-half the up-grade speed may be obtained. Mechanical brakes are also used, as well as electric or magnetic brakes.

The Burgdorf-Thun polyphase railway in Switzerland is 40 kilometers long and is a standard-gauge, three-phase road. The energy is obtained from the Kander power house at a tension of 16,000 volts, and is reduced to 750 volts for use on the contact or trolley line. There are two locomotives used, each being equipped with two 150-horsepower, three-phase motors. There are also six motor cars, each having four 60-horsepower, three-phase motors. Fig. 3 shows one of the polyphase locomotives with the cab removed. These machines were built at the Baden works of the firm of Brown, Boveri & Co. The total maximum train weight is about 100,000 pounds, and this can be hauled at full speed up the steep grade of 1 to 40. The locomotives themselves each weigh about 60,000 pounds, which leaves only about 20 tons for the train. For this reason arrangement is made so that the speed can be reduced by gearing to half the normal speed, in which case 70 tons additional may be hauled up the steepest grade, making a total train weight of 120 tons.

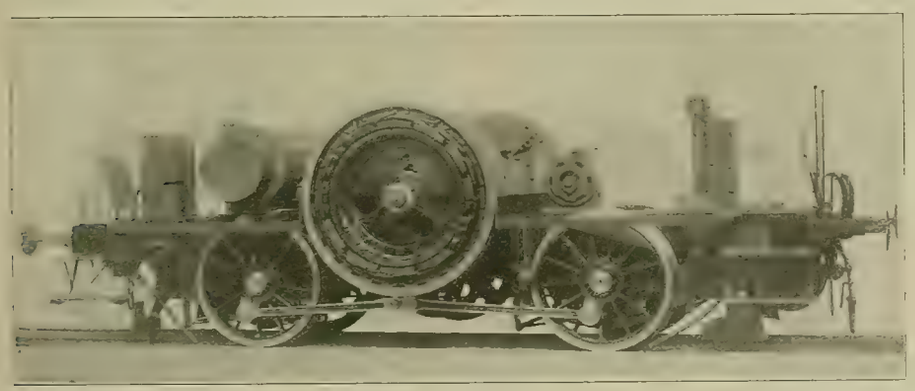


FIG. 3. POLYPHASE ELECTRIC TRACTION ABROAD.—BROWN, BOVERI & CO.'S LOCOMOTIVE ON BURGDORF-THUN RAILWAY.

Chicago Street Railways Compared with Eastern Systems.

George C. Sikes, secretary of the street-railway commission of the Chicago City Council, recently made an extensive eastern trip for the purpose of inspecting the various street-railway systems in operation in New York, Boston, Philadelphia and other large eastern cities. He will present a full report to the commission, and it is expected that the work of framing a subway measure to be presented to the council and the Legislature will be pushed as soon as the secretary's report is ready.

In reviewing his observations, Mr. Sikes said: "While visiting eastern cities I have made it my business to observe street-railway conditions generally. Street-railway service is nowhere entirely satisfactory. There are varying degrees of excellence or of badness of service, however, and I do not see how any fair-minded observer can have hesitation in saying that the surface-line service of Chicago is, on the whole, inferior to that of Washington, Boston, New York, Philadelphia and Baltimore, the cities I have visited on this trip.

"It seems to me there is in Chicago much more sentiment in favor of municipalization of street railways than in any of the five cities I have just named. To a considerable extent, at least, I attribute the greater strength of municipalization sentiment here to the inferiority of the service rendered. There is, however, an unprogressiveness of street-railway management in Chicago that contrasts poorly with the spirit of the city in many other respects.

"In elegance and general equipment of cars, in the lighting of cars and in the introduction of improvements, such as push buttons for signaling, Chicago is behind many other cities. The running of cars in long trains is practiced nowhere else.

"Taking the country as a whole, probably the three most conspicuous features of street-railway development of the past decade have been the general adoption of electricity in one form or another as motive power; the consolidation of separate companies in the same community, and the operation of all the lines thus brought under common control upon the basis of a unified system, and the establishment of routes running through the city from end to end in place of a system of routes terminating in the business center and from there looping or switching back. In all three of these features the development in Chicago is belated, to the detriment of the service here."

An electric line, 12 miles in length, between Fincastle and Roanoke, Va., to connect with the Chesapeake and Ohio road and with the Norfolk and Western at Roanoke, is being promoted by James Godwin, cashier of the Bank of Fincastle

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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The tall talk of a transatlantic trip by the submarine boat Holland has excited the interest of the French. It causes l'Electricien to discourse in this fashion: "A sensational piece of news reaches us from America. It is nothing more than that the famous American submarine torpedo boat of Mr. John Holland is prepared to accomplish the crossing of the Atlantic, making two stops to replenish its fuel supply, one in the Bermudas and the other at Fayal in the Azores. Having been so far rather bluffed by the announcement of feats accomplished, or to be accomplished, by the Holland, we content ourselves with submitting this report without comment for the consideration of our readers. We await developments, which is safer and wiser." Like our skeptical contemporary, we are awaiting developments in the matter of the Holland's long voyage, but in the meantime we note with curious interest that the word "bluff" and its derivatives have apparently taken root in the congenial soil of France. America has not only taught our Gallic friends a few things about electric railroading, but has apparently provided them a few long-sought words as well.

In some respects England is passing through an electric-railway agitation similar to that experienced in this country 10 years ago. Apparatus and methods have been improved in the interval, to be sure; but the outcry of the conservatives is much the same. Thus the announcement that powers are about to be sought for the construction of a system of electric lines in isolated residential districts in the West End of London has resulted in the organization of a "Tramways Opposition association," headed by the Earl of Kinnoull. In a letter soliciting public support to fight these "nefarious schemes," the earl says: "There can be no doubt that these projects are entirely uncalled for and unnecessary. The introduction of tramways into well-inhabited districts almost inevitably brings about great depreciation in the value of property, as well as many other disadvantages. It is most important that every possible step should be taken to prevent these bills from obtaining parliamentary sanction. I cannot too strongly point out the dangers that threaten London through the invasion of these so-called modern improvements." This statement is simply wholesale and indefinite denunciation and is entitled to no respect as an argument. It bears a strong resemblance to the frenzied appeals of the American opponents of the "deadly trolley" a few years ago. But nevertheless the trolley fought its way and is now almost omnipresent in this country except on the busiest streets of half a dozen of the largest cities. Its benefits to the community far outweigh all possible objections, and doubtless this truth will likewise be recognized in England—in time.

Of much more immediate interest are the questions growing out of the proposed electrical conversion of the Metropolitan District underground-railroad system in the heart of London. As has been stated in this journal heretofore, the Ganz system of using polyphase motors on the cars at an electromotive force of about 3,000 volts is receiving careful consideration, and at the close of last week it was rumored that it would be adopted. Advocates of direct current, 500-volt motors are naturally doing their utmost to combat the new system, and they ask the directors of the company "to pause and consider the well-being of the metropolis" before adopting it. Answering this appeal to the fears of the traveling public, Sir William Preece, who has just returned from an investigation of the Ganz system in Budapest, is reported to have said: "While it is true that this system provides for a voltage as high as 3,000, this does not mean that the road must necessarily be operated up to the full maximum. The Board of Trade is the arbiter of public safety in this country, and whatever voltage it decides is proper to employ will be used—no other. There are many manufacturing concerns in London which use electrical power for commercial purposes at a voltage of 3,000, and we have not experienced any epidemic of accidents as the result of such operation." If the high-voltage polyphase system is adopted, the fact will have an important bearing on electric-railway development everywhere, for if the alternating-current motor has at last reached a stage of development where it is adapted to general railway work, the effect of the improvement will be far-reaching and extensive, especially in long-distance, or comparatively long-distance, railroading. It does not follow, of course, even if the high-voltage polyphase motor is adopted on the Metropolitan District road, that the new system is adapted to all conditions of railroading; its field may be still quite restricted, or the attempt may even prove to be a failure when put to the test of heavy London traffic. But nevertheless the adoption of the Ganz system on such an important transportation line as the Metropolitan District of London would give a wonderful impetus to the consideration of the polyphase motor in all important electric-railway projects. The question of possible danger from the high-voltage current is to be considered, of course; but it is likely that this objection will not be found to be insuperable with modern methods of construction and insulation. If the motor itself is found in practice to be suitable to the exacting requirements of electric-railway work, it may be supposed that all other details relating to construction and operation will be successfully worked out.

What is the matter with the Yankee inventors? For many years the New England states, and particularly Connecticut, have been shown by the records of the Patent Office to lead all other sections of the Union in inventive ability, as demonstrated by the proportion of patents issued to the total number of inhabitants. But in 1900, as Patent Commissioner Duell's figures show, Connecticut was exceeded in this respect by both the District of Columbia and the state of Colorado. In the case of the District of Columbia the fact may be accounted for by the advantages that Washington, with its Patent Office records and its museums, offers to inventors. But Colorado's position is something of a surprise. Truly the star of ingenuity has taken its way westward, and made a long leap at that! It will be interesting to observe whether the activity of the inventors of the Centennial State is maintained, for it is of course quite possible that the figures indicate a coincident spurt on the part of the patentees rather than a steady characteristic.

As usual, the financial report of the operations of the Patent Office shows a surplus to add to the comfortable balance of over $5,000,000 now in the United States Treasury to the credit of the department. With this showing to their credit, surely the inventors of the country and the officers of the Patent Office should not ask Congress in vain for any reasonable expenditure to improve the service.

Elihu Thomson contributes the article on "Electricity" in the series of nineteenth-century reviews published in the syndicate of daily newspapers headed by the New York Sun. Professor Thomson states clearly and carefully, without exaggeration or bombast, the rapid electrical progress of the century and the profound effect it has had on human advancement. He does not think science has any answer to the oft-repeated question, "What is electricity?" any more than it has to the question, "What is energy?" but ventures the opinion that the electrical properties of the ether may prove to be the fundamental ones on which the universe is built. Recent investigations lead to the conclusion that all forms of light, whether from a candle, a kerosene lamp or a gas burner, are, in essence, electrical phenomena. Another interesting statement is that moderately high-frequency currents may be used in the future by surgeons to produce anæsthesia without interfering with consciousness. Professor Thomson concludes his excellent article by regretting that a fraction of the vast expenditure for engines of war, for armies and navies, is not turned to the advancement of the arts of peace, to the greater credit of the present time when it shall come to be reviewed by future historians. In this he agrees with all scientific investigators, electrical and otherwise. Prof. Henry A. Rowland, in a recent address, very pertinently asked where was the individual, the society or the nation that would establish a $100,000,000 endowment for an institution for scientific research. And yet, as was pointed out, that sum, large as it is, represents only a small part—perhaps 10 per cent.—of the sum lavished annually on the armaments of the world!

Popular Notions as Hindrances to Electrical Progress.[1]

By Albert Scheible.

The extent to which the force of public opinion has helped electrical workers in making their rapid progress during the last quarter of a century can hardly be overestimated. The bold and often rash moves of the American inventor, which enabled him so quickly to outdistance his European contemporaries, could not have been made had he not been inspired by the enthusiasm of the American public and the American press, to both of which everything seemed possible at the hands of the electrical worker. Nor could he have commanded the money for his extensive and often only half-studied-out experiments if he had not felt this same thrill which ran through the whole nation whenever a new step in advance was foreshadowed in our daily or weekly papers. Our parsons are apt to laud inventors for the faith which they have shown in their own ability, which faith enabled them to overcome obstacles and accomplish the seemingly impossible. In this I think they fall short of the truth. The faith of the scientist in his studies and conclusions has always been with us; but here a whole generation voiced its faith in its scientists, its experimenters, its originators. Did it say to the inventor: "Prove your faith in being able to accomplish something, and we will believe in you?" No; it said to him: "We have faith in you; we will back you; we expect it of you. Now hurry up and do it!" No wonder, then, that electrical work has made such remarkable strides in this country during the last 20 or 25 years.

But this powerful influence of public opinion has not been wholly a help to electrical progress. Our daily encounter with curious popular notions as to electrical work shows how unreasonable it would be for us to rely on the general public for a ready and unqualified support to whatever may seem to us the next logical step. Twenty years ago, when electricity was just working its way into everyday applications, any hindering notions on the part of the non-electrical public were excusable; indeed, electrical people had no time to attend to such notions, as it took all of their own time and energy to work out the problems awaiting immediate solution at their hands. That mad early rush is now over, and on the threshold of what may be an electrical century it behooves us to see if there are still some popular notions which are handicapping electrical progress, and if there are such to try and remove them. Indeed, I doubt if there is any more hopeful or more generally needed work which electrical people can undertake together at this moment than that of arousing the general public to a correct enough understanding of our needs, so that it may show a more healthy attitude toward electrical progress.

If you tell the average man to whom you are introduced that you are interested in electrical work, he will tell you: "Ah; then the world expects a great deal of you." I like the appreciation shown by that remark, but is it right for non-electrical people to look to the electrical fraternity for practically the whole of that progress? Can electrical work ever reach a high state of perfection in its applications to architecture without the hearty co-operation of the architects; in railway engineering without the ready support of trained railway engineers, or in power distribution without the cordial helpfulness of those experienced in the application of power to machinery of various kinds? Of course, such helpfulness implies an active co-operation on the part of the non-electrical public, and perhaps it is asking too much to expect this when even the passive notions held by those all around us are hindering, instead of helping, electrical progress.

Let us look at some of these popular notions.

First, there is the old notion that "anything is good enough for electrical work." The hurried development of electric lighting 20 years ago made this notion partly excusable at the time, but it certainly should have been outgrown 10 or 15 years ago. Our underwriters have long been trying to correct the results of this notion, yet even to-day new work is steadily going on which shows how this idea holds on. If we could overcome this popular notion, the fire losses due to defective wiring would dwindle to very small proportions. At present we can hardly turn around without finding buildings where the electrical work is not only an eyesore and a serious incentive to fires, but also likely to break down at any time and give unsatisfactory service. Of course, the electricians get the blame for it, and if the architects or engineers have it pointed out to them that the electrical part of their work is the only part not carefully planned (and therefore 20 years behind the rest), they take refuge behind the popular notion that "anything is good enough for electrical work."

Then there is the notion that electrical devices are merely substitutes for what they replace, and therefore subject to the same limitations as the replaced items. For instance, our gas jets had to be low enough to be easily reached from the ground for lighting them. Electrical fixtures can be just as readily controlled from any point on the wall, yet most of them are placed just as low as the gas fixtures, regardless of the height which would give the best artistic effect or the most desirable illumination. Oil lamps, when used in show windows, had to be at quite a distance from the ceiling, in order not to blacken the latter; but is that any reason why incandescent lamps should have to be similarly placed so as to detract from one's ability to see the goods in the window? The best practice would mean a new study of the results aimed at in using the lighting unit, regardless of any limitations which may have hampered what was previously used, but the public looks at the incandescent lamp merely as a substitute for gas, and handicaps its usefulness accordingly. So, too, the public looks on the electric telephone as a substitute for the old-time speaking tube or acoustic telephone, into which you had to shout. The modern telephone really brings the listener's ear close to you, so that a low tone of voice is ample, yet the inexperienced user still shouts into the transmitter as if he had a non-electric device before him.

Another hindrance to electrical progress, and one whose effect is apt to be underestimated, lies in the notion that "electricity is in its infancy." Most people are not in the habit of calling their 25-year-old sons "infants," yet they keep right on saying that electricity is still an infant, and this naturally leads to the impression that electricity is something crude, undeveloped and inexact. I have often thought that a school-teacher who would pass a child from the sixth or seventh grade with this notion in his head should be dropped from the payrolls, and that an immigrant who still believes electricity to be in its infancy should be classed with other illiterates and refused admission to this country. No one speaks of the steam engine as undeveloped or as in the infantile state, yet very few engines will show over 15 per cent. efficiency in practice, while our motors and dynamos readily test up to 80, 90 and even 95 per cent. efficiency. This same notion also leads to the idea that it is too early to expect good service from electrical installations, and we all know the fallacy of that idea. There may be electric-light, or railway, or, more likely, telephone, companies that will let this pass as an excuse for the imperfect service given by them; but if there are such, the public is not getting full value for what it pays such concerns, and the public ought to know by this time that electrical work has reached a high state of development, where first-class service may be reasonably expected from it.

Allied to the above is the notion that electricity is a mystic something about which nobody knows much, and the effects of which cannot be definitely foretold. We might as well speak of gravitation as mystic; yet who will say that the laws of mechanics, which depend so largely on gravitation, are not clearly known? This notion that nobody knows what electricity is (and that therefore no one knows much about it) has led to a widespread belief that it takes very little time to learn what there is known about electricity, and that even now there is plenty of room for speculation as to causes and effects in electrical work. That is why so many men, after a wee bit of electrical reading or study, can give out the impression that they are experts in the electrical line.

Less common than the above is the notion that electricity is a source of energy, or that it is a multiplier of energy. Many of us thought that scientists had long ago settled the point that energy can be transformed, but not created. Yet people who are otherwise well educated will express their belief that, somehow, electricity can be made out of nothing, or that a small amount of mechanical energy will be ample to produce a much larger quantity of electrical energy. Only a year ago a prominent manufacturer in this city spoke to me about equipping his factory with electric power. Before I had talked with him long I found that he was planning to throw away his steam engine and boiler, yet had not thought of getting a supply of current from outside! Like thousands of others, he had the idea that somehow or other the electrical machinery would operate itself without the further use of engines or boilers, or, in other words, that the needed energy could be made out of practically nothing when electrical devices were used.

Such a notion often handicaps the introduction of electrical power transmission, yet it probably does much less harm than the idea that "everything is possible electrically" does when applied in medical practice. The friction machine, the electric belt, the induction coil and the Roentgen tube have each in turn been held up as a cure-all for every ill under the sun, and the people kept from proper medical treatment by the electromedical freaks are countless. Some of these practitioners even evolve their own theories of electrical phenomena, with an utter disregard of all that scientists have known and proven. Of course, they could not thrive but for this popular notion that electricity can accomplish everything. Happily, the medical profession, as a whole, is opposed to these rash practitioners, though hindered by the force of public opinion.

Then there is a fallacy for which the press may be largely to blame. It is the notion that electrical work is likely to be revolutionized at any moment by some new inventions. This notion has perhaps done more than any other to keep investors from putting money into perfectly legitimate electrical enterprises. It makes fine reading matter for a sensational paper when the reporter has dined some noted electric experimenter and then writes up the prophesies made between the clinks of the glasses; but the result too often handicaps the sober and plodding electrical worker, who knows that such a remarkable discovery is no more imminent now than it was 10 years ago.

Such are a few of the prevailing notions which have been and are still hindering electrical progress. Others could be mentioned, but I think these will suffice to show in how many ways the public takes a wrong attitude toward electrical work, and how we need to strive to root out these erroneous notions. Further progress in electricity as a power conveyer, a time-saver, a distance-annihilator and an otherwise helpful servant depends largely on the support given by the non-electrical public.

This is what it demands:

That our architects give us sightly and rational lighting for show windows, stores and residences; also artistic substitutes for the outdoor fixtures which now disfigure the fronts of so many handsome buildings.

That our artists and municipal-improvement associations insist on handsome designs in fixtures and on sightly wiring for both street and building lamps.

That our civil engineers give us the well-paved and well-drained streets, which alone are needed to make conduit-railway systems a practical success.

That our physicians and surgeons drive out the practitioners who make rash use of electrical devices (often as adjuncts to equally rash surgical operations) and who use the word electric as a cloak for their unscientific attempts.

That our educators teach even their grammar pupils that electricity in its various applications offers a field of work open to best advantage only to those who have devoted year after year to the needed study and preparation.

And what does electrical progress ask the general public to do?

To know that electricity is so highly developed that first-class service can be expected in every electrical line.

To realize that the electrical field is so large as to require specializing, and so deep as to demand at least as thorough a preparation as that needed for the medical profession or for other engineering lines.

To know that electrical devices cannot give out more energy than is supplied to them.

To learn that electricity, instead of being uncertain and unmeasurable, is one of the most exact of sciences.

To realize that the present high cost of electricity for certain uses is due, not to the undeveloped state of the electrical devices, but to the low efficiency of the steam boilers and engines which drive the electrical machinery.

To know that there is no prospect of any developments which will so revolutionize electrical work within the next 10 years as to jeopard investments in up-to-date electric machinery.

To feel that electrical progress will come just in proportion to the eagerness with which users of electrical devices want really effective service and to their willingness to waive old prejudices so as to give the electricians an unhampered opportunity for applying this modern servant to the best advantage.

Such are the demands which electrical progress makes on the general public. Do we not owe it to our non-electrical neighbors to make them aware of these demands, so as to break down the popular notions which at present are hindering the real progress wanted by us all?

1. Read before the Chicago Electrical association, January 18 1901.

Municipal Ownership Not Wanted in Montreal.

A few months ago a special committee was appointed by the City Council of Montreal to report upon the best course to adopt in regard to the electric lighting of the city, upon the expiration of the present lighting contract with the Royal Electric company of that city. The committee did not favor municipal ownership, but recommended that bids for the new lighting contract be called for, and that the specifications contain certain conditions which do not apply to the existing contract. The following objections to municipal ownership were given: That it would cost the city a large sum to purchase such a plant; that the city would find it costly to operate such plant by steam power; that there was an unfavorable outlook of getting waterpower, without purchasing it from the companies, on account of so many waterpower companies operating water plants in the vicinity of Montreal; that if waterpower was bought, it would cost the city as much to manufacture electricity as if produced by coal; and, finally, under these conditions, it would be better to give the lighting out by contract and to have the keenest private competition for the service

The Lansdale and Norristown Electric Railway company has been incorporated, for $60,000, to build a trolley line from Lansdale to Norristown, Pa. George H. Young is president of the company.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

Bills have been introduced in the Wisconsin Legislature seeking to change the system of taxing telephone companies from gross earnings to a property valuation, and also requiring competing telephone companies to receive and transmit messages for each other, and fixing telephone rates of $4 a month for cities of 100,000; $3 a month in cities of 30,000; $2.50 a month in cities of 20,000, and $2 in cities under 20,000. A long-distance rate of 10 cents a minute for 100 miles or less is provided. Heavy fines are provided for violation—$200 to $500 for the first offense, $500 to $1,000 for the second, and $1,000 to $5,000 for the third and $10,000 for each subsequent offense.

The toll line from Sparta, Wis., to Sowle and Rice has been bought by Charles D. Johnson, proprietor of the Tomah (Wis.) telephone exchange.

The Minnesota Electric Telephone company of Willmar, Minn., has been granted a franchise for a local exchange at Monticello, Minn., and will install a system at once.

Receiver E. E. Webster of the Mississippi Valley Telephone company at Minneapolis has worked hard since the receivership, January 14th, and managed to secure funds with which to pay employes for their work during the period under a receivership up to February 1st. He is confident that there is a chance for an Independent telephone system in the Twin Cities.

Farmers of Washington and Mahaska counties, Iowa, have about 100 miles of rural telephone lines, which were constructed at a cost of $6,000, and they connect more than 200 farm houses. The owners have unceremoniously refused an offer from the People's Telephone company to take over the line and give connection with the exchanges in Keota and other towns. These farmers have seven lines centering in South English, and are given free connection with Webster, Keswick, White Pigeon, North English, Green Valley, Kinross, Nira, Wellman and Harper. They propose extending their lines to Iowa City, Sigourney and What Cheer.

The People's Telephone company of West Superior, Wis., has petitioned the council of Ironwood, Mich., for a franchise for a local exchange. The Michigan (Bell) Telephone company has an exchange at Ironwood, but its service is not satisfactory. The People's company promises a toll line through Northern Wisconsin from Duluth and Superior to Ironwood.

The Hutchinson (Minn.) Telephone company has filed articles of incorporation, with $25,000 capital stock. The company has its exchange completed and it has been in operation for some time.

The J. C. Hubinger company of Keokuk, Iowa, operating telephone exchanges at Keokuk, Fort Madison, Burlington, Muscatine and Wapello, Iowa, has sold its interests to Charles H. Randle of Chicago for a consideration of $45,000. The sale includes the toll lines of the company throughout that section of Iowa.

F. C. Hubbell has been appointed general manager of the Mutual Telephone company at Des Moines, Iowa. It is said that F. M. Hubbell & Son will take $10,000 worth of preferred stock of the company.

The Seattle Automatic Telephone company has asked permission of the Board of Public Works of Seattle, Wash., to construct a system which will cover practically all the residence portion of the city. The rival Independent company, working under the franchise granted J. S. McGroarty, will be known as the Independent Telephone company. Immediately upon the passage of the franchise by the council over the mayor's veto, a check for $3,500 was filed with the city clerk as a forfeit in case the line failed to be constructed.

One hundred farmers in the vicinity of Keota, Iowa, have formed a telephone association and will build an exchange in the spring, which will cover their entire territory. It will also connect with town exchanges.

A mutual telephone company is projected at Wapello, Iowa.

Farmers propose a line between Panora and Guthrie Center, Iowa.

Business men of Union, Iowa, have formed an organization and will establish a local exchange.

The Inland Telephone company will extend its wires from North Yakima, Wash., to Moxee and Sunnyside, thence to Walla Walla, where connection will be made with Spokane.

The proposed new line between Sheboygan, Wis., and Fond du Lac is to be constructed at once.

The Albert Lea (Minn.) Telephone company has been incorporated, to succeed to the late Fobes exchange, which has been bought by local parties. A committee of investigation has been at work, with a view to improving the system. It is probable that a more complete Strowger automatic system will be put in, instead of the automatic being abandoned, as it was at first proposed.

The Minnesota Electric Telephone company has secured 45 subscribers for a new exchange at Melrose, Minn.

The local exchange at St. Peter, Minn., is to be rebuilt.

The farmers' telephone line from Clarinda to Villisca, Iowa, is to have a branch built through Bethesda to Clarinda.

The Western Electric Telephone company will improve its toll lines between Britt, Iowa, and Kanawha, doing away with the present roundabout connection.

A local exchange is projected for Stanwood, Iowa, in the spring.

A local telephone company has been formed for Corning, Iowa, with a capital stock of $10,000.

A line is projected between La Grange and Canton, Mo.

A local exchange is in prospect for Stockport, Iowa.

A stock company has been formed for a local exchange at Carson, Iowa. An exchange of 50 connections is proposed.

The Maquoketa (Iowa) Telephone company has been incorporated, with $45,000 capital stock. R.

Ohio Telephone Notes.

On February 5th the stockholders of the Zanesville Telephone and Telegraph company and the Zanesville Citizens' Telephone company, recently incorporated, met and voted to consolidate the two companies under the name of the Zanesville Telephone and Telegraph company. The capital stock of that company was recently increased to $200,000, and $160,000 of that had been subscribed last week, with the books still open. The officers of the company, made up from both the former companies, are as follows: President, Sherman M. Granger; vice-president, W. D. Schultz; secretary and treasurer, H. A. Sharp; attorney and general counsel, S. M. Winn; general manager, J. B. Rhodes. The probate judge has designated the manner in which the lines shall be constructed, according to the decision of the Supreme Court. He requires that the portion in the business part of the town be laid in conduits. It is said that the case will be appealed from his court to the Common Pleas Court on error, and so another legal fight seems to be imminent over the matter. The company will begin work at once, and it is intended to complete the plant before fall. It will cost about $125,000. This company has a very close connection with the United States Telephone company.

The Home Telephone company of Dayton has made application to the Probate Court to fix the conditions upon which it will be allowed to construct a plant in that city, averring that the City Council has refused to grant a franchise. The company was incorporated and organized some time ago, and has been waiting upon the decision of the Supreme Court in the Zanesville case. S. R. Harshman is the president of the company.

It is reported that the Central Union Telephone company will move its office at Zanesville from the present location to a more desirable one, and that an entire new system will be installed. The system which has been contracted for is of the common-battery, multiple type, and it is the intention of the company to replace all the instruments with those of latest design, and to operate the plant with a storage battery. It is estimated that the improvement will cost about $24,000.

A. C. Morse, engineer of the Home Telephone company of Findlay, will take up his work soon, when the construction of the plant will be begun.

The commissioners of Butler County have granted a franchise to the Western Butler County Telephone company, which will at once begin the construction of a line to connect Hamilton, Darrtown, Oxford, Millville, and will extend to some points in Indiana.

The capital stock of the Ada Telephone Exchange company has been increased from $10,000 to $30,000.

There is a movement on foot among the people of Miamisburg and Germantown to organize a local telephone company, with a special view of giving service to farmers and other persons who live in the country. It is believed that residence service can be furnished for $1 per month and business houses for $2 per month.

An ordinance has been introduced in the council at Marion to grant the Marion County Telephone company a franchise for 25 years. The ordinance provides for either an overhead or underground system, and in case the system is an overhead one, the poles used must be 35 feet high in the business section and 25 feet in the residence districts. It is said that another company will soon ask for a franchise.

Julius Vautrot, Jr., C. B. Selby, E. A. Seeley and other Warren (Ohio) citizens have secured a franchise in Seattle, Wash., to build an Independent telephone system, under the name of the Seattle Automatic Telephone company.

Guy Zimmerman, in charge of the affairs of the Home Telephone company, Findlay, was married to Miss Amelia Beckley of Tiffin a few days ago.

O. M. C.

Michigan Independent Telephone Association.

The annual meeting of the Michigan Independent Telephone association was held at Lansing, Mich., on February 6th and was presided over by President J. B. Ware of Grand Rapids. Every exchange represented at the meeting reported a growing business, and it is stated that the prospects of the Independent companies never looked brighter. The day was spent in discussing rates and transacting business of interest to the members of the association. The association will hold a meeting next August in Alma, Mich. The following-named officers were elected for the ensuing year: President, J. B. Ware, Grand Rapids; vice-president, Orrin Morrow, Benton Harbor; secretary, C. F. Brown, Alma; treasurer, J. H. Fildew, St. Johns; executive committee, J. R. Hyde, Hart; W. O. Hunt, Adrian; C. W. Gale, Owosso; R. F. Johnson, Saginaw.

Michigan Company Refusing Connections to Independents.

A telephone war is on in Owosso, Mich., between the Owosso Telephone company and the Michigan Telephone company. When the New State (Independent) Telephone company installed the plant at Owosso and Corunna in February, 1898, a 25-year contract was entered into by which the New State company agreed to connect the Owosso and Corunna exchanges with its exchanges in Detroit and with any and all of its stations within the state, giving them the same rights and privileges as the New State company's own subscribers. About a year ago the New State company was sold out to the Michigan Telephone company, and since that time, it is alleged, attempts have been made to break up the Owosso company's business. Within the last two or three weeks the Michigan company has refused the Owosso exchange connections with nearly 40 exchanges and towns east and south of Owosso. The Independent company has now caused an injunction to be served on the Michigan company, restraining it from further action along this line. The Owosso company contends that under its 25-year contract with the New State company, the successor of the company is bound to stand by the original contract. A temporary injunction has been granted, and the motion for a permanent one will be heard on February 20th.

Changes in the Michigan Telephone Company.

At the recent annual meeting of the Michigan Telephone company Charles J. Glidden was prevailed upon to remain as president of the company for the present. The resignations of Frederick A. Farrar and Charles E. Adams from the board of directors were accepted, and Reginald Foster and Philip Dexter were elected to succeed them. Walter Abbott was elected treasurer in place of Charles A. Grant, who was in turn elected auditor of the company. The Michigan Telephone company also authorized the redistricting of Michigan, and the new plan places Grand Rapids at the head of the telephone business of the state. The southern division has been abolished and its headquarters, which have been at Kalamazoo, will be closed. C. E. Wilde, who has been the superintendent of that division, will be retained in another capacity for the present. Superintendent Barry of Grand Rapids is made superintendent of the combined western and southern divisions. Mr. Barry's supervision will now extend from the Indiana state line to the Straits of Mackinaw. The eastern division, which has had its headquarters at Saginaw and which has been in charge of George E. Dutton, is abolished and Mr. Dutton's division is absorbed in the Central division, with headquarters at Detroit. Mr. Dutton is retained for the present in another position. The northern division, with headquarters at Marquette, is left unchanged. Mr. Barry states that the new western division now contains as many telephones as the entire state had three years ago.

Independents Win Eldred Patent Suit.

The suit brought by the Western Electric company in 1896 against the Citizens' Telephone company of Grand Rapids, Mich., the American Electric Telephone company and P. C. Burns of Chicago has been decided by Judge Severens in favor of the defendants. The case involved the infringement of a patent granted to Horace B. Eldred and owned by the complainant. The four claims in suit of this patent cover broadly a cutting-in switch or key in the operator's cord circuit, a power generator for signaling, a clearing-out signal device and a calling drop. The defense had to prove that the patentee did not discover the clearing-out drop, nor apply it in use, and it was established that Eldred had appropriated an invention made by another. The decision is regarded as a signal victory for the Independent telephone interests, as the case was regarded as of much importance. The American Electric Telephone company fought the case alone, its attorney being C. C. Bulkley. As the patent expires next August, in all probability the case will not be appealed.

Henry Jaehning, owner of the new telephone exchange at New Richland, Minn., will shortly put in a new 100-subscriber board and extend his lines.

Cuyahoga Telephone Company.

The annual meeting of the stockholders of the Cuyahoga Telephone company was held in the office of the company at Cleveland on February 4th, 150 stockholders being present. In his report Henry A. Everett, president of the company, said that when a few of the contracts now outstanding were completed, the Cuyahoga would be the largest Independent telephone company in the world. It is second now, as matters stand. At the first of the year the company had 5,735 telephones in operation, and contracts had been secured for between 2,000 and 3,000 more, which were being put in place at the rate of nearly 50 a day. This company has a capital stock of $3,000,000, and its bonded indebtedness is $2,000,000. It is now earning about five per cent. on the cost, and with the completion of the contracts now out it will earn more, and there will be a moderate surplus on the capital invested. The directors were re-elected as follows: Henry A. Everett, E. W. Moore, John Sherwin, Mark Davis, F. T. Pomeroy, B. Mahler, H. Clark Ford, J. B. Hanna, F. M. Stearns, C. W. Wason and R. A. Harman. The officers are as follows: President, H. A. Everett; vice-president, E. W. Moore; treasurer, John Sherwin; secretary, Frank R. Price; assistant secretary, James B. Hoge; general manager, Mark Davis. The capacity of the plant has been more than doubled within the last few months.

American Bell Telephone Company Sued for Heavy Damages.

A suit for $50,000,000 damages has been filed in Chicago by the Atlantic and Western Telephone company against the American Bell Telephone company, the American Telephone and Telegraph company, the Chicago Telephone company and the Central Union Telephone company for alleged infringement of a patent issued to Henry C. Strong, a Chicago electrician. The principal defendant is the first-named company, the others being involved in the suit as licensees of the American Bell Telephone company. The Strong patent was issued in 1885, and will therefore expire in 1902, and in the meantime the claims pleaded in the suit will have to be settled. The Atlantic and Western Telephone company was incorporated in 1892, with a nominal capital of $5,000,000, but never installed any instruments or did any business. It acquired the Strong patent, and now asserts that the defendant corporations have conspired to deprive the Atlantic and Western company of the benefits rightly secured to it by the patent. The mechanism in question is described as an ordinary telegraphic signal instrument connected with the line wire, having one-half of its armature removed and the other half operated in the usual way by the portion of the electromagnet over which it lies, the remaining portion of the electromagnet being provided with a permanent magnet fastened to its core, with a cup and diaphragm to constitute it a telephone.

MANUFACTURERS AND DEALERS.

Telephone wall and desk sets, transmitters, magneto bells, receivers, induction coils, calling generators and other telephone apparatus and supplies are listed and illustrated on a large wall-sheet price-list issued by the Williams-Abbott Electric company of Cleveland. A separate circular, under the heading, "Something New in Telephones," describes the Sands Victor telephone, made for series and multiple work and manufactured by the Williams-Abbott company.

The Standard Construction company of 72-88 Market street, Chicago, is a new concern that is meeting success in the manufacture of telephones and small switchboards and in doing telephone and other electrical construction work. It is made up of active and energetic young men, two of whom, Messrs. Peacock and Porter, are practical telephone men, while the others look out for the business interests of the company. The concern also controls the patents of some new telephone devices which it is about to put on the market.

The E. J. Noblett company, Chicago, which for many years has been manufacturing all kinds of cabinet and special woodwork used in telephone exchanges, also cross-arms, locust and oak pins, oak brackets, cable, terminal, distributing and generator boxes, linemen's tool boxes, fuse and protection boxes, switchboards and monitor frames, backboards, battery boxes, etc., states that it is in a position to make a considerable saving to buyers who deal with it direct. The Noblett company, especially known for its careful and painstaking work in the manufacture of its products, which are American Bell standard, and are said to be the best that time and money can produce, has recently increased its facilities to meet the demand for its products. The company will be pleased to receive plans and specifications from Independent telephone manufacturers, exchanges and others in need of this class of goods.

George H. Robinson & Sons, Laurel Bloomery, Tenn., are in the market for materials and equipment for the construction of five miles of telephone line, together with about eight instruments.

Western Electric Desk and Ceiling Fans.

In the design of its line of fan motors the Western Electric company has exercised the greatest care to bring out apparatus that shall represent the highest stage of the art, both electrically and mechanically. The motors have been given an artistic and graceful design, their appearance being enhanced by a high finish. Some of the interesting features entering into the construction of the Western Electric fans are illustrated by the accompanying pictures.

In Fig. 1 is given a sectional view of the direct-current desk-fan motor, showing the position of the various parts. The self-aligning bearings (A) have a spherical outer surface. The gland of the oil cup (B) containing a felt wick, passes through without touching the bearing seat and fastens into the journal. The gland of the oil cup serves at the same time to steady the journal, while leaving it perfectly free to move in any direction. The oil cup is provided with a large oil chamber, which is filled with heavy cylinder oil, and one oiling will, under ordinary conditions, last an entire season. The wick conducts the oil in sufficient quantities to insure good lubrication, while, on the other hand, not so rapidly, it is said, as to cause the oil to run out at the end of the journal and drip on the desk or table supporting the motor. The wick is held against the shaft by a coiled spring, as shown in the cut. If it is desired for any reason to remove the journals, it may be done by unscrewing the gland of the oil cup after the cup is removed, when the journal itself can be easily slid out of the bearing.

The magnet frame is a drop forging, and is held to the base by a slotted bolt (E). The armature is of the ironclad type, which protects the wires from mechanical injury.

By means of a switch (D) the motor may be operated at three different speeds, the position that the switch must occupy for any speed being marked upon the base of the motor, as shown in the cut. The rheostat (C) consists of a porcelain spool upon which is wound german-silver wire. All switches are mounted upon porcelain bases. The 220 and 500-volt motors are designed to be connected directly to the service wires, no series resistance being placed in the motor to cut down the voltage. The 500-volt motors are provided with an added precaution of a double-pole, quick-break switch placed beneath the motor. The motors are designed for continuous running at any of the three speeds without sparking and without heating, to any appreciable extent.

Fig. 2 shows a sectional view of the company's standard ceiling fan for direct-current circuits. The self-aligning bearings (H) are similar to those used in the desk-fan motors. The screw marked (I) is of peculiar shape, and projects into a cup-shaped recess in the journal. After the motor has been set up and started and the journals brought to perfect alignment with the shaft, the screw (K), which has a sharp point, is forced into the journal. The upper journal is supported in a similar manner, the centering screws being placed at right angles to those in the lower bearing, thus giving ample opportunity for the journals to be brought into proper alignment. The oil-cup stem is fastened to the journal, as shown by (E).

Below the upper journal is a small oil pan, intended to prevent any oil that may run from the journal getting into the armature. Immediately above the oil pan is a small hole through the shell of the shaft, which permits the oil that may collect in the pan to run through the hollow shaft to the pan below on the top of the switch box (N). The upper part of the fan hub (L) is also made cup-shaped, which catches any oil that may drip from the lower bearing. These two precautions effectually prevent any oil dripping from the motor.

The armature is of the ironclad type, and the brushes are of specially prepared graphite. The motors are all capable of running at three different speeds, the switch (O) mounted on a porcelain base being used as a speed controller. The rheostat (D) is fastened to the upper bearing bracket (F).

The 170-volt fan, made to run three in series on 500 volts up to 550 volts, has a speed of 205 revolutions, and is not equipped with a regulating switch. The 220 and 500-volt motors are designed to be connected directly to the service wire. These motors are designed for continuous service at any of the three speeds, with two or four blades, and the motors run without sparking and without heating to any appreciable extent. The standard ceiling-fan motor is equipped with four blades, but two blades may be removed from the hub and the motor operated with two blades, if desired. The fan has a sweep of 60 inches and the blades are 8¾ inches wide across the face.

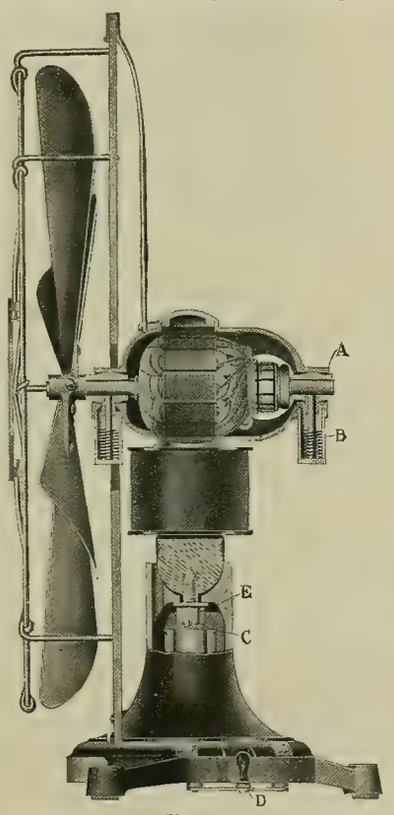


Fig. 1.

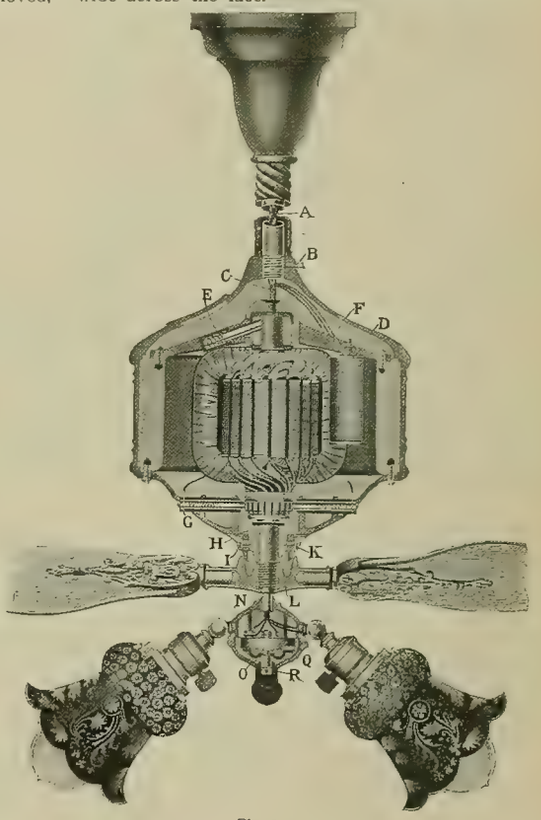


Fig. 2.

WESTERN ELECTRIC DESK AND CEILING FANS.

The ceiling-fan motors are each provided with a cold-drawn, hollow-steel shaft, through which an iron pipe (N) runs, which contains a double-silk and rubber-covered cable (C), connecting the rheostat with the switch. This cable also contains leads for the chandelier lights. When a fan is not used with the chandelier attachment these leads are coiled in the top of the switch box. To make the chandelier attachment, the small screw (R), holding the rubber switch handle to the switch stem is taken out, the switch box cover (Q) is then unscrewed, the two screws which hold the porcelain base in the switch box taken out, and ready access may then be had to the lead wires for the lamps. The cable (A) has three leads which are connected with the line wires inside of the canopy.

The hanger pipe, which is fastened to the motor casting, is covered with brass tubing of rope design. The motor is encased in an ornamental covering, the connections at the ceiling being concealed by a canopy, while the lower part of the motor is made of a fine open-work casing. The motors are made with a bright or dull brass finish, or oxidized copper, as desired.

The track of the Buffalo, Niagara Falls and Rochester electric railway has been built under practically the same specifications as would apply to the roadway of heavy steam roads, and in busy times it is the intention of the company to run trains of not less than 20 cars for freight traffic. The motors specified are of sufficient power to haul a loaded train of this length at a speed of 20 miles an hour.

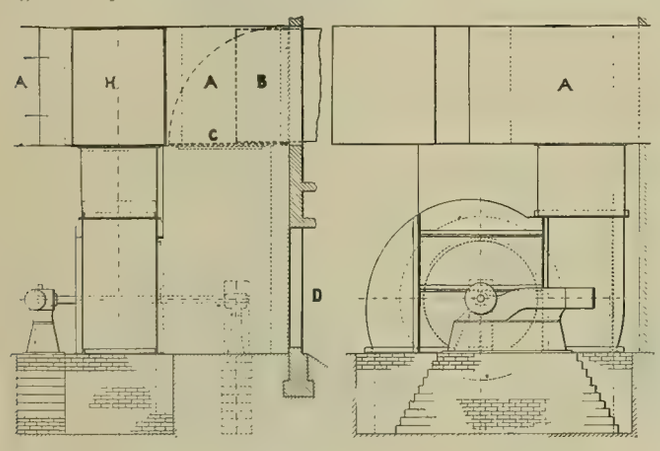
Application of Mechanical Draft to Stationary Boilers.

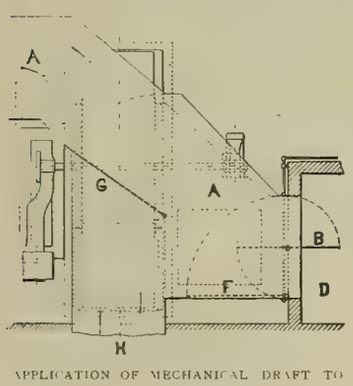
By Walter B. Snow.

In any consideration of mechanical draft, comparison must naturally be made between the chimney and the fan blower as a means of draft production. Inasmuch as the steam jet usually requires for its operation from five to 10 times as much steam as does the fan, this method of producing draft does not properly enter the discussion.

The chimney, because of its method of operation, is of necessity an exceedingly inefficient device for moving air, for a relatively high temperature of the flue gases is absolutely essential to its action. As a result, from 20 to 40 per cent. of the heat of the fuel is dissipated in the atmosphere without further useful effect. This is by far the greatest waste occurring in modern boiler practice. Any attempt to utilize a portion of this waste heat necessarily reduces the temperature and lessens the draft, which, in the case of a chimney, can only be made good by increasing its height. A chimney 100 feet high with external air at 60 degrees and internal gases at 500 degrees will produce an unbalanced pressure of about 0.65 of an inch. If the temperature of the gases be lowered to 300 degrees a chimney about 150 feet in height will be required to produce the same intensity, while for a temperature as low as 200 degrees the chimney will have to be about 240 feet high.

With the low chimney effective utilization of the heat of the waste gases is therefore impossible, for in order to maintain the draft they must of necessity pass away at relatively high temperature. A high chimney on the other hand entails considerable





APPLICATION OF MECHANICAL DRAFT TO STATIONARY BOILERS

expense and even then continues to employ the heat wastefully.

As compared with this wasteful process of air movement a fan calls for an expenditure of only about one-seventy-fifth of the heat required by the ordinary chimney to produce the same results. Or in other words practically all of the heat of the waste gases is rendered available for utilization and it only remains to provide the necessary means for abstracting the heat. For effective working the initial temperature of these gases must be approximately 75 degrees above the temperature of the steam within the boiler. Between this point and the atmospheric temperature is marked the range through which the heat abstracted may be effective.

The fuel economizer is now well established as an effective means of transferring the heat from the gases to the water fed to the boiler. It naturally shows the highest efficiency when the initial temperature of the gases is excessive, that of the water entering the economizer is low and the fuel is high priced. The temperature of the gases necessary to produce the requisite draft with a chimney evidently marks the limit to which they may be cooled by the economizer. With a fan, however, the intensity of the draft is practically independent of the temperature of the gases, and in point of fact when a fan is applied upon the induced principle, a decrease in the temperature actually increases the intensity of the draft produced at a given speed. It is here, therefore, that the fan shows its fundamental advantage over the chimney, in that it renders available for utilization practically all of the waste heat.

Reports of tests made by William R. Roney in plants equipped with fuel economizers and mechanical-draft apparatus in place of a chimney show an average saving of about 15 per cent. resulting from the introduction of this combination.

Another means of utilizing the heat of the flue gas is by air heaters or heat abstracters. In 1881-82 John C. Hoadley carried on at the Pacific Mills, Lawrence, Mass., an exhaustive series of tests of the Marland apparatus so arranged above the boiler that the gases drawn therefrom by means of a blower served to heat the incoming air before it entered the ash pit. The result was an increase of about 300 degrees in the temperature of the air so admitted and an opportunity for perfect control over its volume and pressure independently of atmospheric conditions.

A maximum boiler efficiency of nearly 90 per cent. was thus secured, while the steam required to drive the blower with a reasonably good engine was stated to be only one per cent. of that generated by its use. Although certain features of this particular apparatus militated against its general use, other devices, such as those applied to marine boilers by Ellis & Eaves and by Howden, have shown satisfactory economical results.

Evidently there are limits to such attempts at saving, for they can hardly be seriously considered in small plants, but the field is invitingly open for further economical advancement along these lines.

In the primary introduction of mechanical draft as a substitute for the chimney, first consideration is of course to be given to the relative costs of the two devices and to the expense of their maintenance and operation. From comparison of a considerable number of plants differing widely in character and capacity it appears that under ordinary conditions a single forced-draft fan with direct-connected engine and short stack can be installed for less than 20 per cent. of the cost of a brick chimney; a single induced-draft fan with direct-connected engine and short stack will cost less than 30 per cent. of a chimney, and that a duplex induced-draft apparatus consisting of two fans with direct-connected engines, inlet and outlet connections and short stack will cost but little more than 40 per cent. of a chimney. The latter arrangement is only employed where, as in the case of an electric-lighting plant, it is the practice to introduce relay units.

Of course the height of the delivery stack must depend upon the elevation of the surrounding buildings. Where tall buildings are not adjacent and the boiler house is of moderate height, the smoke pipe need pass only just above the roof. This is in fact the customary practice. But where the smoke must be discharged near to other buildings, it is obvious that the delivery pipe must be carried above their roof line. Owing however to the positive action of such a fan, the area of the stack may be materially less than would be required with natural draft.

The cost for maintaining a mechanical-draft apparatus depends to a certain extent upon the method of application. If applied to force air to the ash pits it will operate at moderate speed, will handle only cool air and will certainly have as long a life of service as the usual boiler fixtures and attachments. If employed to exhaust the gases from the boilers, it will be subjected to temperatures ranging up to perhaps 600 degrees. Disregarding leakage, the capacity will have to be greater in proportion to the increased temperature and decreased density of the gases, and the circumferential speed will have to be higher to produce the same intensity of draft. Within the ordinary range of temperatures the constituent gases, which are of necessity dry, have no deleterious effect upon the steel plate of which the fan is constructed. Overheating of shaft bearings is avoided by passing water through chambers provided in the boxes. The conditions, so far as they affect the life of the fan, are therefore practically no more adverse than in the case of a forced-draft installation. As evidencing the durability of a fan operated under these conditions it may be stated that in 1892 Cheney Bros. of South Manchester, Conn., installed in connection with a plant of 1,000 horsepower an induced-draft fan for taking care of additional boilers and economizers, the chimney being of insufficient capacity to do the work. A recent report indicates that this fan shows no effects of wear and that there is no evidence but that it will last for a long time.

The expense of operation depends of course upon the disposition of the exhaust from the fan engine. If this is utilized as it should be in any well-planned plant the cost of draft production becomes almost infinitesimal. If, however, the exhaust must be discharged to the atmosphere the actual expense for operation, as measured by the proportion of steam so used, compared with that generated, ranges from one-half to two per cent. in plants of reasonable size up to perhaps three or four per cent. in small plants. It may be readily shown that with the smaller amount the annual fuel expense for operating the fan will be materially less than the fixed charges on the additional cost of a brick chimney to produce the same results. Any great expenditure for operation is almost universally offset by increased efficiency of combustion and decreased cost of fuel. It is evident that mechanical draft may be introduced either as a substitute for, or as an auxiliary to, a chimney, and furthermore that it may be installed for operation on either the forced or the induced principle, as may be desired.

Wherever the fan is the sole reliance for draft production it is of course necessary that it should be provided with an independent engine, usually direct-connected, so that it may be operated as soon as steam is raised in the boiler. The height of even a small stack is sufficient to start the fire, while the fan begins to operate as soon as a few pounds' pressure is attained. Inasmuch as the power necessary to drive a fan varies as the cube of the speed, it is evident the power required per revolution at one-fourth speed is only one-sixteenth of that required at full speed, while with one-fourth of the power per revolution the fan may be run at one-half speed. There is therefore no difficulty in raising steam without a chimney if the independent engine is provided.

The installation of an economizer frequently introduces such resistances that a chimney capable of producing the draft without the economizer becomes insufficient when the gases are lowered in temperature and the increased resistances are introduced. Such was the case at the Talbot Mills, North Billerica, Mass. In order to utilize the economizer and the existing flue connection, and at the same time meet the requirements of an increased boiler plant, an induced-draft fan, as illustrated in the accompanying drawing, was installed by the B. F. Sturtevant company of Boston, Mass. Before the fan was introduced the gases passed with considerable difficulty from left to right through the flue (A) and thence downward and through a fuel economizer situated to the right of (B), but not shown. From this they passed through the opening (D) to the discharge flue (H). When the economizer was thrown out of service the damper (G) was swung over to the right and the gases passed from (A) on the left directly to the discharge flue (H). The introduction of the fan made possible the continuous action of the economizer with increased efficiency, and the operation of a larger number of boilers, and also made it feasible to secure combinations as follows: The gases may pass as before from (A) through the economizer and the opening (D), whence they may enter the fan, which creates the necessary intensity of draft to overcome the resistances, and discharges the gases directly upward into the flue (H). In case the economizer is thrown out of service the butterfly damper (B) can be closed, the swing damper (C) raised so as to leave clear the opening beneath it and the gases allowed to pass directly downward into the chamber below, thence through the fan up into flue (H); or the fan may be stopped and the gases may pass through economizer, opening (D), and through the fan to the flue (H), but of course with much decreased intensity of draft; or when they pass directly from (A) to (H) the damper (G) having been properly adjusted. Had the fan not been installed neither the economizer nor the extra boilers could have been successfully operated with the existing chimney, and to secure their proper efficiency a new chimney would have been required. In this instance the fan is driven by a direct-connected, horizontal engine with the shaft extending through the fan and a portion of the chamber, at the outside of which it is supported in a water-cooled box.

All types of engine-driven fans can be readily controlled by the steam pressure through the medium of a special regulating valve, or a combination of damper regulator and lever valve. A very slight rise or fall in the steam pressure actuates the valve and greatly decreases or increases the amount of steam admitted to the engine. The steam pressure can thus be automatically maintained within a pound above or below the normal while the fan instantly responds to changes in conditions and particularly to sudden demands for more steam. This feature of flexibility and of ready response is almost invaluable in plants where there are great fluctuations in the steam requirements, such for instance as in dye houses and bleacheries. Higher fan speed not only increases the air volume but coincidently increases the intensity of the draft which, of course, facilitates the ready passage of larger volumes at higher velocity.

Surplus capacity can be more readily and economically provided in the fan than in the boiler. That is to say, within the limits it costs far less to install a fan of sufficient capacity to force 1,000 horsepower of boilers to an output of 2,000 horsepower to meet sudden or temporary demands than it does to provide a like surplus in boiler capacity. The fan thus finds special opportunities for service in connection with mills which are usually operated by waterpower but which of necessity must install steam plants to meet possible contingencies of low water. Inasmuch as such a plant is likely to be operated for only a portion of the year it is warrantable to force it and thus operate it under somewhat less economical conditions than could be obtained if a much more expensive equipment was installed to secure a higher efficiency.

In the case of sudden accident, like the destruction of a chimney, the fan, which can be built and shipped on short notice, may perform even a temporary service of great value during the erection of a new chimney. Experience with the fan is however likely to result in doing away with a chimney altogether.

The largest item of operating expense being the fuel, it is natural that in a boiler plant special attention should be given to the reduction of this item. It is manifest that low-grade fuels are almost invariably more finely divided and require greater draft pressure than those of better quality. With the customary height of chimney, ranging from, say, 100 to 150 feet, and particularly with economizers, it is difficult to produce sufficient intensity of draft to burn fuel of this character. For the burning of No. 2 or 3 buckwheat coal at a very moderate rate of combustion, that is, less than 15 pounds per square foot of grate, a draft of five-eighths inch to more than one inch of water is required. The theoretical height of a chimney to produce the latter intensity with external air at 60 degrees and gases leaving an economizer at, say, 350 degrees, is very nearly 200 feet. The fan, introduced either for forced or induced draft, readily creates this intensity while operating at moderate speed. This speed may be automatically regulated to the exact requirements of the fuel.

Inasmuch as the average height of chimney practically determines the relation between the rate of combustion and the quality of the fuel which may be burned, it indirectly establishes the proportions of the boiler. An increased rate of combustion necessitates a deeper fire and more intense draft which the chimney may be unable to produce but which may be readily created by means of a fan. Each particle of air, in passing upward through the deeper bed of fuel, under this more intense draft, thus has better opportunity for parting with its oxygen and therefore produces more effective combustion. Principally for this reason plants operated by mechanical draft have been forced far beyond the boiler rating without showing material loss of efficiency.

As this system of draft production becomes more generally introduced we may therefore look to certain changes in boiler design which will more effectively meet the conditions of high furnace temperatures with decreased air supply. The economy in fuel resulting from the introduction of mechanical draft is of necessity relative, for it depends largely upon the quantity of fuel which it was possible to burn before this method was installed. Thus, for instance, in the 1,000-horsepower boiler plant of the United States Cotton company at Central Falls, R. I., it was necessary to burn Cumberland coal costing $4 per ton when chimney draft was used. The introduction of a forced-draft system costing less than $600 made possible the reduction in quality and price of fuel to a mixture of about 70 to 75 per cent. of No. 2 buckwheat, 20 to 25 per cent. of yard screenings and five to 10 per cent. of Cumberland, costing $2.62 per ton. The result in annual saving was about $6,500. Of course, such comparisons are largely affected by geographical location and the possibility of securing low-grade fuel. But it is evident that mechanical draft may be employed to burn almost any grade that it is practicable to employ.

Mechanical draft has thus been shown to cost far less for installation than the chimney, to be essential to the most complete utilization of the waste heat of the flue gases, to be capabale of burning low-grade fuels and decreasing the fuel cost, be able to meet readily sudden and excessive demands for more steam, to be flexible in its character, entirely independent of atmospheric changes, and capable of adaptation to almost all conditions whether as a substitute for, or an auxiliary to, a chimney. It is manifest that it may be installed either on the forced or induced principle as required, and that it may be automatically controlled so as to maintain constant steam pressure. The recent remarkable increase in the adoption of this method of draft production is far better evidence that any personal prophecy of the fact that mechanical draft will occupy a most important position in the boiler plant of the future.

Falcon Arc Lamps.

To satisfy the increased demand for Falcon arc lamps, the Falcon Electric Manufacturing company of New York city during the last few weeks has added several new designs of arc lamps to its line, two of which are illustrated herewith. Lamp No. 1001, shown in Fig. 1, is a black lamp, with opal reflector, for interior lighting, while lamp No. 1003 (Fig. 2) is a brass lamp, intended for outdoor use. Both lamps, as can be seen from the cuts, are equipped with reflectors so as to direct as much light as possible to the floor or ground where it is required. Besides these two designs and the designs Nos. 1000 and 1010, which have been manufactured by the company for some time, the brass lamp can be furnished with an opal reflector, and the black lamp with a metal reflector. The mechanism of all these lamps is identical. Its extreme simplicity and the method of making the joints of its moving parts insure reliability, and therefore result in very close regulation and steadiness of light. The Falcon arc lamps are manufactured at present for all constant-potential, direct-current circuits, and prompt shipments from stock can be made. They are broadly covered by the Marks' enclosed-arc-lamp patents, and are fully guaranteed against infringements. Bulletin No. 7, just issued by the Falcon company, describes all the various designs of the company's arc lamps, and upon application a copy will be mailed to any intending purchaser.

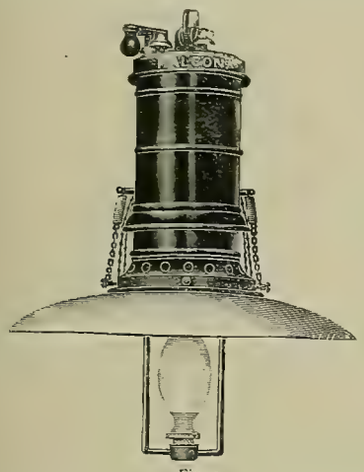


Fig. 1.

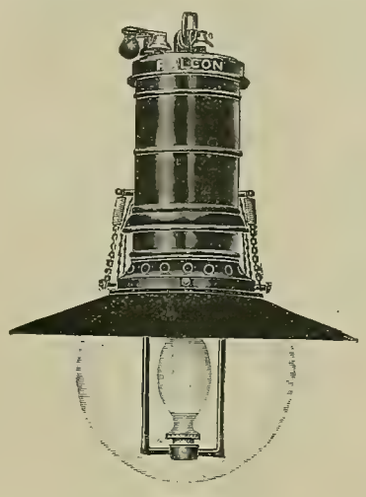


Fig. 2.

FALCON ARC LAMPS.

Patent Office Requirements.

The Patent Office examiners frequently find it necessary to call the attention of intending patentees to existing rules of the office and to changes that may be made in the same from time to time, in order that work may be expedited as much as possible.

It must not be forgotten that specifications and claims should be either written or printed on but one side of the paper, legal-cap, line-numbered paper being preferred, and a wide margin must always be reserved on the left side of each page.

If amendments are to be made, the exact word or words to be stricken out or inserted in the application must be specified, and the precise point indicated where the erasure or insertion is to be made. Amendments must be on separate sheets of paper.

Erasures, additions, insertions or mutilations of papers and records must never be made by the applicant.

When an amendatory clause is to be amended, it must be wholly rewritten; if the amendments render the case difficult to consider or to arrange for printing or copying, the examiner or commissioner may require the entire specification to be rewritten.

In the matter of drawings, no alterations or erasures are permitted on the part of the applicant or any person acting for him, except where a blueprint or photographic copy has been filed. When the examiner makes a requirement for a change in the original drawing and no blueprints or other drawings have been filed by the applicant, the office will make the copy without charge and the applicant may make the required alteration under the direction of the examiner, or it will be done at the office at the expense of the applicant.

Applicants are expected to furnish with their originals a blueprint or other photographic copy of all drawings forming a part of that application, the same to be made a permanent part of the record, or, upon the request of the applicant, the office will make such blueprints at a cost of five cents each to the applicant.

Street-railway Matters in the Chicago City Council.

Several matters in connection with street railways were brought up at the regular meeting of the City Council of Chicago on the evening of February 11th. An ordinance granting a franchise to the Chicago City Railway company to operate a branch line in Center avenue from Sixty-third street to Seventy-fifth street was passed. The order compelling the stopping of street cars at street intersections, when signaled, was killed. An ordinance to force teamsters to turn out of the tracks for cars was sent to the judiciary committee. An order to repeal the ordinance of the Chicago Passenger Traction company, which was granted in 1895 for a street railway in Fullerton, Central and Maynard avenues and Tanner road, because of failure to comply with the terms of the franchise, was sent to the judiciary committee. An order was passed for the corporation counsel to investigate and to compel the Union Traction company to run cars according to schedule in West Twenty-sixth street and in West Thirty-first street, in the Thirty-fifth Ward, and to run cars in West Harrison street west of Forty-eighth avenue, and to clear the tracks of snow.

What Professor Slaby Says.

The daily newspapers have the following news from Berlin: "Prof. A. Slaby, of the Berlin Technische Hochschule, in the course of a remarkable interview on 'The Coming Electrical Revolution,' which is to appear in the forthcoming number of a new technical periodical, asserts that his recent invention, multiplex wireless telegraphy, will produce a great transformation in existing methods. It will be possible, he declares, to apply the principle to submarine cables in such a way as to send hundreds, and even thousands, of messages simultaneously on the same wire, thus enormously cheapening rates. Professor Slaby believes that the problem of direct production of electricity from coal will be solved. Germany, he predicts, will be the foremost nation of the twentieth century in technical production, and electricity will be the poor man's source of power and light. He is confident of the success of the electrical express locomotives now being constructed in Berlin for a speed of 200 kilometers an hour."

Proposed Combination in the Steel Trade.

The announcement that Andrew Carnegie has given an option on his holdings of stock in the Carnegie Steel company to J. Pierpont Morgan chronicles the most important step in the negotiation which may result in the formation of the largest corporation in the country. Mr. Carnegie holds about 54 per cent. of the $160,000,000 outstanding stock of the Carnegie company, and it is stated that for this he will receive about $87,000,000 in securities and cash. He will retain his holdings of the bonds of the Carnegie company, the interest on which will be guaranteed by the new company. The total amount of these now outstanding is $160,000,000, bearing five per cent. interest, of which Mr. Carnegie holds about $100,000,000. The properties mentioned as likely to be consolidated are the Carnegie Steel company, the Federal Steel company, the National Steel company and the American Steel and Wire company.

Michigan Labor Statistics.

In a recent report of the Bureau of Labor and Industrial Statistics of Michigan, presented by Joseph L. Cox, commissioner, four pages are devoted to electric railways. A canvass of 1,021 of the employes showed that the average daily wages of the men during 1899 ranged from $2.48 for superintendents and $2.08 for electricians to $1.36 for linemen and $1.06 for assistant engineers. Nearly all the employes received extra pay for overtime. They averaged nearly 30 days' work each month, and worked, on an average, 11.8 months during the year. Forty employes reported increased wages, the increase averaging 14 per cent. Forty-seven per cent. reported that they were able to save something from their earnings. Those who rented homes paid an average monthly rental of $7.98. The report also showed that the average daily wages of electricians in the general labor canvass was $3.12, the largest daily wages paid to any of the male employes whose conditions were canvassed.

Space Telegraphy for 200 Miles.

Professor J. A. Fleming, in a lecture at Liverpool recently, announced that Marconi had succeeded in sending messages between St. Catherines, on the Isle of Wight, and Lizard Head, a distance of 200 miles. The transmission is practically over water for the entire distance, and it is said that perfect communication has been established between the two points. This is the longest transmission recorded so far, and constitutes a considerable step in advance of the long Hawaiian line recently put in operation.

CORRESPONDENCE.

New York Notes.

New York, February 9.—The Merchants' Association of New York is preparing, through its counsel, a bill for the construction of pipe galleries in the rapid transit subway. The association is acting in conjunction with several other organizations.

The Fortifications bill, as reported to the House of Representatives at Washington, carries $7,227,461, of which $150,000 is for electric searchlights for New York harbor. Forts Wadsworth and Newton are to have seven battery lights, a detecting light and an extra power light, the system to cost $35,000. Six battery lights are planned for Fort Hamilton, one detecting light and one extra power light, at an expense of $25,000. For Fort Hancock seven battery lights are planned, one detecting light and one extra power light, at a cost of $25,000. Three battery lights, one detecting light and one extra power light, for $15,000, are planned for Norton's Point, while two battery lights and one detecting light are to be installed at Ward Point for $10,000.

At a meeting of the governors of the Automobile Club of America recently it was decided to open the new clubrooms in the Plaza Bank building on February 16th. Resolutions were adopted to prevent members of the club from driving their machines at excessive speeds.

The car barn of the Brooklyn Rapid Transit company in Flatbush was destroyed by fire on February 8th, together with 50 of the cars stored there. The loss was estimated at $250,000, and the barn will not be rebuilt.

A bill is to be introduced in the Legislature providing that the railway companies of Brooklyn may collect only two cents from passengers who are not provided with seats, an additional three cents to be collected when the passenger is seated. It further gives passengers the privilege of choosing whether or not they will accept seats.

The Times is authority for the statement that negotiations are in progress for the leasing of the Manhattan elevated road by the New York Central, and that negotiations between the Manhattan and Metropolitan interests have been dropped.

About 40 of the New York alumni of the Massachusetts Institute of Technology had dinner at the Arts Club in New York city on the evening of February 9th. The board of management of the club for the ensuing year was elected as follows: Alexander Rice McKim, secretary-treasurer; C. D. Pollock, H. D. Hibbard, Charles A. Meade and Azel Ames, Jr., executive committee. C. A. Meade acted as toastmaster. Prof. William T. Sedgewick, an expert on typhoid, spoke on technical education, and Prof. Michael I. Pupin gave some interesting details about his invention of the submarine telephone.

The Metropolitan Street Railway company has consented to the removal of the outer tracks on Amsterdam avenue, thus settling a controversy between it and the property owners which was begun three years ago. For 10 years there have been four tracks on the street, and now that all four have come under the Metropolitan management no opposition will be presented to their removal.

The New York Central is experimenting with compressed-air locomotives, with a view to obtaining a motive power for use in its underground station, which is to be built to afford connections between the suburban trains and the rapid-transit tunnel. The experiments are being carried on at Rome, N. Y. M. L. G.

New England News.

Boston, February 9.—The abolition of the horse-car line in Marlboro street, Boston, the heart of the fashionable Back Bay district, where the advent of the trolley car has been successfully opposed for a number of years, has given great impetus to the electric omnibus line recently established, and, in spite of the 10-cent fare charged, the patronage of the new company is of gratifying proportions.

Two petitions for time extensions from railway companies have been presented to the Massachusetts Legislature at this session. One was from the Boston Elevated, which wants six months longer in which to finish its overhead structure. The other is from E. Moody Boynton, who asks for an extension until 1903 of the time for construction of his much-talked-of "bicycle" road from Boston to Fall River. The system has a single surface, or under, rail, and theoretically it should permit of a speed of about 100 miles an hour. The New York, New Haven and Hartford Railroad company thought the matter of sufficient importance to send Colonel Benton to the hearing last week to oppose the granting of Mr. Boynton's petition. B.

Canadian Intelligence.

Ottawa, Ont., February 9. The waterpower of the Pend d'Oreille River, in British Columbia, is about to be utilized by a New York company.

The Keewatin Power company and the Lac du Bonnet Power company of Manitoba are said to have made propositions to transmit electric power to the city of Winnipeg. The distance from Keewatin to Winnipeg is about 130 miles.

The Maitland River Power company of Goderich, Ont., through Joseph Clarke, its president, has made a proposition to operate the waterworks and electric-light plant of the town. The company has in view the development of the waterpower of the Maitland River, at an estimated cost of $100,000.

It has been decided to enlarge the plant of the Montreal Electric Street Railway company, and the company will at once install a direct-connected railway generator of 850 kilowatts. It will be coupled to a cross-compound engine.

Mr. L. Robinson, who has been manager of the Montreal Park and Island railway for the last four years, has retired, to accept a good post with the Compagnie de Traction of Paris, France. This appointment was secured by Mr. Robinson through Mr. Duncan McDonald, now of Paris, the late superintendent of the Montreal street railway.

The Canadian Pacific Railway company's telegraph department, connecting with the Commercial Cable company, announced that the rate from Montreal to New South Wales, in the Australian commonwealth, would be reduced on the 1st of February to $1.11 a word, via the eastern or India route. The rate hitherto was $1.45 a word.

The annual general meeting of the shareholders of the Ottawa Electric Railway company was held at Ottawa on January 30th. The annual report and financial statement for the year ended December 31st showed a most satisfactory year's business. Four quarterly dividends of two per cent. each, amounting in all to $65,184, were paid, and a balance of $17,932.57 carried to the credit of profit and loss, after reserving $18,000 for the contingent account to make good uninsured losses by fire during the last year. The operating expenses were 57 per cent. of the gross receipts. There were 7,940,656 passengers carried during the year, making an increase of about 2,000,000 over the year previous. The following-named directors for the current year were elected: T. Ahearn, George P. Brophy, Peter Whelen, Warren Y. Soper, Thomas Workman, A. Lumsden and Senator Cox. T. Ahearn was elected president, Peter Whelen vice-president and James D. Fraser secretary-treasurer.

The proposed trolley line between Port Dalhousie, Ont., and Buffalo, N. Y., is regarded on this side of the line as having been projected to benefit Buffalo more than the Canadian end of the route. Having sent out its electric tentacles in every direction on the United States side of the river, it is now claimed that Buffalo is extending its suburban-railway system so as to take in the Niagara peninsula. There are only a few miles of track needed to complete the road from Port Dalhousie to Buffalo. It is expected that within six or eight weeks through cars will run every hour or half-hour from Port Dalhousie, St. Catherines, Merritton and other towns in Ontario into the center of the city of Buffalo. This invasion of Canadian territory is already exciting alarm among the promoters of the Toronto electric radial system, and it is said that the next objective point of the Buffalo system will be the city of Hamilton, Ont.

Two electric furnaces have been installed in the physical-chemistry department of McGill University, Montreal, through the aid of which many interesting experiments can be made. The furnaces are large enough to take a current of 100 amperes at a pressure of 110 volts. The principal use to which these furnaces are to be put is the resolution of compound substances into their component parts. They will also be used for the experimental manufacture of diamonds.

The invasion of the horseless vehicle is spreading in Canada. The recently organized Electric Cab company of Toronto, Ont., will have cabs and tourist brakes on the streets of Toronto as soon as they can be turned out of the factory. The company now proposes to extend its business to Ottawa and other large Canadian cities. At a meeting of the stockholders a few days ago it was decided to double the capital of the company and go into wider fields of operation.

It is announced that by the 1st of July, 1903, the city of Toronto, Ont., will be fully supplied with electric power generated at Niagara Falls. The Canadian Niagara Power company, it is stated, will at once begin work on the production of the power. No prior arrangements have been made for the sale of the power in Toronto, and the city authorities will, therefore, probably be given the first option of handling it. The company has not yet decided whether a line across the country or a cable across Lake Ontario will be used to transmit the energy. This company is the Canadian branch of the big concern that has developed 50,000 horsepower on the American side of the Falls, and is now adding 30,000 horsepower.

At the annual meetings of the three electric-railway lines, controlled by the Cataract Power company of Hamilton, Ont., good showings were made in connection with each company. The reports of each of the lines disclosed a substantial surplus over the operating expenses, fixed charges and the five per cent. dividend that was declared. The following-named officers were elected for the current year: The Hamilton Electric Street Railway company—President, Hon. J. M. Gibison; vice-president, John Dickenson; secretary, John Patterson. The Hamil-Radial company—President, John Patterson; vice-president, Hon. J. M. Gibson;. The Hamilton and Dundas Railway company—President, John Dickenson; vice-president, J. A. Kammerer, Toronto. A. V. W.

From the Buckeye State.

Columbus, Ohio, February 9.—The Columbus City Council has passed an ordinance renewing the franchise of the Columbus Railway company on the streets of the city for 25 years, the vote standing 12 to 7. The company made several concessions over the first ordinance prepared by Mayor Swartz and others, but the greatest was in the way of fares, seven tickets for 25 cents, with universal transfers, and eight tickets for 25 cents after the annual income reaches $1,750,000. At the rate of increase for the past few years, the next reduction will come somewhere from 10 to 15 years from the present time. Cash fares will be five cents and the owl-car rates will be held to 10 cents, and after five years, five cents, with transfers either way. E. K. Stewart, manager of the company, states that 50 new cars will be put on the lines within a short time. The cars are now greatly crowded and the lower fares will increase the patronage of the road. There has been a very hot fight over this matter, and Tom L. Johnson made two different offers to buy the road and operate it on a three-cent fare. Some persons thought politics influenced the matter, however, and these offers did not go so far as they otherwise would have done. An injunction suit stands against the company now in regard to the claim for a perpetual franchise on certain streets, and the new ordinance will not go into effect until this is settled or dismissed from the courts.

T. A. Simons of the Columbus, Worthington and Clintonville Railway company announces that the line will be extended to Delaware and that the plan now is to build it on to Marion, with branches to Marysville, Richwood and some other places.

The attorney-general has filed his answer in the Supreme Court in the case of the state against the Cincinnati Edison company, in which it is denied that the company was ever given authority to use the streets of Cincinnati without authority from that city, and that the Probate Court of Hamilton County has never given it authority to use the streets.

The Ohio Northern Railroad company of Toledo has been incorporated, with a capital stock of $25,000, by A. C. Van Dreisen, G. W. Kurtz, W. H. Cummer, J. W. Cable and Alma B. Cable. It is the intention of the promoters of this company to build a line in Williams County from Pioneer to Alverton, and this will be done with a view to paying special attention to freight business. The right-of-way for the greater part of the distance has already been secured.

The Marion (Ohio) council is considering the advisability of establishing a municipal lighting plant.

The Wellington, Ashland and Mansfield road is securing rights-of-way along the line designated by the names of the towns.

The Little Miami Traction company will be financed in the East this week. The franchises and rights-of-way are all in good shape and there will be little trouble with the money, as the line will without doubt be a paying one. It is said that the company will secure $1,500,000, which will build it from Xenia to Cincinnati, or else will back connecting lines, which will give a through route, as Mr. Martin wants.

The Anness-Freeman company, Hamilton, has completed its organization by the election of the following-named officers: President, W. P. Freeman; vice-president, George Duersch; second vice-president, W. A. Utz; secretary, Louis Utz; treasurer, W. H. Anness. The company will erect a factory and manufacture all kinds of electrical machinery and appliances.

The commissioners of Columbiana County have granted Hait & Smith of Cleveland a franchise to build an electric road connecting East Liverpool, Lisbon, Salem and other towns in that county.

The Huron county commissioners have granted the Cleveland, Elyria and Western road a franchise to build through the county. The Sandusky and Interurban will also be given a franchise. The Erie county commissioners have done the same thing, and thus the long fight between the two roads is ended, so far as franchises are concerned, and both may build through, side by side, if they like.

The Sandusky, Norwalk and Southern Railway company has planned to change its route to Norwalk somewhat, and will shorten it almost a mile.

It is said that the Central Ohio Electric Railway company will soon begin the construction of a line across the state from Brilliant, Jefferson County, to Celina, Mercer County.

When the bridge over the Big Sandy River is completed, the Camden Interstate Railway company will have its line in operation from Ashland to Huntington in West Virginia and Kentucky. This will be before many months. It is said that Senator Camden will then extend the line to Wheelersburg, Ohio, and connect with the Portsmouth local roads. These will be connected up with the proposed line from Columbus to Portsmouth by way of Lancaster, forming a through route to West Virginia and Kentucky. As soon as the Columbus, London and Springfield electric railway is completed to Springfield, Columbus people will have a through line to Dayton, and arrangements will likely be made to connect there with a road to Cincinnati.

Stories have been going the rounds in Cleveland and Northern Ohio that a plan is on foot to consolidate all the suburban lines with the Big Consolidated road of Cleveland, which is largely owned

by Henry A. Everett. This would not be a very difficult matter, as Mr. Everett is already largely interested in the Akron, Bedford and Cleveland, the Cleveland, Painesville and Eastern, and a number of other Northern Ohio lines, which might easily become a part of such a system.

Frank M. Greene, manager of the Western Union office at Toledo, has resigned and has been succeeded by George L. Wagner.

It is reported that a number of Chicago capitalists have been negotiating with the Tiffin (Ohio) Electric Railway and Power company, with a view to having it extend its line to Catawba Islands, by way of Fremont, Port Clinton and Lakeside.

The Chagrin Falls Electric Railway company has given a mortgage of $200,000 to secure the issue of bonds to that amount, to the Dime Savings and Banking company of Cleveland.

An ordinance has been introduced in the City Council at Circleville to give the Columbus Southern Railroad company a franchise on condition that it carry passengers within the city limits free of charge. This resulted from a contest between this road and the Scioto Valley Traction company.

The State Board of Public Works has arranged to build retaining walls along the Miami and Erie Canal where necessary, in order to allow J. N. Fordyce to carry out his contract to propel canalboats by electric power.

The Columbus Auto Cab company has made a proposition to the postal authorities to haul the mail to and from the depot and collect it from the boxes where wagons are used for less than it is now costing to do it. This company is making every effort to get all the light work in the city, and it is said that it already has many good contracts of this kind.

The annual meeting of the directors of the Youngstown Park and Falls Electric Railway company was held a few days ago and the following-named officers were chosen: President, Samuel Grier; vice-president, Joseph Hastings; secretary and treasurer, C. W. Dahlinger; general manager, Robert Ivory.

The Columbus, Winchester and Lancaster Traction company has secured all the right-of-way through Franklin County, and it is said work will commence on the line at an early date.

Thomas L. Childs has deposited a certified check with the commissioners of Summit County, and his franchise for an electric line from Akron to Canton now becomes valid. L. E. Myers, general manager of the Peoria and Pekin road, is one of the backers, and he asserts that there is plenty of money behind the venture, and all he wants is an opportunity to go ahead.

The Dayton and Northwestern Traction company has been granted a franchise by the commissioners of Montgomery County. It is the intention of the promoters to build the line to Lewisburg, and later on to Richmond, Ind.

The interurban lines entering Cleveland will probably have a passenger station before long. The officers are considering the matter and most of them think that a union station would be of great advantage to all.

There is trouble in both Dayton and Toledo in regard to freight hauling by the electric roads. The city officials object to this business mainly because the freight is unloaded at any convenient place along the streets. The Dayton people want the roads to build a station on the outskirts of the town for this purpose, but that would hardly be fair, as the disadvantage would be great to the railroad companies. There is talk of an application for an injunction in Toledo.

The new electric line from Toledo to Monroe, Mich., is almost completed and it is expected that cars will be running by March 1st. The power house at Monroe is not completed or the road would be in operation at a still earlier date.

T. T. Brooks, G. W. McDonald and G. B. Hancock of New York were in Sandusky a few days ago in consultation with Clark Rude of the Sandusky, Belleville, Monroeville and Norwalk Electric Railway company in regard to floating the bonds of that company.

The Toledo, Napoleon and Defiance Electric Railway company has been granted a franchise by the commissioners of Lucas County to build a line along the Maumee River toward Waterville and Defiance. The grant is for 25 years.

The Northern Ohio Traction company has issued a mileage book to be used on the new Cuyahoga Falls line. This company may have some trouble in extending its line to Ravenna, as the Portage Lake Traction company will oppose such an extension and there may be a fight. O. M. C.

Washington, D. C.

Washington, February 9.—President Frederick C. Stevens of the Washington Traction and Electric company has resigned his office as president and director of the company, and the board of directors has elected Allan L. McDermott of Jersey City, N. J., to succeed him. It is rumored that this company, which is now operating 11 electric roads and two electric-light plants in Washington, maintaining separate offices and forces of accountants for each, will shortly consolidate these offices. This action is due to the effort to reduce the cost of operation, as it is said that the company is operating at considerable loss.

The annual report of the Capital Traction company for the year 1900 has been laid before the Senate. It showed total receipts amounting to $2,288,012, and a balance on hand December 31, 1900, of $35,547.80. The expense account included $41,668.32 for fuel, $18,000.06 for injuries and damages, $41,709.20 for interest and $479,962 dividends. The total operating expenses, exclusive of interest and taxes, were $528,547.14. The company has a paid-up capital of $12,000,000 and a funded debt of $1,080,000. It operates 35.96 miles of single track, and in 1900 carried 26,165,389 passengers, a daily average of 71,686. During the year extensions were made amounting to about $150,000. W.

Information from Indiana.

Indianapolis, February 9.—The commissioners of Hendricks County have reported favorably on the petition of Fairbanks and others for a trolley-line franchise through that county from Indianapolis to North Salem. The terms are a tax of $25 a mile annually, work to begin June 1st. The terms were accepted and a guaranty will be filed soon.

The Leckney Contracting company of Chicago, to which the Town Council of Churubusco delivered the electric-light and waterworks plant, will operate the same until a purchaser can be found. An agent of the eastern bondholders, representing $14,500, is in the state trying to dispose of the bonds.

The Elkhart Electric company has been formed at Elkhart, with a capital of $100,000, to absorb the Home Electric Light and Power company and to assist in developing the power of St. Josephs River.

The Indiana Street Railway company, which controls the lines operating in South Bend and connecting with Mishawaka, has decided to make extensive improvements, on which work will begin at once. Five miles of additional track will be laid in the city, and an interurban line will be built, connecting South Bend with Notre Dame. About $1,000,000 will be expended.

At a recent meeting of the directors of the Indianapolis, Greenwood and Franklin electric line, the following-named officers were elected: President, William G. Irwin; vice-president, C. F. Coffin; secretary and treasurer, Hugh T. Miller. The contract for the steel equipment for the extension has been let to the Carnegie company. Work of laying rails will begin next week.

There is a well-grounded rumor that the Big Four railroad is trying to buy the Aurora pike, with a view of building an electric road from Aurora to North Vernon. The Cincinnati and Aurora electric railway has offered the Pike company $10,000 for the road. If accepted, its line will be extended from Aurora to Friendship, a distance of 20 miles.

J. O. Moran, chief engineer of the Fort Wayne and Southwestern Traction company, was in Huntington during the last week and located the company's power house, barns and shops. The company has decided to make Huntington headquarters. Work will begin with favorable weather.

Promoters interested in the proposed electric line over the towpath of the Wabash and Erie Canal between Logansport and Lafayette were in Delphi, the half-way point, last week, canvassing the situation. They were George B. Inman of New York, Charles Fox of Grand Rapids, Mich., and A. N. Dukes of Peru, Ind. The latter claims to own the canal property, but Inman and Fox are proposing to furnish the money to consummate the scheme.

A bill has been introduced in the Indiana Legislature making it unlawful for any street car used in transportation of passengers to have running boards extending along the sides for the entrance and exit of passengers. The penalty is from $25 to $100. The bill is aimed to protect the Indianapolis public against the practice of the local company of filling the summer cars to the running boards. The records show that many accidents occur in this way. It is claimed that center aisles are preferable.

Judge Carter of the Indianapolis Superior Court has rendered an important decision to the effect that the city of Indianapolis cannot by ordinance compel the railroad companies entering the city to elevate their tracks 16 feet. He says, "That the state has the power to compel the elevation of tracks by a railroad company, as a police power, is not denied, and that the state may delegate this power to a municipal corporation cannot be questioned. But in the absence of such a delegation of power the city has no power to move in the matter, and in my opinion it has not done so. A municipality should not assume the exercise of a power so far-reaching in its results as the elevation of all railroad tracks in the city to 16 feet or more, unless the delegation of such power is given in clear, explicit and unmistakable terms." The city charter provides that the city may require either viaducts or tunnels, but neither the general law nor the city charter contemplates the elevation of the railroad tracks above the grade of the highway or streets. F.

Northwestern Notations.

Minneapolis, February 9.—It is reported that New York capitalists have secured an option on the street-railway system at Green Bay, Wis. The same men are understood to be behind the proposition to build an electric railway from Green Bay to Manitowoc.

The Edison Electric Light company of Des Moines, Iowa, has paid the city $697.45 as one per cent. of the gross receipts of the company for the eight months ended December 31st.

The Union Electric company of Dubuque, Iowa, expects to expend about $150,000 in rebuilding the street-railway system. The system is in poor shape, and while it has never been a profitable investment, the company has confidence that the town will repay the venture, if the service is made first class.

The council of Oshkosh, Wis., has extended the franchise of the electric-light company for 21 years.

The Seattle Electric company of Seattle, Wash., has united part of the Third Avenue and Suburban line with the Lake Union line. The Seattle Electric company will absorb the line of the Seattle City Railway company, if negotiations now pending are completed.

The council of Creston, Iowa, has adjusted its differences with the gas and electric company, and the streets again have light. The council had to yield to the company's demand for a five-year contract, but the company agrees to submit to arbitration at any time if the service is not satisfactory. The company received $100 per light for 18 arcs under the old contract, while under the new, 23 lights are furnished for $820.

The Street Railway company of Des Moines, Iowa, announces that its line to the new army post will go via the proposed Eighteenth street route.

J. M. Colman of Seattle, Wash., proposes to put in an electric-lighting plant to furnish light for his buildings and for buildings immediately adjoining.

The Menomonie Submerged Electric Motor company of Menomonie, Wis., has been incorporated, with $100,000 capital stock, and has secured quarters for its factory. The company has completed its experimental work and is ready to proceed to manufacturing.

The Chicago, St. Paul, Minneapolis and Omaha railway announces a successful test of a new system of electric interlocking switches between Eau Claire and Altoona, Wis. The Taylor electric interlocking system for intervolved tracks is used. The company will put in similar systems at other points along its road.

C. R. Collins, formerly manager of the Seattle (Wash.) Gas and Electric company, has secured a controlling interest in an electric-light plant at Skagway, Alaska.

Neil McInnis has secured a franchise at Eveleth, Minn., for an electric-light plant, and proposes to establish a system at once. He has made overtures to buy the present plant, but has been unable to do so, and will proceed to install a new system.

An electric-lighting and hot-water-heating system is projected for the coming season for Alden, Iowa.

S. T. Norvell, formerly president of the Superior Rapid Transit company of Superior, Wis., and one of the founders of its predecessor, the Douglass County Street Railway company, died recently on a Southern Pacific train in Louisiana. Heart failure was the cause. Mr. Norvell was 38 years of age and unmarried.

The council of Chaska, Minn., has rejected the engine furnished for its power plant at the electric-light station as failing to meet specifications. The remainder of the plant was accepted.

Engineer F. W. Cappellen of Minneapolis estimates the cost to the city of Duluth, Minn., for a 500-arc-light plant, with steam power, at $120,683 and the cost of operating per year would be $53.77 per light. With gas-power generation, the cost would be $129,314, and the cost per light per year, $57.24. A distributing station, with poles and wires, is estimated to cost $62,414.

The Washington Water Power company of Spokane, Wash., has notified its employes that hereafter they must put in meters for the electricity used on their premises. The company will give them $3 worth per month, and all over that amount is to be paid for. R.

PERSONAL.

E. F. Seixas has resigned as general manager of the Amsterdam Street Railroad company of Amsterdam, N. Y., to become general manager of the Niagara, St. Catherines and Toronto Railway company and the Niagara Falls, Wesley Park and Clifton Tramway company. Mr. Seixas has had a wide experience in electrical work, and was at one time a resident of Chicago.

Tom L. Johnson has formally announced himself a candidate for the Democratic nomination for mayor of Cleveland, Ohio. Mr. Johnson discourages the extension of street-railway franchises and suggests that they be sold to the highest bidder with the condition of three-cent fares. Personally, Mr. Johnson says, he favors municipal ownership of street railways and other public utilities.

John B. Bennett, business manager of the Street Railway Journal, has severed his connection with that publication, and has acquired an interest in the Municipal Journal and Engineer, for which he will act as business manager. Mr. Bennett is well and very favorably known in the street-railway and electrical field, and many friends who admire his attractive qualities will extend their best wishes for his success in the new venture.

Colonel Albert D. Shaw, president of the Canadian Niagara Power company, died suddenly at Washington, D. C., on February 10th, aged 59 years. He served in a number of the principal battles of the Civil War, and had been commander-in-chief of the Grand Army of the Republic. He was

appointed United States consul at Toronto about 1868, serving in that capacity for 10 years, when he was given a similar appointment at Manchester, England, which he held until 1886. For several years Colonel Shaw was largely interested in the development of electric power at Niagara, and he had been at the head of the Canadian company since 1890. He was elected to Congress early in 1900 from New York, his home being in Watertown.

Carroll D. Wright was renominated by the president on February 6th for the post of United States commissioner of labor. Mr. Wright has now held that useful and important office since 1885, and he was the first man to fill it after it was created in that year. It was Mr. Wright who, in the fourteenth annual report of the Department of Labor, published last summer, gave out the most elaborate statistical review of "Water, Gas and Electric-light Plants Under Private and Municipal Ownership" that has yet appeared. This volume was reviewed at length in the Western Electrician of August 4, 1900, and was referred to in flattering terms in the recent presidential address of Pliny Norcross at last month's convention of the Northwestern Electrical association.

ELECTRIC LIGHTING.

W. G. Schuwirth of San Antonio, Texas, is in the market for supplies for a lighting plant.

The city officials of Troy, Ill., wish bids for the construction of a municipal lighting plant.

L. F. Wakeman of Arcadia, La., wants prices on a lighting plant for a town of 1,000 inhabitants.

The lighting plant at Brownsville, Tenn., was recently destroyed by fire, with a loss of about $8,000.

The Board of Public Works of Ripon, Wis., has asked for bids for furnishing electric lights for that city.

The Sac City (Iowa) Electric company is contemplating the installation of a hot-water heating plant.

The People's Light company of Davenport, Iowa, is preparing to erect a power station to cost about $100,000.

The Wadsworth Light and Water company of Wadsworth, Ohio, has been incorporated, with $50,000 capital.

C. G. Baldwin has made a proposition to the Board of Trustees of Riverside, Cal., to supply the town with electricity.

The Homer Electric Light and Power company of Homer, Mich., has been incorporated, with a capital stock of $14,000.

A lighting company has been organized at Minden, La., with $10,000 capital stock. Felix Drake and others are interested.

The Magnolia Electric Light company of Magnolia, Miss., has been chartered by L. L. Lampton, with a capital of $10,000.

The plant of the Citizens' Electric Light company of Independence, Mo., was destroyed by fire recently, with a loss of $5,000. It is proposed to erect a municipal electric-lighting plant at once.

Bids will be received until March 2d by L. N. Ley, city clerk of Canton, Ohio, for furnishing all the necessary labor and material for supplying to that city 35 all-night arc lights of 1,200 candlepower each.

ELECTRIC RAILWAYS.

The council of Belvidere, Ill., has granted a franchise to the Rockford-Belvidere electric road.

The Chicago and Milwaukee Electric Railroad company is considering an express service between Evanston and Waukegan.

Fire destroyed the Twentieth street power house of the Omaha Street Railway company at Omaha, Neb., recently. The loss was $50,000.

The Siemens-Halske electric tramway of Berlin, the most important system of Berlin, Germany, has been sold for $2,380,000 to the municipality.

The council of Brighton, Mich., has granted a 30-year franchise to G. H. Winteres and others for an electric line to extend from Detroit to Lansing.

The Milwaukee Street Railway company has obtained from the council of South Milwaukee a 50-year franchise which includes a 10-year lighting contract.

The Baltimore, Halethorp and St. Denis Railway company has been granted a franchise to construct an electric railway on Wilkens and Beachfield avenues, in Baltimore, Md.

The Interstate Electric Railway company, which contemplates building a line from Niles, Mich., to Benton Harbor, has filed articles of incorporation, with $350,000 capital stock.

It is announced that the Niagara Falls, Saint Catharines and Toronto Electric Railway company has completed arrangements with the International Traction company, which controls the lines between Buffalo and Niagara Falls, by which direct trolley-car connection will be afforded within a few weeks between Toronto and Buffalo. The trip is expected to require 3½ hours.

Articles of incorporation for a new street-railway company at Evansville, Ind., have been filed. The capital is $50,000, and the incorporators are J. E. Bowles, G. A. W. Dodge and J. O. Parker.

The Board of Aldermen of Natchez, Miss., has granted a 50-year franchise to the Natchez Street Railway and Power company, and it is reported that work is to begin upon the line within a short time.

The Portland, Nehalem and Tillamook Railway company has been incorporated, for the purpose of constructing and operating a railway from Portland, Ore., through Washington County. The capital stock is $1,000,000.

The Durham Traction company of Durham, N. C., has been incorporated, with a capital stock of $1,000,000. The company contemplates building and operating an electric street-railway and an electric-light and power plant.

AUTOMOBILES.

The Crowdus Automobile company of Chicago has been incorporated, with a capital stock of $100,000, to manufacture and operate vehicles of all kinds. The incorporators are J. S. Jacoby, E. Atherton and F. N. Warren.

The Automobile and Cycle Parts company has been organized in Cleveland, Ohio, with a capital stock of $5,000,000, and has taken over the plants of eight companies formerly engaged in allied pursuits in different parts of the country. The officers of the new company are: President, A. L. Garford, Elyria, Ohio; vice-president, M. B. Johnson, Cleveland, Ohio; treasurer, F. N. Smith, Elyria, Ohio; secretary, F. E. Lytle, Cleveland. The company says that the manufacture of automobiles will be greatly expedited and their cost materially reduced to the purchaser by the combination.

The Olds Motor Works of Detroit will place upon the market this spring their new model of gasoline runabout which they have named the "Oldsmobile." A number of the vehicles are already finished and they are said to work perfectly. Features of the runabout are its simplicity of construction, lightness and economy of operation; it is said that once filled a vehicle will run 150 miles without further attention. The carriage complete weighs about 580 pounds. Although light, all the parts are constructed with a special view of assuring strength. The motor is one of the standard Olds gasoline motors of four horsepower, which has sufficient power to handle the machine on a 25 per cent. grade and give it a speed of from 10 to 25 miles an hour.

Otto A. Spahr, Millersburg, Ohio, the inventor of a "drop-by-drop" battery mentioned in the Western Electrician a few weeks ago, has turned his attention toward perfecting a battery that will be suitable for electric-vehicle operation, and he now claims to have a vehicle almost completed which he believes will be practically continuous in operation and of light weight. According to Mr. Spahr, the vehicle, including the motor, battery and all other parts, will not weigh more than 500 pounds. The battery will consist of 20 cells. A small tube will connect a cylinder, holding about two gallons of the Eureka fluid, with the cells, and the fluid, regulated by a cock, will flow constantly to the cells at the rate of about two drops a minute. The inventor says that this amount of fluid will last for several days and that the machine will run as long as the fluid lasts. Zinc plates and additional electrolyte can be carried to renew the battery when necessary. The new Eureka battery is made by Spahr & Swingle of Millersburg, Ohio.

PUBLICATIONS.

The Bullock Electric Manufacturing company of Cincinnati has just issued a bulletin (No. 38) describing its electric locomotive and crane car. This bulletin may be obtained by addressing the company.

A second edition of the lecture by Walter B. Snow on "Mechanical Ventilation and Heating by a Forced Circulation of Warm Air" has just been issued by the B. F. Sturtevant company, Boston, Mass., by which a copy will be mailed on application.

The St. Louis Automobile and Supply company, St. Louis, Mo., is distributing catalogue supplements and other literature descriptive of its electric and gasoline vehicles (principally the latter) and numerous automobile accessories which the company handles.

The Falcon direct-current, enclosed-arc lamps of different types and for different voltages are illustrated and described in an eight-page bulletin (No. 7) recently issued by the manufacturer, the Falcon Electric Manufacturing company, 432 East Seventy-first street, New York city.

A description of the installation of Chloride accumulators for the Peekskill Lighting and Railroad company, Peekskill, N. Y., being a reprint of a paper read before the New York State Street Railway association by B. B. Nostrand, Jr., has been issued in bulletin form by the Electric Storage Battery company of Philadelphia.

Four twentieth-century articles originally written for the American Artisan of Chicago by men well known in the hardware world have been reprinted in neat pamphlet form. The articles are "The Dawn of the Twentieth Century," by John Bindley; "The Twentieth Century Man," by T. James Fernley; "Opportunities," by William W. Supplee, and "The Golden Rule Applied to Business," by H. H. Bishop.

The official report of the twenty-third convention of the National Electric Light association has just been issued by Secretary George F. Porter. The book, which is bound in cloth, in its usual serviceable form, contains 455 pages devoted to the lists of members and officers and the proceedings and papers of the convention held in Chicago on May 22d to 24th, 1900. A good portrait of General S. T. Carnes, ex-president of the association, forms the frontispiece.

The A B C system of mechanical draft, forced and induced by blowers and exhaust fans, is treated in an illustrated catalogue recently issued by the American Blower company of Detroit, Mich. The publication points out the advantages of mechanical draft in a clear and concise manner and illustrates different installations and apparatus of the company. Some very handy reference tables used in the design of mechanical-draft plants are given, and brief reference is made to some of the other lines of manufacture which the company follows. The catalogue has been carefully edited and printed.

ELECTRICAL SECURITIES.

The Metropolitan West Side Elevated Railroad company of Chicago has declared a dividend of 1½ per cent. on its preferred stock, payable February 28th.

The management of the Philadelphia Electric company of Philadelphia is credited with having bought $2,000,000 of the company's four per cent. bonds for the purpose of retiring them. This was done out of the proceeds of the last call.

The Guaranty Trust company and Harvey Fisk and Sons of New York offer for sale $9,500,000 of consolidated mortgage four per cent. 50-year gold bonds of the Nassau Electric Railroad company. These bonds are part of an issue limited to $15,000,000, of which $4,526,000 are reserved to retire underlying bonds.

The North Jersey Street Railway company of Jersey City, N. J., has arranged to replace the $100,000 Newark and Bloomfield street-railway six per cent. bonds, which mature in February, by an issue of five per cent. bonds of the Newark Passenger Railway company, which controls the Newark and Bloomfield railway.

SOCIETIES AND SCHOOLS.

The Morse School of Telegraphy of Shelbyville, Ky., has been opened, with about 60 students.

Dr. Frank W. Gunsaulus severed his official connection as president with the Armour Institute of Technology, Chicago, on February 1st. His successor has not been selected, and Victor C. Alderson, dean of the technical college of the Institute, will continue as acting president until the board of directors fills the vacancy.

The department of electrical mechanics of the manual-training school at Girard College, Philadelphia, has a working model of an electric street-railway or trolley system complete in every detail and containing about 150,000 pieces. There are also complete models for demonstrating the construction of arc lamps, both open and enclosed; complete models for demonstrating the making of incandescent lamps and the telephone, and the construction and operation of the electric motor and dynamo.

MISCELLANEOUS.

The new National Life building in Chicago, for which the contracts have recently been signed, is to be equipped with six electric passenger elevators with automatic indicators.

A bill has been introduced in the Illinois Legislature abolishing hanging and establishing electrical execution as the legal mode of inflicting the death penalty. A similar bill is pending in the Indiana Legislature.

Calcutta leads the cities of Asia in the use of electric power, and the development has been exceedingly rapid. Electric lights are quite generally used, and electric motors are taking the place of the coolies for the operation of the punkas or fans used for cooling buildings.

Judge Lowell of the United States Circuit Court, District of Massachusetts, has issued an order denying the petition of the defendant to reopen the case and take further proof in the suit brought by the General Electric company against the Webster (Mass.) and Dudley Street Railway company, involving the Eickemeyer winding patent.

TRADE NEWS.

The Gordon Battery company of New York city announces that it has removed to 13 and 15 Laight street.

The Union Carbide company of Richmond, Va., with a capital of $6,000,000, has been incorporated in Illinois, with an Illinois capital of $60,000.

The Bullock Electric Manufacturing company has recently opened an office at 675 Ellicott Square, Buffalo, N. Y. The office will be under the management of Francis B. Smith, an electrical engineer of wide practical experience. The New England office of the Bullock company has been opened at 70 Kilby street, Mason building, Boston, with E. T. Pardee in charge.

A recent fire destroyed the entire stock of the King Plating company of Chicago, valued at $7,000. The Chicago office and showrooms of the B. F. Sturtevant company, which were on the first and second floors of the same building, corner of Clinton and Harrison streets, also sustained damages, although the stock carried by the latter company was not destroyed. The damage is covered by insurance.

The factory address of the Varley Duplex Magnet company has been changed to Phillipsdale, R. I., and the company requests that all communications be addressed thereto in the future. The above change in location of the company's winding plant, it is expected, will work to the advantage of the Varley company's customers, as all delays incident to the transportation of raw material to the Jersey City factory are avoided and special hurry orders can be gotten out without any delay. The American Electrical Works of Phillipsdale, R. I., now have the right to solicit and accept orders for Varley windings.

The Parker Engine company of California, owner of the Parker steam generator, mentions an advance in steam-boiler practice which permits specifications to include, in addition to the usual tensile and hydrostatic tests, the following trial conditions: "Evaporation, 11.5 pounds where 10.5 pounds is usually specified; priming, foaming or lifting to be impossible, and moisture in steam not to exceed one per cent. under any conditions; to stand forcing to 50 per cent. above rating to date of acceptance, without leaks, or above 10 per cent. loss in economy; quick changes between no load and full load, or sudden drops in pressure from any cause; and in no case shall the circulation be reversed, the tubes overheated, or the water lifted; ground hand-hole joints to be made tight without bolts; internal cleaning to be accomplished without shutting down, or the use of mechanical cleaners." The Parker company, which has its general office at 1041 Drexel building, Philadelphia, has issued a catalogue describing the Parker regenerative system of steam making and the Parker combined boiler and economizer, which contains much interesting information.

The Standard Underground Cable company of Pittsburg announces that it has recently completed and put into operation its eastern factories at Perth Amboy, N. J., and is therefore not only able to give its customers the benefit of favorable freight rates, but assurances as well of prompt fulfillment of orders. In order to enable the company to serve its patrons better and to take care of its increased business throughout the East and Northeast, the company has organized a new department, known as the Eastern and Northeastern sales department, of which Charles J. Marsh, for many years and until now officially associated with the electric-lighting companies of New York city, is the general manager, with offices at 56 Liberty street, New York city. George L. Wiley, with offices at 56 Liberty street, New York city, continues as the manager of the Eastern sales department, which includes Northern New Jersey, New York state, Western Connecticut, Western Massachusetts, Vermont and the Canadian provinces of Quebec and Ontario east of and including Toronto; also the West Indies. Atlee B. Saurman, formerly assistant manager of the Eastern sales department at New York, will be manager of the Northeastern sales department, with offices at Boston, Mass., to be opened on or about March 1st. the Northeastern sales department will include Eastern Massachusetts, Eastern Connecticut, Rhode Island, New Hampshire, Maine and the maritime provinces of Canada. The Standard company solicits inquiries in relation to any material in its line of manufacture, and will be glad to submit prices, details and samples.

BUSINESS.

The Electric Appliance company, Chicago, is sending out literature describing the Adams-Bagnall arc lamps. These lamps are made in seven different styles, and for alternating-current, direct-current, constant-potential, constant-current, series and street-railway work.

R. H. Leavitt of Capron, Ill., manufacturer of standard electric-light and telephone cross-arm brackets and pins, has added to his business a full line of glass insulators, lag screws, bolts and cross-arm braces. He carries a large stock and is prepared to make prompt shipments. He has recently issued a new price-list of his goods.

The Shaw Electric Crane company of Muskegon, Mich., is said to have recently received contracts for 32 electric traveling cranes in one month. The cranes include a 10-ton and 3½-ton one which are to go to Buenos Ayres, a five-ton crane for the Brooklyn navy yard and 14 cranes for the American Car and Foundry company at Detroit. Among the orders are five 50-ton and two 40-ton cranes.

Recent export shipments of the Ball Engine company, Erie, Pa., included a 40-horsepower, simple engine and a 75-horsepower, compound, direct-connected engine to Japan; two 125-horsepower, tandem-compound engines to Russia; one 50-horsepower, simple engine to Honolulu, H. I.; one 60-horsepower, direct-connected engine to Vera Cruz, Mexico; one 150-horsepower, cross-compound engine to British Columbia; one 400-horsepower, direct-connected engine to England.

The Electric Storage Battery company of Philadelphia has recently closed a contract with the Youngstown and Sharon Street Railway company of Youngstown, Ohio, for the installation of two batteries of Chloride accumulators, to be used on its lines. Each battery, consisting of 288 cells, will have a capacity of 191 kilowatt-hours and will be operated in connection with differential boosters of 200-ampere capacity at the railway company's rotary-transformer sub-stations, located at distances of two and 12 miles, respectively, from the power house.

The American Bridge company has closed a contract with the crown agents for the colonies of Great Britain to furnish and erect on the line of the Uganda railway in Africa 27 viaducts. This contract will require about 6,000 tons of steelwork. The viaducts will consist of plate-girder spans on towers; the highest tower will be 112 feet. Sir A. M. Rendel & Co. of London, England, are the engineers for the crown agents. The American Bridge company has also received the contract from the Pittsburg and Lake Erie Railroad company for the new steel bridge over the Monongahela River at Homestead, Pa.

The Chicago House Wrecking company, Chicago, has on hand many hundreds of steam engines of the best makes. These engines were purchased from dismantled plants and other buildings. Most of them are practically as good as new. The company makes a specialty of handling second-hand machinery of all kinds, and gives a binding guarantee with each sale. In addition to engines, the company has a fine line of dynamos and motors and electrical supplies. Having purchased this apparatus at a sacrifice, the company states that it can offer exceptional inducements to prospective purchasers, and is desirous of mailing its new catalogue, No. 156, to those in the market for machinery and supplies of all kinds.

The Emerson Electric Manufacturing company, St. Louis, Mo., announces that it will send on request, to any electrical dealer or central station of financial responsibility in the United States, one sample each of such types of its 1901 desk and ceiling-fan motors as may be designated, transportation charges prepaid by the Emerson company. These samples may be returned after 30 days' trial, by freight, at the company's expense, if for any reason whatever, it should be desirable to do so. The Emerson company will carry a stock and endeavor to make prompt shipments of fans for standard voltages and alternations, both from St. Louis and New York city. It has also completed arrangements whereby the following-named firms will act as its special selling agents: H. C. Roberts Electric Supply company, Philadelphia, Pa.; Doubleday-Hill Electric company, Pittsburg, Pa.; Western Electrical Supply company, St. Louis, Mo.; California Electrical Works, San Francisco, Cal.

Among the sales entered by the Bullock Electric Manufacturing company of Cincinnati, Ohio, for the week ended February 2d were 14 motors of miscellaneous sizes for the Fore River Engine company, Quincy, Mass., making about 40 Bullock motors in all which this company has purchased; a 15-horsepower motor for the Pacific Coast Borax company, Bayonne, N. J., making about 20 Bullock motors now in operation by the company; a 225-kilowatt generator and two 60-horsepower Teaser equipments for Bergtheil & Young, London, England, for operating newspaper presses; two 60-kilowatt generators, switchboard and several small motors for Jacob Ruppert, New York city. Sales of engine-type generators and motors were made to the following-named parties: Joseph Joseph, Cincinnati; Manning, Maxwell & Moore, and American Sugar Refining company, New York city; Pittsburg Engineering company, Pittsburg; John L. Thompson estate and National Enameling and Stamping company, Baltimore; United States Furnishing company, Greenwich, Conn.; Mosler Safe company, Hamilton, Ohio; Wolf Process Leather company, Summerdale, Pa.; Christian College, Columbia, Mo.; Brown Hoisting and Conveying company, Cleveland, Ohio; Columbia Chemical company, Barberton, Ohio.

Some large consignments of transformers, aggregating several hundred thousand lights in capacity, were recently received by the Gregory Electric company of Chicago. The shipments of this company from its transformer department are more than double what they were a year ago. Among its recent shipments of generators may be mentioned the following: To the Malvern (Iowa) Light and Power company, one 60-kilowatt, 500-volt, and two 30-kilowatt, 110-volt Edison dynamos; Williamsport, Ind., one 60-kilowatt, General Electric alternator; Kankakee (Ill.) Electric Light and Power company, one 120-kilowatt, Westinghouse alternator; one 75-kilowatt, 550-volt, Westinghouse generator to the City Railway company of La Salle, Ill.; one 60-kilowatt Thomson-Houston alternator to the Virginia (Minn.) Water and Light company; one 35-kilowatt, Siemens & Halske, 250-volt generator to the Rico (Colo.) Light and Power company; one 100-kilowatt, General Electric generator to the Aurora (Ill.) Gas Light and Power company; one 100-kilowatt, Thomson-Houston generator to the Oelwein (Iowa) Electric Light company; one 45-kilowatt, Edison generator to Ozier & Hardeman, Henderson, Tenn.; one 150-kilowatt, Detroit, 500-volt generator to the Archer Starch company, Chicago; one 75-kilowatt, Wood alternator, City of Sheridan, Ind.; two 80-light, Standard arc machines to the Capitol Electric company, Springfield, Ill. In addition to the above many shipments were made of smaller motors and dynamos.

The B. F. Sturtevant company of Boston, Mass., states that it recently submitted, in competition with other blower manufacturers, an estimate for certain electric fans of its own manufacture and, according to its usual practice, carefully designed the same, together with the piping system, in order to accomplish the desired results with the least expenditure of power. To this end, large, slow-running fans were planned and the relative air velocities at all points were carefully regulated. Owing to the large size of the apparatus, the price was fully $500 the highest, but to impress upon the purchaser the economic value of such an equipment, the Sturtevant company enforced its logic by guaranteeing that the power required would not exceed 15 horsepower, and agreed to forfeit $100 per horsepower for any excess above this, provided it received a bonus of $50 per horsepower for any reduction below the amount specified. The Sturtevant apparatus was purchased under the conditions of the guarantee. The trial test indicated an actual power expenditure of only 10.5 horsepower, thus calling for a bonus of $225. This was gladly paid by the purchasers, with the satisfaction of knowing that, although the first cost was greater than might have been incurred if a competitor's design had been accepted, the power was 58 per cent. less. That is to say, an excess of $725 had been paid, but a constant saving of 14.5 horsepower over the competitor's system was insured. Upon a basis of $50 per horsepower per year the excess payment will be made good by the saving in one year's operating expense.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued February 5 1901.

667,189. Battery Box or Tray for Motor Vehicles. George H. Condict, New York, N. Y., assignor to the Columbia and Electric Vehicle company, Jersey City, N. J., and Hartford, Conn. Application filed September 3, 1898. Renewed July 12, 1900.

The battery compartment has an opening at its rear end and is provided with two or more sets of stationary contact pieces. A battery-containing tray is provided with fixed contact pieces secured to and located at points of different width on the exterior of the tray and adapted when the tray is inserted endwise into the battery box to engage the corresponding contacts in the box when the tray is in operative position. (See cut on next page.)

667,195. Telephone Switchboard Connection. Thomas V. Davis, Chicago, Ill. Application filed April 28, 1900.

A casing adapted to surround a cable for a portion of its length has a series of slots or indentations along its edge, with conductors looped from the cable and received in the slots or indentations so as to be held in a fixed relation to each other. The edges of the casing are held together when the conductors are in the slots.

667,246. Electromagnetic Brake Shoe. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed April 28, 1900.

The body is composed of a series of plates or laminations securely fastened together, and carries a wear-shoe secured at its end. The body is wider at its end where the shoe is attached than at other portions, and additional plates are secured to the side of the body at its narrower portions, whereby a uniform area of cross-section is obtained through its length.

667,275. Electric Motor. George E. Weisenburger, Sharon, Pa., assignor of one-third to E. W. Beadel, Newcastle, Pa. Application filed February 21, 1900.

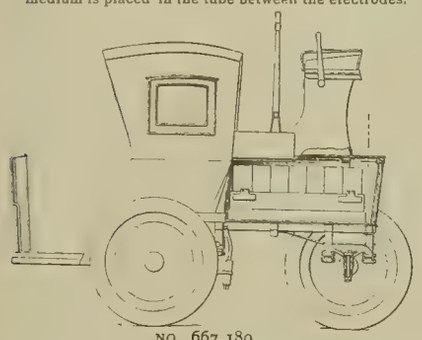
This motor has a rotatable armature and a rotatable field magnet. Removable end casings are pivotally mounted on the armature shaft, one of the casings forming a socket for one end of the shaft and the other forming a closed commutator chamber. Collector rings mounted on the end casings are movable therewith. The rings are in series, each series being on opposite sides of the field magnet. Stationary brush supports for the collector-ring brushes form closed chambers for the collector rings and their brushes.

667,324. Shade Holder for Electric Lamps. George M. Lane, Newark, N. J., assignor to M. Samuel Kamm, Newark, N. J. Application filed September 17, 1900.

Clamps are pivotally connected to opposite ends of a base plate, and springs connect the jaws of the clamps and span the space formed between them and supplement the action of the jaws to prevent lateral displacement of the shade or part placed upon the plate.

667,327. Telephone Transmitter. Tiodolf Lidberg, Chicago, Ill., assignor to the Swedish-American Telephone company, Chicago, Ill. Application filed October 3, 1900.

A metal tube is counterbored at one end and a flexible diaphragm adapted to rest upon the shoulder formed by the conjunction of the two diameters of the tube. A ring surrounds the edges of the diaphragm for holding the diaphragm in place. An electrode fixed to the inner surface of the diaphragm moves with it. A stationary electrode is introduced into the open end of the tube with means for adjustably fixing it, and a granular conducting medium is placed in the tube between the electrodes.



NO. 667,189.

667,336. Trolley Head. Eli S. Reed, Hill City, Tenn., assignor of one hundred and fifty-three two-hundredths to Edward M. Smith and William P. McClatchey, Chattanooga, Tenn. Application filed June 20, 1900.

The head is connected with the spindle, so as to be capable of an axial rotation, and a ring carrying a lug is riveted to the upper end of the spindle and engages the head so as to limit its axial movement.

667,372. Electric Arc Lamp. Hans O. Swoboda, New York, N. Y. Application filed June 15, 1900.

A pair of studs project upward from a resiliently mounted gas cap. A clutch plate has openings to receive the upper carbon and the studs projecting from the gas cap. Electrically actuated means are provided for lifting the end of the clutch plate.

667,374. Electric Heater for Liquids. Joseph A. G. Trudeau, Ottawa, Canada. Application filed April 4, 1900.

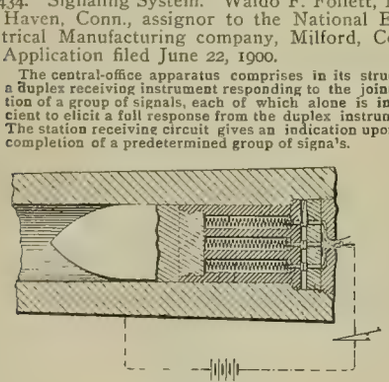
Two short electrodes arranged near together project through the wall of the vessel containing the liquid to be heated and close to its bottom so as to be wholly below the liquid level under normal operation. An insulating and liquid-tight retaining packing is placed between each of the electrodes and the wall of the vessel through which it projects.

667,421. Means for Connecting Electrodes. Henry Blackman, New York, N. Y. Application filed June 6, 1899.

For making connection between an electrode and an independent conductor a protecting tube or sheath encloses the conductor, and a packing at the upper part of the tube surrounds it and forms a seal to prevent passage of fluids past the seal into the space between the tube and conductor.

667,434. Signaling System. Waldo F. Follett, New Haven, Conn., assignor to the National Electrical Manufacturing company, Milford, Conn. Application filed June 22, 1900.

The central-office apparatus comprises in its structure a duplex receiving instrument responding to the joint action of a group of signals, each of which alone is insufficient to elicit a full response from the duplex instrument. The station receiving circuit gives an indication upon the completion of a predetermined group of signals.



NO. 667,435

667,435. Cartridge Fired by Electricity. William Friese-Greene and Percy E. Knell, London, England. Application filed December 30, 1899.

A case of insulating material contains a length of metal vaporizable more or less quickly by the passage of electricity. Electric contact is made with the vaporizable metal at its ends, whereby on the passage of a current of electricity through the metal explosive energy is generated. (See cut.)

667,448. Signal for Trunk Lines. Frank R. McBerty, Downer's Grove, and James L. McQuarrie, Chicago, Ill., assignors to the Western Electric company, Chicago, Ill. Application filed January 11, 1897.

A source of current is included in the plug circuit uniting two telephone lines, with means for closing the line circuit at the sub-station during the use of the telephone. A magnet interposed in the circuit to respond to current therein controls a supervisory signal adapted to be displayed when the magnet is inert. A key disconnects the source of current from the plug circuit when in one position, and switch contacts associated with the key alter the circuit determining the display of the supervisory signal to prevent its display.

667,454. Facsimile Telegraph. Anton Pollák, Szentes, Austria-Hungary. Application filed February 17, 1899.

The transmitting device has a series of selenium cells with means for varying their illumination in accordance with the message. Current impulses sent through the cells successively individually correspond with the successive points of the message. The receiver has a vibrating member adapted to respond to these impulses to reproduce successive points of the message. The after vibrations of the vibratory member are so suppressed that its response to the current impulses may be substantially unaffected by them.

667,460. Telephone Exchange Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed September 25, 1896.

The subscribers' lines enter a common annunciator board. Terminals of different subscribers' lines and trunk lines extend from the annunciator board to each of the switchboards. Two or more separate signal-indicating instruments for each subscriber's line are located in the annunciator board, with different circuits for each of the instruments associated with the corresponding telephone line. At the sub-station of the line either of the signals of the line is actuated through the agency of the proper circuit.

667,461. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed January 9, 1897.

A lamp in the local circuit is provided with a shunt. A supervisory signal is associated with the plug of the telephone line, and circuit connections closed in registering contacts of the plug and spring-jack bring the supervisory signal into circuit with the shunted lamp, whereby the response of the supervisory signal is made independent of the condition of the lamp.

667,462. Signal Lamp for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed March 9, 1898.

A cylindrical lamp-bulb is adapted to be inserted within a tubular lamp socket. Terminal plates secured on opposite sides of the bulb conform thereto and have slots therein. A pair of contact springs project longitudinally into the socket, one on either side of the lamp, bearing upon the portions of the terminal plates in which the slots are cut, to make electrical contact with the lamp and prevent it from turning in the socket.

667,463. Signaling Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed June 7, 1899.

A telephone circuit between two stations is provided with means for breaking the circuit at either station. A signal-controlling instrument is normally responsive to current in one of the lines. A pair of switch contacts actuated by an electromagnet responsive to currents through one of the lines alter the circuit connections to make the signal-controlling instrument responsive to current in both lines.

667,484. Device for Disinfecting Transmitters and Receivers of Telephones. Cyrus F. Axtell, New York, N. Y. Application filed May 25, 1900.

A generator of ozone operated from a magneto-shaft of the telephone distributes the ozonized air to the receiver and transmitter.

667,498. Electrolyzer. William T. Chapman, Manchester, England, assignor to the American Alkali company, Philadelphia, Pa. Application filed September 12, 1900.

An electrolytic cell has an anode comprising a block with a series of carbon rods secured thereto. A metallic rod secured to the block extends vertically through the top of the cell, and has an outer screw-threaded portion and an inner-sheathed portion to shield it from gas or fumes. A hollow collar internally threaded for part of its length engages the outer screw-threaded portion of the supporting rod.

667,503. Phonograph Attachment for Telephone Circuits. Allan B. Clark, Nashville, Tenn., assignor of one-half to J. Roy Boone, Nashville, Tenn. Application filed July 10, 1900.

In a central station embracing a telephone circuit and subscribers' lines a phonograph is normally in circuit with different subscribers. Spring-jacks are provided for each subscriber's line at the central station, and a plug is adapted to be inserted so as to release the spring-jacks and break the connection between the phonograph and the subscriber while connecting the subscriber with central or with another subscriber through central.

667,508. Automatic Switch. Joe D. Edwards, Washington, D. C. Application filed October 30, 1900.

In an underground electric-railway system a trip-lever is operatively connected with a series of pivoted switch points and located below the surface. A plow is carried by the car and provided with bearings. A bar slidably mounted in the bearings has a collar on its lower end, with a coiled spring interposed between the collar and one of the bearings. A trip on the bar engages the trip lever. An operating table passing over a roller mounted on a plow holder is detachably connected to the bar.

667,509. Current Collector for Electric Railways. Frederick C. Esmond, New York, and Norton P. Otis, Yonkers, N. Y. Application filed November 17, 1899.

Several parallel bars extend longitudinally of the vehicle and are grouped together on a common support to form a unitary device. Each has an independent vertical movement with respect to the support and an additional movement against a spring.

667,519. Electric Meter. Jesse Harris, Rensselaer, N. Y. Application filed June 2, 1900.

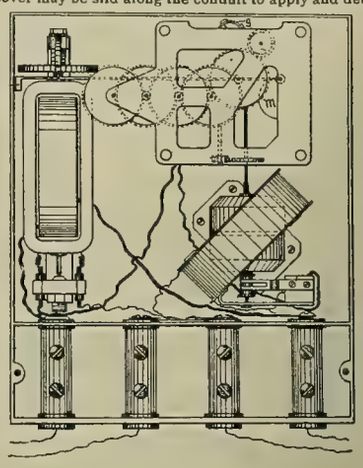
The source of power consists of a motor and clockwork. The motor is arranged to receive initial power intermittently and to wind the clockwork intermittently, the clockwork being arranged to complete an electric circuit whereby the motor is given motion. The meter also has a registering train, an indicating device and a transmitting device, the registering train being arranged to receive motion intermittently from the transmitting device and the latter to receive motion from the motor and communicate it to the registering train and indicating device. The transmitting device has a resilient device in connection with it whereby its movements are controlled, the resilient device having permanent initial resilience. (See cut.)

667,546. Telephonic Transmitter. Lemuel Mellett, Somerville, Mass., assignor to Albert F. Henderson, Melrose, Mass. Application filed June 14, 1900.

A body of loose granular resistance-varying material is located in a chamber behind a diaphragm and actuated thereby. Vibrators respectively responsive to different tones located in the chamber behind the diaphragm and actuated thereby react independently on the granular body.

667,567. Conduit for Electric Wires. Emmett D. Page, New York, N. Y. Application filed May 14, 1900.

The conduit has one or more channels or ducts for wires and is provided with a pliable detachable cover adapted to be bent toward and away from the conduit. It also has longitudinally extending grooves whereby the cover may be slid along the conduit to apply and detach it.



NO. 667,519

667,571. Trolley Wire Crossing. James W. Perry, Philadelphia, Pa. Application filed May 10, 1900.

Two parts are pivoted together at the middle and respectively adapted to be connected to the trolley wires of the two crossing railways, and each of the parts is provided with guide-rails upon its under surfaces, those of one of the parts being adjustable so as to turn horizontally into or out of alinement with the trolley wire and acting to support the other part and adjustably lock the two parts together.

667,584. Electric Arc Lamp. Rupert Schefbauer, Jersey City, N. J., assignor to the Sterling Arc Lamp company of New York. Application filed May 1, 1900.

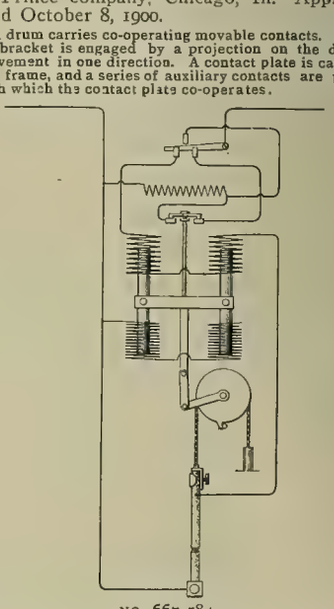
This is an alternating-current arc lamp comprising regulating magnets, an inductive reactance, a manually controlled switch, and connections whereby the switch can either cut out the lamp and cut in the inductive reactance, or throw the lamp and inductive reactance into parallel with each other. (See cut.)

667,585. Electric Arc Lamp. Albert Schweitzer, Pittsburg, Pa. Application filed October 6, 1900.

A plunger arranged in an interior air-tight casing is provided with air passages and means for their control. An upper-carbon holder arranged in the casing has contact springs at its upper end. A gravity clutch engages with the upper carbon. Swinging rods carry a bracket for supporting the globe. An insulated casing is arranged above the solenoid.

667,619. Controller for Electric Motors. Thomas W. Eaton, Chicago, Ill., assignor to the Eaton & Prince company, Chicago, Ill. Application filed October 8, 1900.

A drum carries co-operating movable contacts. A frame or bracket is engaged by a projection on the drum for movement in one direction. A contact plate is carried by the frame, and a series of auxiliary contacts are provided with which the contact plate co-operates.



NO. 667,584

667,625. Automatic Electric Circuit-breaker. Bertram Hopkinson and Ernest Talbot, London, England. Application filed July 16, 1900.

In this circuit-breaker an electromagnetic device is provided for closing the breaker automatically. A normally open local circuit supplies current to actuate the closing device and upon the opening of the circuit-breaker the local circuit is closed and held closed until the mechanism acts to return the circuit-breaker to its closed position.

DESIGN.

34,040. Incandescent Electric Lamp. Charles A. Chase, Chicago, Ill., assignor to the General Incandescent Lamp company, Cleveland, Ohio. Application filed January 11, 1901. Term of patent, 14 years.

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Alternating-current Development in Austria.

By Frank C. Perkins.

In Austria, as in all parts of Europe, the polyphase, alternating-current apparatus has been installed very extensively and will undoubtedly be still more prominent in the next few years. In Vienna, the most important city of Austria, the central station of which will first be considered, single-phase, alternating-current apparatus was first installed to the extent of more than 2,000 horsepower. Later, two-phase, alternating-current machines were installed to the extent of 15,000 horsepower; and now very few modern central stations in Austria or elsewhere are being equipped with anything but three-phase machines.

The questions as to what has been the greatest electrical development during the last five years and what the future prospects are for the next five years may be stated, in a digression, by quoting two leading English engineers:

Sir William Preece of London, in a recent letter to an American inquirer, says: "The greatest development of the last five years is undoubtedly polyphase, alternating-current working in Europe." "In the development of power transmission and electric traction on railways it is going to shove us ahead of your very progressive country." While the latter part of the statement may come true, there is no question that American enterprise, invention and practical engineering work with polyphase, alternating-current machinery are not at present behind any country in the world. It is also to be noted that a great deal of American polyphase apparatus, as well as American engineering talent, is being used to aid in the "shoving" process in England.

In reference to the same questions Colonel R. E. Crompton of Kensington, London, says: "I think it probable that most of us in England consider that the great development of light and power supply from central stations or power houses, and which it is now seen can be commercially worked up to a radius of 15 miles from the power house, is likely to be greatly extended in all countries, and will have far-reaching commercial and social results."

Colonel Crompton continues: "It is 10 years since I first publicly stated that this development of electrical engineering was likely to be of the greatest value in preventing overcrowding in towns, and by encouraging cottage industries would insure the better distribution of the working population. These facts and the probability that even long lines of existing railways that are now overcrowded with traffic will be worked by electric locomotives from power stations make me feel that the distribution of electric light and power is beyond doubt the greatest electrical development of the last five years. As regards polyphase matters, the prevailing opinions vary greatly; I think the majority, however, myself among the number, consider that at present, wherever electrical energy has to be supplied very largely for lighting purposes, the balance of advantage appears to lie with direct-current distribution. Where, on account of distance, transforming is necessary, the right use of polyphase apparatus is for generation and distribution at high voltages, with transformation to 500-volt, direct-current distribution at the transforming points."

The latter method referred to by Mr. Crompton is advised by American engineers in connection with the introduction of electric power for the underground railways of London, polyphase currents being generated at the power station at high potentials, with static transformers and synchronous converters at the sub-stations. European engineers of prominence, however, are advocating the direct use of polyphase motors on the electric locomotives, and it is with great interest that the decision is awaited. For incandescent and arc lighting the latest approved practice in all countries is to use large central-station units, those with stationary armature and rotating-flywheel fields preferred, with distribution to sub-stations at high voltages, step-down, static transformers giving a low house-lighting potential.

But to return to Vienna. The great commercial city of Austria was among the first to introduce alternating-current apparatus on a large scale, and it has a central station (Fig. 2, page 126) whose capacity is now more than 15,000 horsepower. The boiler house is equipped with 32 boilers which have a heating surface of 8,000 square meters and supply steam to 19 horizontal, compound, condensing engines of various sizes. The engine and generator room seen in the accompanying illustration (Fig. 1) is supplied with single-phase and two-phase alternators. There are 14 single-phase machines, six of 500 kilowatts each and eight having a capacity of 400 kilowatts each. The two-phase generators are five in number, each having an output of 1,000 kilowatts. The line potential is 2,100 volts, and underground cables are used in the distribution, a total of more than 250 kilometers of primary cable being employed. The entire station was equipped by Ganz & Co. of Budapest for the Internationale Elektricitäts Gesellschaft of Vienna.

Trieste is an Austrian city of considerable importance on account of its shipping. It is one of the principal seaports, and its docking facilities have recently been brought to the highest standard. The central station of this city was constructed and equipped by the firm of Ganz & Co. The steam-boiler plant consists of five boilers, each having a heating surface of 135 square meters and operating under a pressure of 11 atmospheres. The boilers

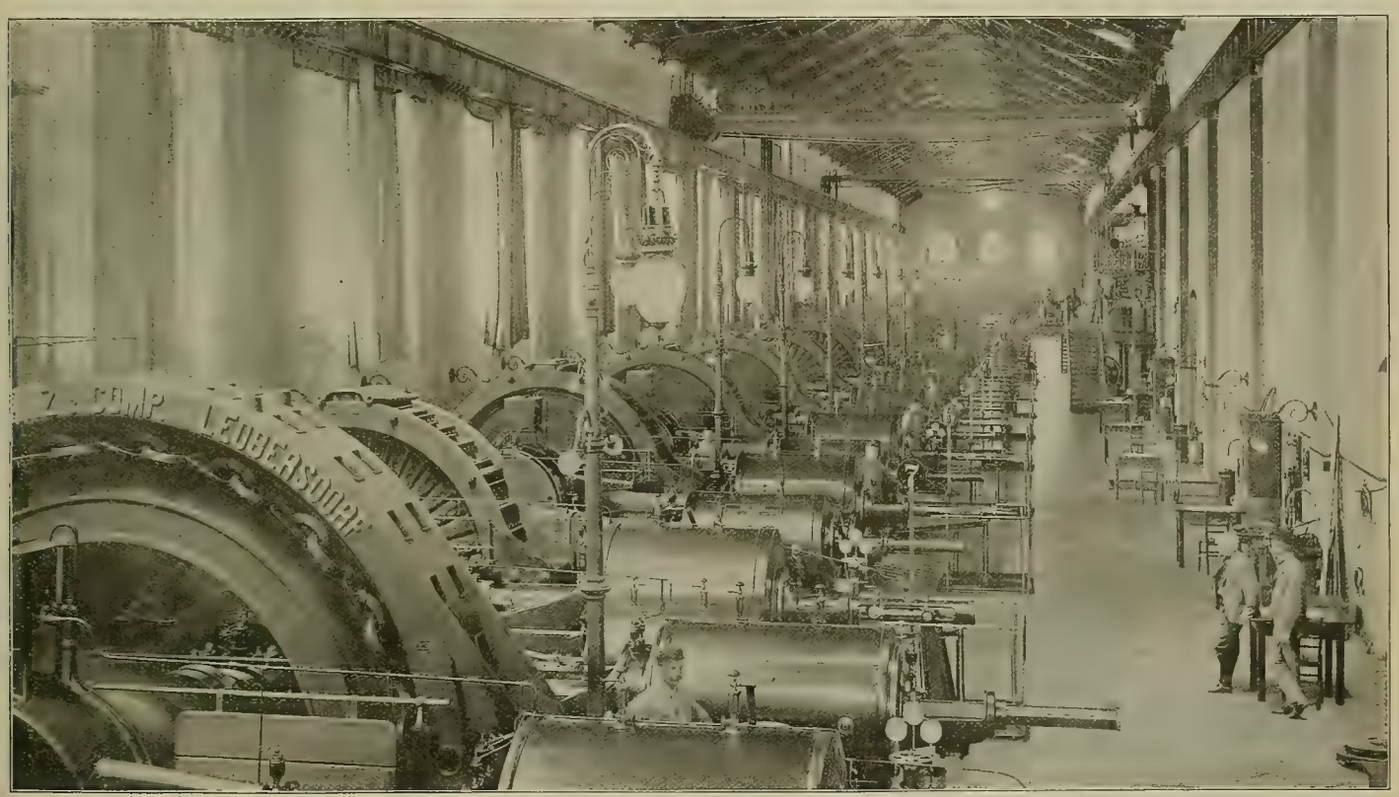

FIG 1. ALTERNATING-CURRENT DEVELOPMENT IN AUSTRIA.—ENGINES AND GENERATORS IN CENTRAL STATION AT VIENNA.

are of the Tischbein type, and were built by Ringhoffer of Prague. The engine room, shown in Fig. 3, is supplied with three Tosi engines, one of 350-horsepower capacity, one of 300 horsepower and one of 450 horsepower, each being of the horizontal, tandem-compound type. Under the engine room are placed the condenser pumps, which are operated by the main engines. The alternators seen in the illustration have rotating-flywheel field magnets, and are designed for an output of 250 kilowatts. These machines are of the three-phase type. The revolving fields, directly coupled to the engines, have a normal speed of 100 revolutions per minute, and the exciting current is supplied by collector rings from a continuous-current dynamo, mounted on the end of the engine and alternator shaft, outside of the main bearing, as indicated in Fig. 3. The potential of these alternators is 2,000 volts, and the current at this pressure is carried to the points of distribution about the city by underground cables. At the various arc lamps a transformer reduces the tension to 33 volts, required for each lamp. The incandescent circuits are supplied at 100 volts, step-down transformers being placed at various transformer buildings located at various points on the thoroughfares. The Trieste plant is a fair example of this method of generation and distribution for a moderate-sized central station with distances within reasonable limits.

The central stations just described are examples

of the use of single-phase, two-phase and three-phase, alternating-current apparatus, not only in Austria, but throughout Europe, when operated by high-power steam engines, and for transmission and distribution at moderate potentials. It may now be of interest to consider an important high-potential, polyphase transmission plant in Austria.

The Bozen-Meran high-tension, polyphase power transmission will illustrate very well the use of polyphase generators driven by turbines for long-distance power transmission. From the power house (Fig. 4) two lines of power transmission are required and two different line potentials are employed. One transmission line conducts the current to Meran, a distance of 5.5 kilometers from the power house, and the other line supplies the necessary electrical energy for operating arc and incandescent lights, as well as motors, at Bozen, a distance of 30 kilometers from the generating station. The Meran line utilizes a polyphase current of a potential of 3,600 volts, while the Bozen conductors operate with a potential of 12,000 volts. Both of the lines are of high-grade pole construction, carrying two sets of three conductors each. The potential is reduced to 115 volts, and is used largely in the manufacture of calcium carbide, as well as operating the motors and arc and incandescent lamps of the two places.

FIG. 2. ALTERNATING-CURRENT DEVELOPMENT IN AUSTRIA.—VIENNA CENTRAL STATION.

The turbine and dynamo room, shown in Fig. 5, (page 127) has six turbines of 1,200 horsepower each. These waterwheels operate under a hydraulic head of 64 meters, and are each directly coupled to a polyphase, alternating-current generator of 1,000 kilowatts' capacity. Four of these units are seen in the illustration, the automatic governor controlling the turbines being shown at the left.

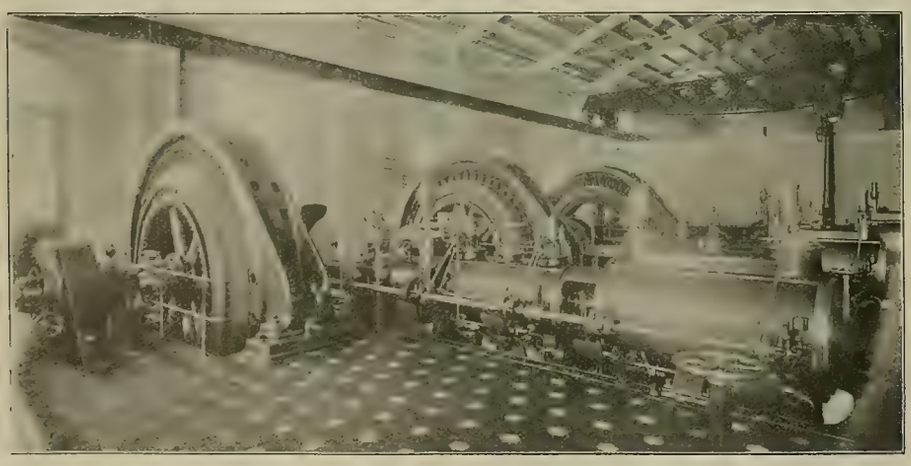

FIG. 3 ALTERNATING-CURRENT DEVELOPMENT IN AUSTRIA.—ENGINE-DYNAMO UNITS AT TRIESTE.

One of the alternators supplies current at 12,000 volts and three of the others generate a polyphase current at 3,600 volts, while two of the 1,000-kilowatt machines are designed to give both 12,000 volts and 3,600 volts. These machines are all of the inductor type, and hence it will be readily understood how such high voltages can be generated directly by the alternators, thereby avoiding the necessity of using step-up transformers for the high-tension line of 30 kilometers to Bozen. On account of the armature winding as well as the field winding of these machines being stationary, the great difficulty of high insulation of moving coils is avoided. At the Paris Exposition recently closed a machine was exhibited which generated successfully currents of more than 30,000 volts. This is, however, somewhat beyond the present practice, but higher voltages may be looked for in all new long-distance power-transmission plants.

Vestibules for Boston Street Cars.

The Massachusetts State Railroad Commissioners have decided that the Boston street-railway companies must provide vestibules for the protection of motormen in cold weather. The Legislature in 1900 passed an act providing for the use of vestibules on all street cars during January, February, March and December, but allowed the commission to suspend the law in Boston. The single question before the commissioners was that of safety of operation, the railway managements asserting that the vestibules obstructed the view of the motormen in the narrow, crowded streets in the business district of Boston, and rendered the operation of cars more dangerous to the other users of the streets. Many conflicting opinions were heard from people who had investigated the subject in other places, in several instances the views of two managements in the same city being at variance. It was regarded as significant, however, that the number of vestibuled cars in use has steadily increased, and that no cases could be found where companies had been forced to abandon them for the old style of open-platform cars. The fact that modern vestibules are so built as to be practically convertible was also regarded as an argument in favor of the change. While the commissioners admitted that in very crowded streets there was reasonable ground for apprehension that enclosed platforms would increase the danger to pedestrians, the fact that the doors could be opened and the windows lowered so as to allow the motorman free use of his sight and hearing seemed to provide for such cases.

The time set for the completion of the change is January 1, 1905, and certain lines are to be equipped with the new platforms by December 1, 1901, for trial. The board agrees to reverse its decision in case these cars prove unsuccessful.

American System Favored for London Metropolitan Railway.

[From the Chicago Daily News.]

London, February 14.—A lively discussion over the relative merits of American and European electrical ideas animated this afternoon's meeting of the Metropolitan District Underground railway shareholders. Referring to the international competition for the conversion of the road from steam to electricity, Chairman Forbes stated that the management, acting on expert advice, strongly advised the system submitted by a Budapest house [Ganz & Co.]. He added: "The Americans are not in it, though they think they are."

This shot provoked the ire of Robert W. Perks, M. P., the London solicitor, who represents the financial interests which control the company. Mr. Perks said: "I am free to declare that not a penny will be forthcoming for the installation of any experiment on this property. The system of which the management seems enamored will not do. Its cheapness fails to atone for its utterly untried character. We must bring ourselves to understand that when we are looking for the best system electrical science affords us we must go to the country where that science has reached its highest development and where practical experience, regardless of cost, governs all forms of commercial enterprise."

Sir William Preece, consulting engineer of the railway, upon whose approval the Budapest system was about to be adopted, told the Daily News correspondent after the meeting that Mr. Perks' ultimatum would necessitate a revision of his recommendation.

Franchises Taxable in Michigan.

The Michigan Supreme Court, in a recent decision, holds that franchises granted to street railways and similar corporations are taxable. The decision is an important one, not only on account of the changes that will be made in the assessment of property belonging to Michigan corporations, but because it will probably serve as a precedent to justify similar decisions in other states. The case grew out of the recent increase of the personal-property assessment of the Detroit Citizens' Street Railway company from $1,500,000 to $5,000,000, $2,000,000 of which the company claimed was represented only by the alleged value of its franchises. In the opinion handed down by the court, careful distinction is made between the right granted to a concern to organize and exist as a corporation, the right to act generally as a corporation and the special privileges granted to a corporation already licensed. Under this latter classification is included the use of streets as granted to street-railway and conduit companies. The first two mentioned are not transferable, and therefore cannot be said to have an actual cash value. Even special privileges are usually of little more than nominal value except in connection with tangible property which makes it possible for the owner, who may be a corporation or a private individual, to avail himself of them. When, however, they are associated with property which makes them available, the property with which they are connected generally takes on a new form

FIG 4. ALTERNATING-CURRENT DEVELOPMENT IN AUSTRIA.—BOZEN-MERAN POWER HOUSE.

in the law and is enhanced by the privileges and uses to which it is adapted, and the court believes that it should pay a correspondingly increased tax because it has an increased cash value. Special privileges, unlike the right to corporate existence, have an actual value in connection with the property adapted to their use and are salable with it, and the court holds that they are therefore assessable.

Changes in Lake Street Elevated Company.

At the annual meeting of the Lake Street Elevated Railroad company held in Chicago last month, besides the election of C. E. Yerkes to succeed his father, Charles T. Yerkes, as president of the company, which has been previously recorded in these columns, Frank Hedley, the general superintendent of the company, was elected vice-president, to succeed A. S. Littlefield. The board of directors now includes President Yerkes, Vice-president and General Superintendent Hedley, Secretary and Treasurer W. V. Griffin, W. W. Shaw, L. S. Owsley, M. C. McDonald, C. A. Knight and Edwin C. Veasey. W. E. Merwin has been appointed superintendent of the Lake Street road, to succeed A. K. Stone. General specifications have been drawn for the construction of the new power house of the company, and the work will be carried forward as rapidly as possible.

It is announced that a site for the new power house has been purchased in West Lake street, between Forty-sixth and Forty-eighth avenues. The building to be erected thereon will cost, approximately, $200,000. Charles T. Yerkes takes the title to the land, for which $25,000 was paid.

Automatic Train Indicator.

An annunciator or signaling device has been installed on the Northwestern elevated railroad in Chicago to notify patrons of the approach of trains. About 1,000 feet from each station is placed a trip which is operated by the flange of the car wheel striking it in passing over the track. The trip closes a circuit connected to the return rails on the structure and to the station. A connection with the third rail is made at the station, and in the circuit on the wall of the waiting room are placed five incandescent lamps in series and a gong. The closing of the circuit by the train rings the bell and lights the lamps, giving ample time for passengers to mount to the platform before the train arrives,

Marks Enclosed Arc Lamp Patents.

It is reported that the General Electric company has ended the litigation in which it was the defendant in a suit for infringement brought by the Marks Enclosed Arc Light company and that, by the terms of the settlement, the General Electric company secures entire control of the Marks patents for enclosed-arc lamps that were involved in the suit. Of the Marks patents one is particularly broad in scope and covers generally an electric arc burning in a practically air-tight enclosure. It is on these patents that the Marks company brought suit against the General Electric company some time ago. In view of the fact that the General Electric company has now abandoned its defense and secured control of the patents, it would seem that it regarded the latter as valuable.

Other suits are pending in the interests of the Marks company against alleged infringers. Unless the court should decree otherwise all the testimony and evidence that has been collected in the suit just abandoned will be suppressed. Of the several enclosed-arc-lamp manufacturers in the field, some are licensees of the Marks company while others are fighting the patents or disregarding them. The proposition under which licenses were offered by the Marks company some time ago was that the licensed company should continue the manufacture of its lamps until the patents were either sustained or not sustained in court. In the latter case no remuneration was to be paid, but if the patents were upheld a royalty was to be paid on each lamp manufactured by the licensed company. These old licenses, it is understood, will not be affected by the changed conditions, but will be continued. The General Electric company is said to have appointed new officers to represent its interests in the Marks company.

The Cost of Power.[1]

By C. S. Brown.

In order to produce power cheaply the plant must be of large capacity, of modern design, located in close proximity to a plentiful supply of water for condensing purposes, which is available at small cost for pumping, and the cost of fuel must be low. The load must be uniform in character and of such amount as to load the engine to the point of maximum economy. A plant of this character of 1,000-horsepower capacity can be installed complete—including brick buildings and stack; compound condensing engines, using 13.5 pounds of steam per indicated horsepower-hour; boilers, evaporating from nine to 10 pounds of water per pound of coal; economizers, and all accessories—for $60 per indicated horsepower. Such a plant can run on 1.5 pounds of coal per indicated horsepower-hour for total coal consumed. On its cost the fixed charges would be: Interest, five per cent.; depreciation, four per cent.; repairs, two per cent.; insurance and taxes, two per cent.; total, 13 per cent. The total cost of one indicated horsepower, 10 hours per day, 308 days per year, would be as follows, estimating coal at $1.62½ per ton, delivered—a rate for which good steam coal can be obtained in Nashville:

Thirteen per cent. on $60	$ 7 80
Coal, 1.5 pounds per indicated horsepower-hour at $2 per ton	3.75
Attendance boilers—two day men, one night man, $1.50	1.39
Attendance engine—one engineer, $3.50, one assistant, $2.	1.70
Oil, waste and supplies	.80
Total cost of one indicated horsepower-year	$15.44

For continuous service it would be necessary to construct the plant of a sufficient number of units so as to permit of making repairs without interference with the operation of the plant at full capacity. For such condition the cost of the plant complete would probably be at least one-third more than for that just considered. The fixed charges would then be:

Thirteen per cent. on $80		$10.40
Coal, 1.5 pounds per indicated horsepower-hour at $1.625	$\frac{1.5 \times 24 \times 365 \times 1.625}{2000}$	10.67
Attendance boilers: Two day men, One night man at $1.50	$\frac{600 \times 365}{1000}$	2.19
Attendance engine: One day engineer $3.50, One night engineer 3.00, Two assistants 4.00	$\frac{10.50 \times 365}{1000}$	3.83
Oil, waste and supplies		1.25
		$28.34

Service at this low figure could be expected only with the best possible machinery, kept always in perfect repair, and with expert attendance.

For electric street-railway work, where the load varies through wide ranges, the economy of the engines would be materially reduced and the cost of one indicated horsepower in fuel increased accordingly. Prof. W. E. Unwin states on this point: "The general results of numerous trials with large engines with constant load shows that an indicated horsepower should be obtained with a consumption of 1½ pounds of coal per indicated horsepower-hour for condensing engine and 1¾ pounds for non-condensing engine. It is much more difficult to ascertain the coal consumption in everyday work, but such facts as are known show that it is more than on trial runs."

In electric-lighting stations the engines work under a very fluctuating load, and the results are far more unfavorable. An excellent Williams non-condensing engine, which on full-load trial worked with less than two pounds per effective horsepower-hour in the ordinary daily working of the station, used 7½ pounds per horsepower-hour in 1886, 4.3 pounds in 1890 and 3.8 pounds in 1891. Probably in very few cases were the engines in electric-light service working with a consumption of less than 4½ pounds of coal per effective horsepower-hour, or of 3.5 pounds to four pounds per indicated horsepower-hour. In the case of small, isolated engines working under fluctuating loads still more extravagant results are obtained.

On an estimate of an average of 2½ pounds of coal per indicated horsepower-hour, with compound engines in such service operated 24 hours per day for 365 days per year, coal at $1.62½ per ton, the fuel cost per indicated horsepower-year would amount to $17.80, or $7.13 in excess of the fuel cost per uniform load, an addition of 67 per cent. to the fuel cost and about 25 per cent. to the total expenses of operation, making the cost of the average variable load per indicated horsepower-year, $35.51.

The following data compiled from the reports of the cost of operation of a number of large power stations more or less modern in design and construction show the wide variation in cost of development of a horsepower:

Cost of One Indicated Horsepower Per Year.

	Average I. H. P. Developed.	Fuel.	Labor.	Supplies.	Water.	Repairs.	Fixed Charges.	Total.	Fuel Per I. H. P. Hour.
1. Largest.	4 000	$13.56	$ 6.81	$ .82	$1.00	$ 1.74	$ 8.75	$32 68	1.76
2. Smallest	600	22.38	16 53	2.91	.....	2.95	13.20	57.97	....
3. Average.	1.600	17.24	9.54	1 80	.48	2.25	9.90	41.21	..
4. Most expensive..	1,400	53.00	11.10	4 38	.....	11 82	10.80	71.10	....
5. Most economical . .	1.000	11 85	6.18	.33	.23	.82	11 55	30 96	2.20

A study of tabulated matter suggests that the largest plant, giving an average output of 4,000 indicated horsepower, is working under conditions approximating uniform load, its coal per horsepower-hour being only 1.76 pounds, and total fuel account but little higher than the amount estimated as required for uniform load. The smallest plant, of 600-horsepower average output, has a fuel cost of $22.38, which would suggest a fluctuating load. Its labor cost is also excessive, and is the chief cause of the large total cost of $57.97 per indicated horsepower-year. The average plant, of 1,600 indicated horsepower, approaches closely to the estimate for fluctuating load in its total cost ($41.21), being slightly lower in fuel cost and higher in labor. The most expensive plant, of 1,400 indicated horsepower, was operated with oil as a fuel, which may account in part for its excessive fuel cost. Its cost of labor, supplies and repairs is excessively high, however, and would suggest the plant to be old, out of repair and badly managed. The most economical plant, that of 1,000 horsepower, has a fuel rate of 2.2 pounds per indicated horsepower-hour, and would suggest a somewhat fluctuating load; but its low fuel cost ($11.85) shows the use of a low-grade and inexpensive fuel. The labor item corresponds closely with the estimate for labor cost in the 4,000-horsepower plant first considered, while its items for repairs and supplies are very low.

The cost of power as developed by the ordinary small plant of, say, 10-horsepower capacity, is a very indefinite quantity. Such plants are, in general, of poor design, cheaply built, badly cared for, and the cost of repairs is high. The usual plant consists of a small vertical or horizontal boiler of the internal-firebox type, usually entirely unprotected on the outside, and wasting a large portion of its heat by radiation and a slide-valve engine fitted with throttling governor and cutting off at three-fourths to seven-eights of the stroke, in consequence, exhausting steam with an increased loss in power, but little work being done by the expansion of the steam. This outfit is fed by a small, direct-acting steam pump, or injector, or possibly by a power pump operated by the engine, with cold feed water, both engine and pump exhausting to the atmosphere, use being seldom made of the exhaust for heating or similar purposes. The plant is usually cared for by the most common sort of labor, and gets the attention of a skilled mechanic or engineer only when so far out of repair that it refuses to run or develop requisite power. For good practice the boiler may evaporate 7½ pounds of steam per pound of coal, and the engine develop one horsepower on 45 pounds of steam, or an equivalent of one indicated horsepower per six pounds of coal. It would be difficult to set a limit to poor practice in plants of this kind, but it would be no misstatement of actual conditions in many cases to place the boiler evaporation below four pounds of steam per pound of coal and the engine as using in excess of 80 pounds of steam per indicated horsepower-hour, or the fuel cost of one indicated horsepower at 20 pounds of coal per hour.

A fair estimate of the average condition would be: Boiler evaporation, five pounds steam; consumption of engine, 65 pounds, or one indicated horsepower on the expenditure of 13 pounds of coal. The cost of the effective horsepower of this character is still greater, due to the low mechanical efficiency of engine employed, which may range from as low as 40 per cent. in very poor practice to a maximum of 75 per cent. in good practice. In the operation of a plant of this character the fixed charges would be, approximately:

Good Practice.

Cost of a horsepower-year as developed in small plants of 10 horsepower.	
Interest, 6 per cent.; insurance and taxes, 3 per cent.	
Cost of plant per horsepower, $70.	
Fixed charges, 9 per cent. on $70	$ 6.30
Coal, 6 pounds per indicated horsepower-hour at $2 ton, running 308 days, 10 hours per day	18.48
Labor, 1½ hours per day of competent machinist or engineer at 25 cents; three hours per day of laborer at $1.25.	22.10
Depreciation, 5 per cent	3.50
Repairs, 3 per cent	2.10
Oil, waste and supplies	2.00
Total cost of one indicated horsepower-year	$54.48
On basis of 75 per cent. mechanical efficiency, one effective horsepower would cost	$72.64

Average Practice.

Cost of plant per horsepower, $60.	
Fixed charges, 9 per cent.	$ 5.40
Coal, 12 pounds per indicated horsepower-hour at $2, running 308 days, 10 hours per day	36.96
Labor, four hours per day, furnace or tanks, 15 cents	18.48
Depreciation, 6 per cent	3.60
Repairs, 5 per cent	3.00
Oil, waste and supplies	1.50
Total cost of one indicated horsepower-year	$ 68.94
On basis of 69 per cent. mechanical efficiency, one effective horsepower would cost	106.06

Poor Practice.

Cost of plant per horsepower, $40.	
Fixed charges, 9 per cent	$ 3.60
Coal, 20 pounds per indicated horsepower-hour at $2 ton	61.60
Labor, three hours per day, of laborer, $1.25	11.55
Depreciation, 8 per cent	3.20
Repairs, 8 per cent	3.20
Oil, waste and supplies	1.00
Total cost of one indicated horsepower-year	$ 84.15
On basis of 40 per cent. mechanical efficiency, one effective horsepower would cost	210.40

FIG. 5.—ALTERNATING CURRENT DEVELOPMENT IN AUSTRIA—TURBINES DIRECT-CONNECTED TO POLYPHASE GENERATORS AT BOZEN-MERAN.

1. Paper presented before the Engineering Association of the South at Nashville, Tenn.

While all the unfavorable conditions included in the above computation may not be present in any one plant, there are doubtless many plants in operation throughout the country giving results even poorer than those shown. Particularly is this the case in many plants of, say, 20 to 50 horsepower, which are run under light load, delivering from one-sixth to one-third the rated capacity.

Data as to the cost of power in locomotive practice are somewhat lacking, and this cost would vary widely with the varying conditions of service, engines, roadbed, etc. On account of the high rate of combustion of fuel per square foot of grate surface under the locomotive boiler, its efficiency is not so high as for stationary boilers of the same standard of design and construction. During a test of the locomotive drawing the Empire State Express, made by Mr. Angus Sinclair in 1893, an

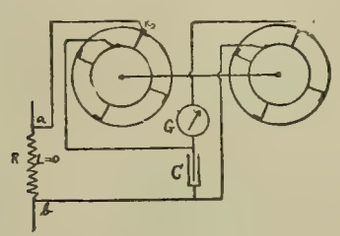

FIG. 1. AN APPARATUS FOR RECORDING ALTERNATING-CURRENT WAVES.

evaporation of seven pounds of water per pound of coal was obtained, and the coal consumption was 3⅞ pounds per horsepower-hour. The maximum power developed was 1,120 indicated horsepower; minimum, 550. The fuel cost per indicated horsepower-hour is so low as to make its accuracy appear questionable.

In average service the locomotive boiler might be expected to evaporate with the steam coal of this section about six pounds of water per pound of coal. An indicated horsepower would be developed by the engine on about 33 pounds of water, or on an expenditure of 5½ pounds of fuel.

Cost of locomotive, $10,000.	
Estimated horsepower, 800.	
Fixed charges: interest, 4 per cent.; taxes and insurance, 2 per cent.; depreciation, 6 per cent., repairs, 12 per cent.; total, 24 per cent. on cost per horsepower	$30.00
Fuel, 5½ pounds per indicated horsepower at $1.50 ton, per day of 10 hours	12.70
Labor. Engineer..$3.50 | Fireman.. 1.75 | $6. Wipers... .75 |	2.47
Oil, waste and supplies	.80
Total cost per indicated horsepower-year	$45.97

The efficiency of the mechanism of a locomotive is very low, as demonstrated by experiments made in France in 1889 on simple two-cylinder locomotives with four drivers coupled. Those experiments demonstrated that 57 per cent. of the power developed in the cylinders was absorbed in the mechanism of the engine itself, leaving but 43 per cent. available at the drawbar. These astounding results were confirmed later on the Pennsylvania railroad, when a locomotive, with 18¼ by 24-inch cylinders and four-foot six-inch by six-inch drums coupled, showed the power at the drawbar to be only 42 per cent. of that developed in the cylinders. On the basis of 42 per cent. mechanical efficiency of the machine the cost of an effective horsepower would be $109.45.

A discussion of the cost of development of power would not be complete without a word on the performance of that interesting, but erratic, motor, the gas engine. The machine, on account of its low cost, ease of operation when in the mood to start, freedom from fire, smoke and ashes, simplicity of construction and ease of management, is coming rapidly into use, particularly for small powers. Under fair conditions it will develop one horsepower on 25 cubic feet of commercial gas for one hour. Approximate fixed charges are about—

Nine per cent. on $60 per horsepower	$ 5.40
Gas, 25 cubic feet per hour at $1 per M.—2½ cents per hour, 10 hours per day, 308 days	77.00
Labor, one hour of laborer or janitor, $1.25	3.85
Depreciation, 8 per cent.; repairs, 4 per cent.=12 per cent.	7.20
Oil, waste and supplies	2.00
Total cost per indicated horsepower-year	$95.45

With the use of gasoline for fuel in this engine, at a cost of 12 cents per gallon, and the consumption of one pint of gasoline per horsepower-hour, the fuel cost per year is $46.20, and the total cost of producing one horsepower is $64.25; with a mechanical efficiency of 70 per cent., the cost of an effective horsepower would be, with gas as fuel, $136.36, and with gasoline, $91.80.

Electric current for power purposes is furnished in the city of Nashville at 10 cents per thousand watt-hours, or about 7.5 cents per horsepower-hour, with discounts varying in amount, depending on the size of monthly bill. At 7.5 cents per horsepower-hour current costs per year of 308 days, 10 hours per day, $231.

With 50 per cent. discount one electric horsepower costs for current per year	$115.50
Cost per horsepower, $30.	
Fixed charges, 9 per cent.	2.70
Depreciation, 8 per cent.; repairs, 3 per cent.	2.20
Oil, waste and supplies	1.50
Total cost per year	$121.90
With 85 per cent. total efficiency, the cost of one effective horsepower is	$143.40

An Apparatus for Recording Alternating-current Waves.[1]

By Frank A. Laws.

The apparatus forming the subject of this communication was constructed at the Rogers laboratory of physics in 1898, and has proved of sufficient value to merit a short description. In brief, the arrangement gives us a modification of the "contact method," by which the record is rendered continuous and traced photographically.

The necessary electrical connections are shown in the diagram (Fig. 1). (K_1) and (K_2) are two rigidly connected contact wheels of ebonite. Into the periphery of each wheel are set four brass blocks. These are accurately placed 90 degrees apart. Upon each wheel a brush and collector ring give permanent contact with the blocks. Another brush resting on the periphery of the wheel completes elec-

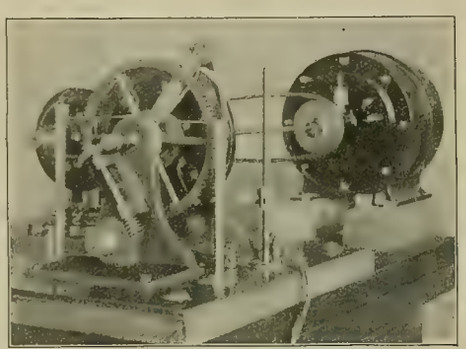

FIG. 2. AN APPARATUS FOR RECORDING ALTERNATING-CURRENT WAVES.

trical connection as the blocks pass under it. The brushes are so placed that contact is made and broken at (K_2) before (K_1) closes. The contact wheels are driven by a synchronous motor which gives one revolution for four complete alternations of the electromotive force. (G) is a dead-beat galvanometer, and (C) is an adjustable condenser. The leads (a) and (b) are carried to the points between which the potential difference is to be investigated. By inspection of the diagram it will be seen that once on each wave and at a definite point the condenser (C) is charged to the potential existing between (a) and (b). As the charge is determined by the breaking of the contact, the blocks may be of sufficient width to eliminate the effect of the jumping of the brushes. Also the resistance at the contact will not be of sufficient magnitude to prevent complete charging of the condenser.

The function of (K_1) is to discharge the condenser through the galvanometer after (K_2) has broken circuit. The instrument would ordinarily experience a constant deflection, but (K_1) and (K_2) are rigidly connected and mounted on a radial arm, which is geared to the shaft so that it moves very slowly. The effect is to move the contact point gradually over the wave. The deflection of the galvanometer will at any instant be proportional to the potential difference between (a) and (b) at the instant of breaking at (K_2), or, in other words, the deflection follows the wave form.

The actual arrangement is shown in Fig. 2, where the contact device, the synchronous motor and the direct-current motor used for starting the apparatus will be seen. By use of worm gearing the wheel train necessary for moving the brushes is made very compact; the reduction for the instrument shown is 7,200 to one.

I have found Sullivan's universal galvanometer to be a most satisfactory instrument for use with the apparatus. This galvanometer, of the d'Arsonval type, has a carefully balanced coil, so that it is not very susceptible to mechanical disturbances; also the magnetic damping is most carefully adjusted. The instrument is not of great sensitiveness, but owing to the stiff suspension the zero is perfectly definite.

The camera used for recording the curves is shown in Fig. 3. The plate is contained in an ordinary plate holder. This is moved vertically by a fine wire which is wound on a drum, seen in Fig. 2, just in front of the lower worm wheel. This drum can be thrown in at pleasure by a pin clutch. The slide of the plate holder is held stationary by a pin, so that the plate is exposed as the holder is drawn up.

The front of the camera, shown removed, is provided with a narrow slit about one one-hundreth of an inch wide. In front of it are projecting lips nine inches long and one-eighth of an inch apart. They are blackened within and serve effectually to shut out extraneous light, and thus prevent fogging of the plate. The spot of light used was the sharply focused image of the filament of an incandescent lamp. An alternative arrangement is to use a plate of ground glass in the holder, and to have a straight-edge fastened across the guides. It is then easy to keep the point of a pencil in contact with it and upon the spot of light.

The arrangement described is of course a device for obtaining the average wave, and unsuitable for recording transient phenomena. The time taken in recording a wave at 120 cycles per second is about 1½ minutes.

The adjustable condenser allows one to adapt the apparatus to varying conditions, so the electromotive-force curves may be taken directly, and the current curves by the use of a drop wire, as indicated in Fig. 1. In starting the arrangement it is very easy to determine when the proper speed for synchronism has been attained, by watching the spot of light, or by listening to a telephone which is inserted in place of the galvanometer. With the latter one hears slow beats as the contact moves over the wave.

Some examples of the records obtained with the device are given in Figs. 4, 5 and 6. Fig. 4 shows the potential difference between the carbons of an enclosed arc, in series with reactive coil. The curves were taken about one minute apart with a view to testing the concordance of the readings. In Fig. 5 (A) represents the potential difference between the terminals of a small alternating-current motor and (B) is the current through the motor. In Fig. 6 curve (A) is the

FIG 3 AN APPARATUS FOR RECORDING ALTERNATING-CURRENT WAVES.—CAMERA.

electromotive force, and (B) is the current in one phase of a quarter-phase synchronous motor running idle with the field adjusted for minimum current. The source of power was a three-phase dynamo with phasing transformers arranged on the Scott system.

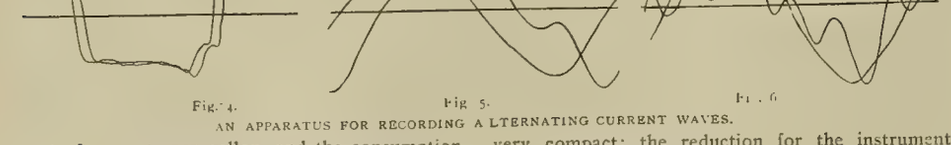

Fig. 4. Fig. 5. Fig. 6.

AN APPARATUS FOR RECORDING ALTERNATING CURRENT WAVES.

1. Contribution from the physical laboratory of the Massachusetts Institute of Technology and presented in the proceedings of the American Academy of Arts and Sciences.

Pearne Printing Telegraph System.

A printing-telegraph system was recently tested at Omaha, Neb., for which the inventor makes great claims. The apparatus consists of a sender, resembling the keyboard of a typewriter, and a receiver similar to the carriage and platen of a typewriter. The message is sent by manipulating the keys on the sender and is received and automatically printed on a roll of paper by the receiver. A patent for the apparatus was granted to Frank D. Pearne on October 9, 1900. According to a newspaper description of the invention, "each letter is made by a certain motion of one of nine fingers, each finger being susceptible to four motions from as many grades of currents, supplied by storage batteries at either end of the line." A successful test of the system is said to have been made over a 554-mile line with current at 85 volts.

Holson Two-wheeled Electric Vehicle.

An electric vehicle that possesses some interesting and rather unique features has recently been constructed by A. B. Holson of Chicago. It consists of a seat and carriage frame suspended between two large wheels, and a good general idea of its construction may be obtained from the accompanying illustration (Fig. 1), which shows the vehicle and its inventor.

Mr. Holson believes that the main improvement in his vehicle over other automobiles is the fact that he uses such large wheels. In passing over rough roads the jar of the storage battery is greatly lessened. The inventor says: "The reason that batteries give out so quickly in automobiles is that the vehicle shakes the batteries so badly that the active material drops out, and there is a tendency to short-circuit the battery. I overcome this by having such a large wheel. When I am driving my rig fast the wheels are turning comparatively slowly, as the vehicle advances 20 feet during every revolution of the wheels. On ordinary dirt roads each wheel makes contact with the ground for a distance of about 11 inches, which makes the cart run steadily and steer easily. In testing the machine I passed over a six by six-inch block of wood very easily, hardly noticing any swinging to one side, as one would naturally expect a two-wheel vehicle of this sort to do. Other advantages of my vehicle are that it only occupies a small amount of room; it is harder to tip over in rounding a curve or surmounting an obstacle; it can be manufactured more cheaply and there is no noise heard from the gearing, as the motors are in the hub."

Probably the most valuable part entering into the construction of the two-wheeled cart is the motor. Each wheel contains a motor in its hub, and the mounting and gearing are of new and unique design. The motor is placed crosswise of the axle, with a pinion on each end of the motor shaft. The pinions operate on opposite sides of a two-faced bevel annular gear. An idea of the gearing and the internal construction of the motor may be gained by referring to the diagram (Fig. 2), which shows a view in the plane of the wheel and at right angles to the axle. The motor axle, with its two pinions, is inclined a few degrees from a position that would be at right angles to the axle, as is necessitated by the two pinions bearing on opposite sides of the annular gear. This latter gear is fastened to the hub of the wheel and is turned by the revolution of the motor, the field frame of which rests in ball bearings in the hub frame. The conducting wires from the battery are run through the hollow axle to the motor and the latter is entirely encased in a malleable-iron case varying in thickness from one-fourth to three-eighths inch. This case is closed tightly and is practically dust and water proof. This is one of the important features of the motor, as the gearing is not exposed

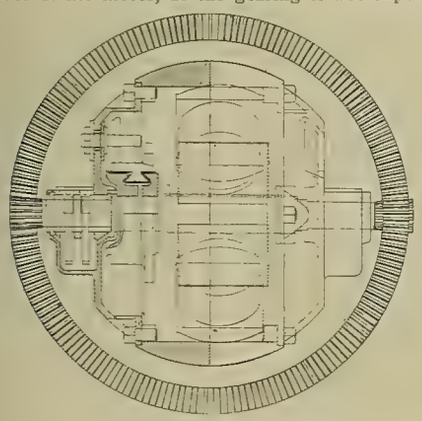

FIG. 2. HOLSON TWO-WHEELED ELECTRIC VEHICLE.—DIAGRAM OF HUB MOTOR

to the elements and dirt, and with the proper lubrication, which has been provided for, it should run practically without noise. The motors are multipolar and series-wound, and while each is designed to deliver one horsepower under normal operation, the inventor asserts that they can be forced to give a maximum of four horsepower each, when necessary.

Mr. Holson says that he has invented a combination of motor and gearing which is twice as powerful as any other of the same size. He accounts for this by having two one-inch pinions on the same shaft, gearing into a 12-inch gear wheel. With a one-horsepower motor, each pinion will deliver one-half horsepower to the wheel. With each revolution of the wheel each pinion will revolve 12 times on its own axis, while a single two-inch pinion that would be necessary with a one-horsepower motor and a 12-inch gear to give the same power would only revolve six times on its own axis. Therefore with this device twice the leverage is obtained over a single-pinion motor, and the wheel may be driven twice as fast.

The diameter of the entire hub casing is 13 inches, while the wheel of the vehicle, which is of bicycle construction, is six feet three inches in diameter. The spokes, 48 in number, are of three-eighths inch, cold-rolled steel, while the rim is of iron, built with a groove for a two-inch, solid-rubber tire. When the photograph was taken for the illustration (Fig. 1) no tires were in place on the wheels. The inventor had been using tires formed of rope as a temporary expedient.

The storage battery weighs 1,200 pounds, and being suspended below the axle and at the lowest part of the frame, serves to keep the seat right-side up. In fact, the bulk of the weight is at such a distance from the axis of the wheels that it steadies the vehicle and there is scarcely any tilting of the seat. In this way the weight of the storage battery is made use of for a good purpose, and, in fact, is indispensable to the successful operation of the two-wheeled rig, while in an ordinary four-wheeled carriage the weight of the battery is generally considered a disadvantage. The battery at present used in the vehicle consists of 40 cells of the Helios-Upton type, having a capacity of 30 amperes at a three-hour discharge rate. The motors are operated in series, and by means of a controller four speeds are obtained. Mr. Holson has driven his vehicle at a speed of 16 miles an hour, and says that one charge of the battery will propel the rig for 45 miles. The motors take from 15 to 23 amperes of current under normal operation.

The vehicle is steered by means of a pair of mechanical brakes of the friction type, one on each hub. These brakes are operated by means of a leather strap held in the right hand of the operator. The action is similar to that used in guiding a horse by means of reins. By pulling on the right-hand portion of the strap the brake on the right wheel is tightened, thus slowing down that wheel and permitting the vehicle to turn to the right. The rig is turned to the left by pulling on the left line in a similar manner. Pulling equally on both lines will set the brakes on both wheels and stop the vehicle. The motors being run in series, when one wheel is slowed down by the brake, the pressure is raised on the other motor. The vehicle is said to be steered admirably in this manner. When the power is first turned on the front of the vehicle is lifted a trifle and held there while the power is on. There is no pendulum movement to the vehicle when in motion. When the vehicle is stopped an iron rod is let down under the front platform to hold it while the passenger is getting in or out. The brake mechanism is such that the operator can stop the vehicle within a very few feet when going at full speed. The entire rig weighs about 2,500 pounds with two men in the seat.

Mr. Holson's patent, which was granted to him last fall, consists of 20 claims and covers the use of the hub motor on four-wheeled, as well as two-wheeled, vehicles. King Upton of Philadelphia has associated himself with Mr. Holson, and it is announced by the latter-named gentleman that steps are to be taken immediately to manufacture the vehicles and place them on the market.

FIG. 1. HOLSON TWO-WHEELED ELECTRIC VEHICLE.

Chicago Electrical Association.

The paper presented at the meeting of the Chicago Electrical association on the evening of February 15th was entitled "The Present Status of Patents Affecting Electrical Industries," and was prepared by Charles A. Brown of Chicago. Owing to the inability of Mr. Brown to be present, the paper was read by George L. Cragg. The paper discussed in a general way the relation of electrical patents to the manufactures they affect and took up specifically some of the more important patents relating to the construction of dynamos and motors, arc lamps, electric railways, telephones, etc. Special reference was made to some of the master or controlling patents and the litigation which these patents have caused or are causing. Copies of several typical electrical patents were presented for the instruction of the members. In the discussion which followed the paper, Mr. Cragg was able to enlighten several of those in attendance as to the workings of the Patent Office and the patentability of certain devices and methods.

In the business session which followed, the question of arranging for a suitable commemoration of the tenth anniversary of the association occurring on April 2d was discussed, and a committee consisting of W. Clyde Jones, F. B. Badt and C. W. Whitney, with President R. F. Schuchardt ex-officio, was appointed to take charge of the matter. At the next meeting of the association on March 1st, A. V. Abbott, chief engineer of the Chicago Telephone company, is scheduled to present a paper on "The Electrical Conditions of Chicago."

New York Electrical Society.

The two-hundred-and-twelfth meeting of the New York Electrical society was held in New York on February 14th. Kempster B. Miller delivered an address on "Modern Telephone Engineering," discussing fully the equipment of the telephone exchange, its functions, and many important problems connected with it. Mr. Miller also exhibited a number of curves, which were of great interest and in many ways threw important light on improved telephone practice. The address was greatly enjoyed by a large audience.

T. C. Martin, president of the society, announced the election of C. E. Knox as vice-president, to take the place of W. C. Burton, who has resigned in consequence of his continued stay in England. The following-named members were elected: A. L. Orton, Munson D. Atwater, Walter L. Thompson, Frank B. Rae, William Kent, A. B. Eads, James R. Strong, E. B. Lever, William B. Osgood Field, E. L. Elliott, J. M. Wakeman and David Killock.

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One of the four 5,000-horsepower engines for the Glasgow electric-railway station is about ready for delivery. It was built by J. Musgrave & Sons (Limited) of Bolton, England, the company which obtained the contract for two of the engines, the remainder of the order going to the Allis people of Milwaukee. Some of the principal dimensions of the English engine are as follows: Total height, 35 feet; weight complete, about 800 tons; main shaft, diameter 36 inches, weight 85 tons; high-pressure cylinder, diameter 42 inches, stroke five feet; two low-pressure cylinders, each 60 inches diameter by five feet stroke; flywheel, diameter 24 feet, weight 140 tons; total weight of bedplates, 135 tons; heaviest casting, 45 tons; speed, 75 revolutions a minute. The operation of this plant will be watched with interest, as the American and English engines will work side by side, and will probably often be called upon to run in parallel, affording ample opportunity for comparisons between the two types.

Although Secretary Gage seems to have acted strictly in accordance with a mandatory law in imposing a countervailing duty on Russian sugar, owing to an indirect bounty on the export of sugar bestowed by the Russian government, the situation is extremely unfortunate. The Russian minister of finance at once retaliated by raising the duty on American iron and steel manufactures and practically all kinds of machinery 30 per cent. We import but a small quantity of sugar from Russia, but our export trade in machinery—largely agricultural machinery and implements, but also including machine tools and some electrical apparatus—sent direct to that country is of large volume, although it is also true that a considerable proportion of American goods sold in Russia finds its way to the czar's dominions through jobbers in England and Germany. This large machine trade to Russia may possibly be ruined for the comparatively insignificant benefit that may accrue to the beet raisers of this country by the extra duty on a few cargoes of sugar. The thing is unjust, disproportionate and altogether absurd. No doubt a way out of the dilemma will be discovered, but our tariff laws should possess a flexibility sufficient to prevent the ocurrence of such an annoying and entirely unnecessary situation.

At a time when much attention is attracted by Professor Pupin's invention, after mathematical demonstration of the theory, of a method of increasing the efficiency of telephone and other electrical conductors by the attachment of inductance coils, it may be instructive as well as interesting to reprint the inventor's description of his experiments in a paper read before the American Institute of Electrical Engineers last summer. The paper begun in this issue of the Western Electrician does not give the demonstration of the mathematical theory on which Professor Pupin's invention is based; it is simply "a physical explanation of this mathematical theory and a description of experimental researches bearing upon it." The theory was first presented before a mathematical society and is reprinted in the Transactions of the American Institute of Electrical Engineers as an addition to the paper here given. Professor Pupin's work is a fine example of a concrete invention resulting from abstract mathematical reasoning, and as the value of the invention seems to have been proved by an extended series of tests under commercial conditions, everyone will rejoice that in this instance, if newspaper report be true, the inventor has received a suitable financial reward for his important work. At present the invention is chiefly considered in its relation to long-distance telephony; but if the principle is correct, and a successful method of application has been invented, it is likely that the improvement in electric-wave transmission will be extended to other fields of electrical work.

It is little wonder that when Edison, who has been continuously and grievously misrepresented by some of the daily newspapers, was asked: "How can the influence of the press be increased?" he made this sententious answer: "By publishing a fact now and then." The inaccuracy of the daily press in technical affairs, and indeed in ordinary news reporting, is often most exasperating. Of course there are newspapers and newspapers, and the exigencies of producing a great daily in 24 hours must be taken into account; but when all is said in palliation the fact remains that slovenly indifference to exact statement of fact is one of the gravest faults of the American daily press.

We speak from knowledge and annoying experience in this matter, for it was only last week that the Western Electrician was led into error by relying on an item in a newspaper. The rueful knowledge that comes to the burned child has made us chary of accepting newspaper statements on almost any subject unless corroborative evidence is at hand; but in the case of the annual report of the commissioner of patents we thought that a daily newspaper could present a correct abstract of a public document to which its correspondent had access. Alas, it was not so! The official report of Commissioner Duell, now at hand, shows that our hesitating confidence was misplaced; and, therefore, in commenting on the relative rank of Colorado among states distinguished by inventive ability we proceeded on a false premise, for the state mentioned is not second but seventh in rank.

The mistake in this instance is not of vital importance, but it shows the prevalent carelessness in a case where there was no excuse for inaccuracy—merely a transcript of names and figures from an official report—and is one of many examples that might be cited to prove that the widespread distrust of newspaper "stories" is well founded. The daily press of the United States, admirable in many respects, owes it to itself to remove this distrust by insisting on accuracy, accuracy—always accuracy—on the part of its writers and proofreaders. It is merely a confession of weakness to say that the press is a pretty good reflex of the American people in this respect. Even if this assertion is true—and we do not believe that it is true—the press should show itself to its readers as an exemplar of a higher estate than theirs.

To return, however, to the figures in Mr. Duell's report—this time official—it may be stated that in proportion to population more patents were issued to citizens of the District of Columbia than to those of any state—one to every 1,110. Next in order, taking the first twelve on the list, are the following-named: Connecticut, one to every 1,203; Massachusetts, one to 1,607; Rhode Island, one to 1,623; New Jersey, one to 1,846; New York, one to 1,918; Colorado, one to 1,941; Illinois, one to 1,976; California, one to 2,028; Ohio, one to 2,419; Pennsylvania, one to 2,457; Michigan, one to 3,131. The fewest patents granted in proportion to the number of inhabitants were in the following-named states: South Carolina, one to every 28,517; North Carolina, one to 23,095; New Mexico Territory, one to 21,701; Mississippi, one to 20,963; Alabama, one to 19,249; Arkansas, one to 13,248; Georgia, one to 12,885. The applications for patents received in 1900 numbered 39,673, while 26,418 patents were granted and 21,196 patents expired. On December 26, 1899, 5,392 applications were awaiting action, while on December 31, 1900, 4,982 applications were awaiting action. During the year the receipts of the Patent Office exceeded the expenditures by $90,808.91, and the total balance in the United States Treasury to the credit of the patent fund is now $5,177,458.55. Commissioner Duell recommends that at least a part of this money should be devoted to the erection of a new building for the department, and which should be at the same time "a fitting monument to the genius of American inventors."

To many inventors more than 100 patents have been issued. A table is given showing the names of such men and the number of patents issued to each. It is interesting to observe the prominence of electrical inventors. Thomas A. Edison heads the list with 742 patents; Elihu Thomson is third with 444 and Charles E. Scribner fourth with 374. Edward Weston has 280 to his credit; Rudolph M. Hunter, 276; Charles J. Van Depoele (deceased), 245; George Westinghouse, 239; Sidney H. Short, 178; Rudolf Eickemeyer (deceased), 171; Milo G. Kellogg, 159; George D. Burton, 144, and Elmer A. Sperry, 132. Chicago's prominence as a telephone-manufacturing center is shown by the fact that both the Chicagoans on the above list—Messrs. Scribner and Kellogg—are telephone men.

In speaking of needed improvements in the patent laws the commissioner says that the most serious defect is the possibility of delaying applications in the office for an indefinite time by amendments. This defect has been very noticeable in telephone patent cases, although Mr. Duell does not say so. The commissioner concludes that "the rights of the public would be protected and very seldom would an injustice be done to an inventor if a provision was incorporated into the patent laws providing that unless an application became involved in an interference it should not be permitted to remain in the Patent Office more than three years without abridging its life of 17 years." A statutory amendment to carry into effect this recommendation would bring about an improvement in practice much to be desired.

Submarine-cable Working of the Eastern Telegraph Company.

The fifty-seventh semi-annual general meeting of the Eastern Telegraph company was held in London on January 28th, with Sir John Wolfe-Barry presiding. The gross revenue for the half year ended September 30th last was shown to have amounted to £642,000, an increase of £167,000 over the corresponding period in 1899. This important advance in the income of the company was not entirely owing to an increase in the traffic, but was attributable to a great extent to a rearrangement of the proportions payable to the company under the Cape joint-purse agreement. By this agreement, in consequence of the company's having laid down an additional line of cables of greater carrying capacity between Porthcurnow, in Cornwall and Madeira, St. Vincent, Ascension, St. Helena and Cape Town, the proportion of this company's share of the joint purse became considerably larger. For various reasons it was considered advisable that the company should carry out on its own account this important strengthening of the telegraphic communication with South Africa. The total traffic had not increased to anything like the extent indicated by the figures mentioned, although there had been a considerable increase in the volume of traffic with South Africa, created by the war in that country. The other classes of traffic also showed a satisfactory increase, especially that attributable to the military operations of the European powers in China.

The total ordinary expenses for the half-year amounted to £132,000, showing an increase of £10,000 over those of the September half of 1899. The items making up this additional charge were directly due to the working of the new cables to South Africa. At the stations an increase of £7,447 was shown in the working expenses. The company had, however, had to work the Ascension and St. Helena cable, which it had not to do in the corresponding period of the previous year.

The expenses attending repairs and renewals of cables amounted to £45,000, or an increase of about £12,000 on those of the corresponding period of 1899. The actual ships' expenses amounted to £49,000, or nearly £15,000 more than in the September half of 1899. This was largely owing to the fact that the company's new steamer, the John Pender, had been put into commission and to the expenses of the South African company's steamer Duplex, which was employed for a short time on repairs to the Eastern company's cables. The company had obtained relief for the expenses of the John Pender by her employment in laying cables in China for other companies, but the amount received from foreign governments and other companies for hire of ships generally was not so large in the last half-year as it was in the corresponding period of the previous year. The company's ships had been fully employed. There seemed almost to have been a fatality against keeping the communications open without great exertions on the part of those who had to execute the repairs; but, speaking generally, the company had been able to keep abreast of requirements, and there had been no serious suspension of telegraphy in any part of the world served by the Eastern company. The chairman thought that this was a matter of great congratulation at such a time, with the military operations in South Africa and China going on.

The tariff to South Africa was reduced from 4s. to 3s. 6d. a word for ordinary telegrams and the Australian tariffs were also reduced to 3s. 6d. a word for telegrams exchanged with South and Western Australia, Tasmania and New South Wales. In order to enable the associated companies to deal expeditiously with the increase of traffic which would have to be carried in order to maintain the standard revenue at these reduced rates, arrangements had been made to continue the new direct route between Great Britain and Cape Town to Australia via Mauritius and Perth. This was a most arduous undertaking, but it had been vigorously grappled with by the Eastern and the Eastern Extension Telegraph companies, and it was to be hoped that the whole undertaking would be completed within the current year.

Another matter of considerable interest was the tariff to India, which had been under discussion for many years, and had given rise to a great deal of difficulty. At the request of the Indian government the company consented last year to reduce the tariff between Europe and India to 2s. 6d. a word, with an eventual reduction, on certain conditions, to 2s., provided the other telegraph administrations and companies unanimously consented.

Electrical Aid to Judicial Dignity.

A recorder in a Paterson (N. J.) court has been so annoyed by the familiarity of prisoners who tried to whisper to him or lean upon his desk that a brass rail has been placed in front of his bench and an electrical connection made between it and a plate in the floor. Recently a man who was arraigned before the magistrate admitted the charge against him, but later, having changed his mind, declared that at the time he was receiving a severe current from the rail, and that he made the confession in order to have the current turned off. The jury found the man guilty, however.

Lightning from a Cloudless Sky.[1]

By Charles E. Ashcraft, Jr.

The phenomenon of lightning from a cloudless sky seems to be regarded in the states as one of very rare occurrence, as it very likely is. I cannot remember of ever observing it while in the states, but down here in the West Indies it is of very frequent occurrence, so frequent, in fact, that it is not regarded as remarkable by the people. When first I saw this phenomenon after arriving in the tropics it caused me considerable wonder, and I was also in doubt as to whether it was real lightning or not. So I made inquiries among the residents, and found, to my surprise, that it occasioned no wonder to them, and they evidently failed to understand why it should to me. Subsequently I have observed it numerous times, till finally the novelty has worn off, and I, like the residents, accept it now as only an ordinary occurrence. However, I believe this letter is justified, inasmuch as the phenomenon is rare in the states, and any information relating thereto may be welcome.

The appearance of the flash is that of sheet lightning, generally single flashes being seen at intervals of from two to five minutes, and again only two or three occasional flashes will be seen during an evening. They do not seem to be confined to any particular quarter of the sky for local reasons, as I have observed them in all quarters. I do not think flashes are due to falling meteors, but they may be the reflected flashes of distant thunderstorms, although a clear sky certainly does not offer so good a reflecting surface as a clouded one. However, I am inclined to believe that the theory of the exchange of electricities between vertical currents of air is a very plausible explanation, for the following reasons: In the first place, the phenomenon has always been observed in the evening, usually between 7 and 9 p. m., never before 7, I believe, but several times after nine o'clock. As this latitude is free from the disturbing effects of ever-passing areas of high and low pressure, the diurnal phases of the weather are therefore very constant and much alike from day to day. So that ordinarily between 7 and 9 p. m. the temperature falls, cool breezes spring up, a rapid clearing condition sets in, the clouds disappearing sometimes like magic, and by 9 p. m. the sky is usually clear. Now, it is always at this time, when the colder currents of air are descending, causing the cool breezes and clearing condition and setting up a vertical circulation with steep gradients, that the lightning is seen. Sometimes the sky is not absolutely clear, a few clouds nearly always hanging over the mountains to the east of station, but the lightning will be seen far out to sea, perhaps, to the westward, where not the least vestige of cloud is visible. Then it is about this time in the evening that the maximum electrification of the air occurs, and in view of the fact that the lightning always occurs at the one time, is it not probable that the exchange of electricities between the descending and ascending currents having different temperatures and humidities, and therefore different electrical potentials, is the cause thereof?

I may add that these lightning flashes have been observed more frequently during the hurricane season, but just what weather conditions prevailed on the dates of occurrence I am unable to say, as I failed to make note of the dates. Furthermore, the phenomenon cannot be peculiar to the region of Dominica alone, as I have talked to a number of persons who have lived long in tropical parts, and they are all agreed that lightning from a clear sky is no uncommon thing. By way of suggestion it might be worth while to question the observers of the West Indian and other tropical stations on the matter, and in this way considerable information might be adduced.

1. From the Monthly Weather Review. The author of the communication is a weather observer at Roseau, Dominica, W. I.

American Machinery for Japanese Arsenals.

It is announced that the Japanese government has contracted with American manufacturers for the equipment of the government arsenals at Tokyo and Osaka with electrical machinery, machine tools and other appliances. Of the machinery for the Tokyo arsenal it is said the Westinghouse Electric and Manufacturing company will furnish three direct-connected, 250-kilowatt generators and eight motors ranging in sizes from 15 to 100 horsepower. The 350-horsepower, vertical, cross-compound engines are to be built by McIntosh, Seymour & Co. The Westinghouse company will also furnish two 100-kilowatt, direct-connected generators and a number of motors for the Osaka arsenal. Thirty electrically driven machine tools are to be forwarded for the equipment of the new machine shops. The Pratt & Whitney company of Hartford, Conn.; Prentice Brothers and the Norton Emery Wheel company of Worcester, Mass.; Cincinnati Milling Machine company, J. A. Fay & Egan Company and the American Tool Works, all of Cincinnati, Ohio, also the William Sellers company of Philadelphia, Pa., will build these tools. Six electric cranes, varying in capacity from 10 tons to 25 tons each, have also been ordered for the Osaka arsenal. They are being built at the Morgan Engineering Works, Alliance, Ohio.

New York State Electrical School.

A bill is pending in the Legislature of New York for the establishment of a state electrical school at Schenectady, for the fixing of official standards for electrical measuring instruments and apparatus, and to secure independent and authoritative information on questions of electrical science. The amount asked for the establishment of the school is $150,000, and the annual amount for maintenance, $25,000. The school is to be a part of Union College, and in return the university is to give 100 free scholarships and the land upon which to erect the building, while the General Electric company is to give the use of its works for observation and instruction. The reason for locating at Schenectady is stated in the preamble to the bill to be because the works of the General Electric company, the largest in existence, make Schenectady the natural center for the study and development of electrical science. Union College, in close proximity to the works, and with a course in electrical engineering already fully organized and in operation, with special privileges granted by the company, offers exceptional advantages for the supervision and direction of such work of experimentation and instruction as the interests of the state require.

Boom in General Electric Stock.

General Electric stock made a marked advance in price during the latter part of last week. The rise came soon after the announcement that the company had secured the Marks enclosed-arc-lamp patents, and that fact may have had something to do with it, although large earnings and a possible "melon" in the way of increased capital stock are also suggested as causes. On Thursday, February 14th, the stock opened at 198¾ and ran up on total sales of 6,300 shares to 215, closing at 211½, or at a net gain, compared with Wednesday's close, of 12½ points. On Friday it closed at 214 and on Saturday at 211.

It was reported that there is a plan under consideration to increase the capital stock to the amount at which it stood prior to August 17, 1898, when the stock was scaled down 40 per cent. from $34,712,000 to $18,276,000 common and $2,551,000 preferred stock. Last July the stockholders voted an increase of $4,415,000 in the common stock for the purpose of retiring the debentures.

BOOK TABLE.

Dynamo-electric Machinery: Its Construction, Design and Operation. By Samuel Sheldon, A. M., Ph. D., assisted by Hobart Mason, B. S. New York: D. Van Nostrand company. 1900. Pp., vi., 281, with 202 diagrams and illustrations. Price, $2.50.

While this book is intended to be used primarily by students of electrical engineering, it will prove of value to the general reader as well. The work is confined to direct-current machinery, and the first two chapters are devoted to a brief but logical discussion of the electrical and magnetic laws and facts upon which the operation of this class of machinery depends. Other chapters treat of armatures, field magnets, constant-potential and constant-current dynamos, motors, motor-generators, boosters, etc. The portions of the book which dwell on the operation and management of machines are particularly good. One chapter is devoted to the design of machines and another to testing. As little mathematics has been used in the work as possible, and what has been employed does not require a knowledge of calculus. Illustrations are given of leading types of standard machines and the text is further explained by several diagrams and sets of curves. The book has been clearly and accurately written throughout, and while the matter has been presented in a rather condensed form, the work should prove a valuable one for those for whom it is intended.

The Inspector and Trouble Man. By A. E. Dobbs. Chicago: The Electrical Engineering Publishing company. 1900. Pp., 106, 6½ by 9½ inches. Price, $1.

This work, put in narrative form and compiled from a series of papers recently published, relates the experiences of a young telephone lineman as he is put through the various steps of the training necessary to give him a good knowledge of telephone systems and apparatus.

The information contained in the book is clear and the arrangement logical, while the many diagrams given add greatly to its value as an elementary treatise. Methods of construction and repair of defects in lines, exchanges, switchboards and telephone instruments are treated without the use of technical terms, so that anyone interested in telephony and possessing a knowledge of the fundamental rules governing the flow of electric currents can readily become familiar with the ground covered. The book likewise contains some good advice on self-education for young men about to enter the telephone field. As the subject-matter is not arranged in chapters, an index would add greatly to the value of the work as a textbook or book of reference.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone Train Dispatching.

All railroads use telephones more or less, but few use them for dispatching trains. There are various reasons for this, writes "G. F. J." in the Railroad Gazette, chief among them the fact that all our railroads are well equipped for telegraph train dispatching, both in men and material, and the rules have so grown as to seem better adapted to telegraph than to telephone. Add to this the influence of the great band of telegraphers, the economical objections and the mechanical difficulties to be overcome, and there is little wonder that so few trials of the telephone in this service are made. Beyond all this there is an almost complete confidence in the accuracy of the telegraph, as opposed to a distrust of the accuracy of the telephone, that is hardly justified by the facts, and that is taking many years to overcome. This distrust was born in the old days of imperfect transmitters, grounded circuits and poor service, and though it is lulled by a daily use of modern equipment, it is waked again by each connection with a noisy line and by each telephone misunderstanding.

We should remember that with modern equipment there is no mechanical superiority, from the point of view of accuracy, in the telegraph over the telephone. Indeed, mechanically, the modern telephone has two advantages over the telegraph. It needs no adjustment, and it works as well or better in wet weather; whereas the telegraph relay must be frequently adjusted and telegraph difficulties in wet weather are chronic and proverbial. It is to be doubted if the officers who now distrust the telephone would have so much confidence in the telegraph if they were brought into personal contact with refractory telegraph circuits, just as they are with refractory telephone circuits. Indeed, the telephone is sometimes at a disadvantage because it continues to work in situations where the telegraph would not work at all. If one of your telephone wires breaks and the ends ground you will have more or less noise on the line—generally more—but you will still be able to talk, though probably in a very uncomfortable fashion, and you will be condemning the telephone because it works so ill under circumstances where the telegraph would not work at all.

The only way to kill this distrust of the telephone is to enforce with it the precautions which a long experience has taught us to use with the telegraph. No one thinks nowadays of making a train order effective before it has been repeated back and made "correct." If this simple precaution is observed with the telephone it can be relied on as absolutely as the telegraph. Indeed, there is no good reason why our standard code of rules should not be adopted with slight emendation for telephone work. This has been the experience of the railroads that are dispatching trains by telephone, and all of them are very careful in having train orders repeated back before they are made "O. K." There is no difference in principle between telegraph dispatching and telephone dispatching, where the telephone simply supplants the telegraph; as provision can be made for all the usual paraphernalia, the reports of trains passing certain points, the train register and all.

On a number of roads, however, we have an essential change of method. With these we have the dispatcher on the one side and the conductors on the other, with no intermediary agent or operator. Indeed, where the system is carried out to its fullest extent, there is no one else on the line. There are telephones at each siding and station, but there is no one to man them unless a train comes along, and that train will not report unless it has orders so to do. Now, if a dispatcher is to work his division to advantage, he must have frequent reports of his trains as they pass given points; but to get such reports, under this new method, he must stop his trains. It follows that this method is only adapted to slow-speed lines where trains can be frequently stopped without grave disadvantage. It is therefore well adapted to coal roads, like the Huntingdon and Broad Top Mountain, which has worked in this way in part for many years.

On the part of safety this system would seem to leave little to be desired. In practice we may suppose that on a busy road each train will stop at nearly every siding and get orders to run to the next. This would amount to a rough block system, with all the blocks worked telephonically by one man. If the orders are properly repeated back by the conductor and made correct there is no chance for misunderstanding, especially when a duplicate is given to the engineer. But this idea is elaborated upon in some cases by additional devices intended to diminish the chance of error. On some roads the conductor receives the train order and writes it out, while the repeating back is done by the engineer, who receives the "correct." On others, two telephones are provided at each point, in adjacent booths. The conductor and engineer each enter a booth, each writes out the order, and each must repeat it back accurately before it is made correct. It is not very clear why this latter requirement is necessary. If the conductor takes down the order in duplicate, repeats it back and gives the engineer a copy, we have all the precaution of a 19 order, while if the engineer repeats it back as well, we have what amounts to a 31.

The experience of the railroads using the telephone in the way described is to the effect that train dispatching by telephone is safe when proper precautions are taken, and when the telephone line and instruments are modern and in good condition. This positive evidence should be taken as conclusive against the suspicions of the others. The advisability of a change is, of course, another question. The system is especially adapted to new and poor railroads and branches, roads where it is cheaper to run trains slow than to equip the station fully with operators day and night. It would seem also to be well adapted to night work on lines that cannot afford to maintain night telegraph offices.

There is no physical reason why on such a line a couple of telegraph wires could not be so connected up that at six o'clock at night every office could throw a switch and change from telegraph to a telephone circuit. Then all the agents and operators would go happily home and the night dispatcher could in all probability get much more freight over the line with a telephone at each station than he can by telegraph with an insufficient number of night offices.

The chief theoretical difficulty with this arrangement is that when you have once given a train an order there is no stopping it until it arrives at the point at which it was ordered to report. It will sail along like a ship at sea until it reaches port. This will, of course, make the dispatchers prone to order all trains to stop frequently to report, which is only another way of saying that this system is adaptable only to a low-speed road.

Whether the standard roads will adopt the telephone for train dispatching is another question. To tell the truth, as block signals come in, the train order shows signs of going out. The train dispatcher is just as important as he ever was, but he issues his orders rather to the operators than to the conductors, and the operators use signals to get the trains around each other without stopping them. Possibly by the time the standard lines are ready to entrust the telephone with train orders they will have no more train orders to telephone.

Ohio Telephone Notes.

The Kellogg Switchboard and Supply company of Chicago has just completed four new sections of switchboard for the Citizens' Telephone company at Columbus, making 1,040 additional drops, or over 6,000 in all. The present capacity had been exhausted for some time and there are over 300 on the waiting list. These will be connected up now as soon as the workmen can get to them. The Citizens' company has one of the finest exchanges in this section of the country.

The newspaper war has begun at Zanesville between the Zanesville Telephone and Telegraph company and the Central Union. Each company and its friends contribute daily to the local press, one side arguing the merits of the plant proposed by the new company and the other showing up the bad thing it will be to have two systems in the town. The new company proposes to make its prices $36 for business houses and $20 for residences, with $3 and $2 off, respectively, if payments are made within 10 days after the end of each quarter. A modern plant on the lines of the Citizens' of Columbus will be installed and the officers say that work will be begun within a very short time.

The Central Union Telephone company's Findlay branch will extend service to the country, and it is said that every residence within a radius of 15 miles may be reached before many months. The company has already installed a number of instruments in country homes.

Henry E. Burch, formerly manager of the Akron People's Telephone company, has accepted a position with the Stromberg-Carlson Telephone Manufacturing company of Chicago.

The Akron People's Telephone company has secured a franchise to erect a plant in Hudson, an ordinance to that effect having been passed a few days ago.

The telephone exchange at Butler belonging to the Ohio Telephone company has been sold to the Central Union Telephone company for $200. It is said that dissatisfaction among the stockholders caused the trouble.

The Home Telephone company of Findlay is now receiving material for the new plant, and the work of construction will begin within a short time.

The Newton Falls Telephone company is endeavoring to form a connection with the Garrettsville and Ravenna exchanges. The new directors of the Newton Falls company are as follows: H. H. Porter, C. F. Gardner, C. M. Rice, C. E. Fenton and F. W. Cory.

The Grove City telephone exchange will receive service from Columbus over the Central Union lines.

George Titus has received a lot of poles and other supplies for the exchange at Vinton, Gallia County. The construction of the plant will begin at once. It is the intention of Mr. Titus to extend lines from that point to various towns over the county, and perhaps into Meigs County.

O. M. C.

Telephone News from the Northwest.

The towns on the Mesaba range in St. Louis County, Minn., want telephone connection with the courthouse in Duluth. The Zenith Telephone company, which has the only connection with the courthouse, has been unable to get toll connections with the range yet, but is working to do so. The Bell company, which has range connections, has been excluded from the courthouse, under an exclusive contract with the Zenith. The County Board settled the matter by readmitting the Bell to the courthouse.

The council of St. Paul has passed an ordinance requiring the telephone and telegraph wires in the business district to be placed underground by September 1st.

The Fox River Valley Telephone company of Appleton, Wis., announces toll connections with over 200 stations in the vicinity.

A bill is before the Minnesota Legislature giving individuals the right to erect telephone and telegraph poles along public highways of the state, upon the written consent of the board of supervisors of the town through which it is desired to run a line. The telephone companies are fighting it, and do not desire to give individuals the same rights that they now enjoy.

The annual report of the Wausau (Wis.) Telephone company shows a growth of instruments in use from 369 last year to 454 this year.

C. A. Fobes of Albert Lea, Minn., has accepted the position of manager of the automatic-telephone system at Trinidad, Colo. The exchange is a Strowger plant.

The Albert Lea (Minn.) Telephone company has concluded to purchase a new 1,000-connection, automatic switchboard, of the latest pattern.

Some improvements are being made to the switchboard in the local exchange at Washington, Iowa.

The Automatic Telephone company of Seattle has applied for a franchise in Ballard, Wash., a suburb.

The Rocky Mountain Bell Telephone company has been granted a franchise at Miles City, Mont., for a local exchange.

A police-telephone system is to be put in at Spokane, Wash.

The North and East Bristol Telephone company has bought the Roach & Seeber telephone exchange at Waterloo, Wis., and the local exchange at Lake Mills. The new owner will extend its toll lines from Sun Prairie to Waterloo and Lake Mills as soon as possible.

The Olds Telephone company of Olds, Iowa, has been incorporated, with $1,800 capital stock.

An association has been formed at Marshalltown, Iowa, of the telephone companies operating within the county. It is to be known as the Marshall County Mutual Telephone company. It is expected that arrangements will be made to connect these rural lines with the Marshalltown exchange, as a rate of $5 a month for a commercial line has been made. The charges will probably be paid by the business men, and the subscribers will keep the lines in repair. Fourteen rural lines are represented in the organization.

The Mutual Telephone company of Des Moines, Iowa, has ordered two new switchboards, one of 200 capacity and the other 300, for branch offices. The company is preparing to do considerable more underground work, purchase new cables, etc. The company will expend about $14,000 in improvements.

A company has been formed to build a telephone line from Corydon to Cambria, Iowa.

The Mutual Telephone company has been organized at Hooper, Neb., to install a local system.

Citizens of Powell, Wis., have formed a company to operate in several divisions. They propose a system of five divisions, all centering at Powell. Each line will be independent, in its management, of the rest, but the whole will be under the control of the Consolidated Pecatonica Farmers' Telephone company.

Ed. N. Leiby contemplates establishing a local exchange at Ellendale, N. D.

A number of farmers west of St. Thomas, N. D., contemplate running a line about eight miles to that village, to connect with the local and long-distance exchange.

The Citizens' Telephone company of Mankato, Minn., is an applicant for a local franchise at Mapleton, Minn.

The Iowa Telephone company seeks a franchise for a local exchange at Alton, Iowa. It also has plans completed for a rebuilding of the local exchange at Davenport, Iowa, and a large amount of underground work, etc. Work will be started as soon as the council passes a franchise pending for the enlarged work. The company will reduce its rates in Dubuque, Iowa, March 1st, to the same basis as those of the Standard Telephone company. The latter's rates are 75 per cent. of the old company's former rates. The Iowa company has submitted to the council of Des Moines, Iowa, a franchise which it desires passed upon by the voters of that city.

Members of the mutual telephone companies operating in the northern part of Marshall County, in Grundy County and in the southern part of Hardin County, Iowa, met at Eldora, Iowa, recently and

decided upon Eldora as a central switching station. A switchboard will be located there.

The Cedar Rapids and Marion (Iowa) Telephone company now has nearly 1,000 subscribers.

The city of Centerville, Iowa, will vote on granting a franchise to the Centerville Telephone company. The company has installed a system, under the impression that the purchase of the Seymour Telephone company's interests carried a franchise. It is now found that the latter's franchise was never passed upon by the voters.

The Jasper County Telephone company, which owns exchanges at Grinnell, Newton and Marengo, Iowa, desires to build into Iowa City, Iowa, and connect with the Johnson County Telephone company.

Paullina, Iowa, is to have a rural telephone system.

The Clarion and Northwestern Telephone company is an applicant at Belmond, Iowa, for permission to enter with a toll line.

The Northwestern Telephone Exchange company will extend its long-distance service to Drayton, N. D., in the spring.

A quarter interest in the Park Region Telephone company, at Alexandria, Minn., owned by the Wegener estate, has been sold to M. W. Hicks, for $1,628.

A bill is before the Legislature of South Dakota which gives the councils of cities police powers, allowing them to place a license on each telephone instrument and pole in the city. R.

Indiana Telephone Items.

The New Telephone company during the last week paid to the city of Indianapolis its semi-annual installment of $3,000, compensation for the use of the streets.

The Logansport City Council on February 8th passed the telephone ordinance submitted by citizens, which opens the field to all competition under the restricted rates of $12 for residence and $18 for business houses. If the Bell company declines to accept the terms of the ordinance a citizens' company will occupy the field. A resolution was adopted authorizing the bringing of a suit to revoke the Mutual company's franchise, which is alleged to be the property of the Bell company.

W. L. Hill, manager of the Central Union Telephone company at Indianapolis, announces that on April 1st the company will offer on direct lines a residence service at $24 and $30 a year, according to the character of the instrument used. The party-line rates will remain, as heretofore, six on a line at $18 a year. The company has a rural service that enables farmers within a radius of 10 to 20 miles of Indianapolis to secure a residence service at $24 a year. This is a party-line service.

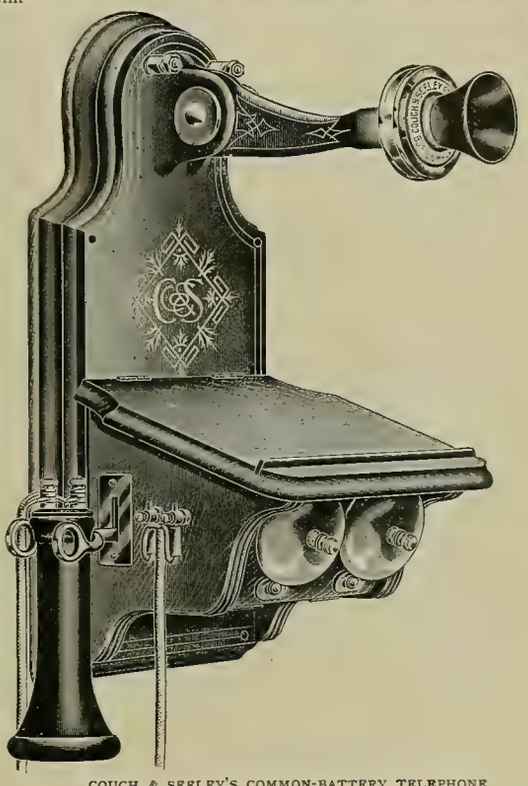
The telephone-pole business has become quite an industry at Medora, Jackson County, where there is an abundant growth of young chestnut timber which, until recently, has been in no great demand. Cedar timber, owing to scarcity and the demand for electric-light and telephone poles, has advanced to such a price that it was found to be too expensive for use on the rural telephone systems. Large contracts have been filled, and contracts for many more thousands are being filled by the shipment of from nine to 15 carloads a week. The prices paid the timber owners range from 35 cents to $1.50 for poles 40 feet and less in length. Larger poles bring better prices. F.

Suburban Service Near Columbus, O.

A plan has been adopted by the Franklin Telephone company of Columbus that has an excellent prospect for success. There has been for some time a clamor from the smaller towns in the vicinity of the city for telephone service, and the farmers in the outlying districts have asked that lines be extended to their neighborhoods for the service of a group of persons. As it did not seem practicable for the Citizens' Telephone company to extend lines to the country and as the primary and original object was to serve the city people alone, Manager Beam and a number of his associates in business organized the Franklin Telephone company, to give service to the small towns and the farmers along the numerous lines it will construct. At this time the company already has exchanges of 100 drops each at Worthington and Westerville, and workmen are installing plants of the same size at Hilliards and Canal Winchester. Exchanges will be installed in all the small towns that are not already provided, and the lines will be connected up with those of the Citizens' Telephone company and with the United States Telephone company's long-distance lines. These small exchanges will also probably be inter-connected by cross-country wires, so that there will soon be a complete system of telephone service all over Franklin County and there will be very few farmers who may not have the benefit of it if they desire. The charge for the service will be moderate. The service into the city over the long-distance or the Citizens' lines will be charged for as any other toll service, but the business will be separate and distinct from either of the other companies. It is the first time that the plan has been tried in Central Ohio, but, judging from present prospects, it will be a perfect success from the beginning. Should this be the case, it will be an impetus to another branch of Independent telephone work that has heretofore been touched upon very lightly.

Couch & Seeley's Common-battery Telephone.

There is being placed on the market by the Couch & Seeley company of Boston a telephone for common-battery exchanges of unique design and which seems to embody some especially desirable features. The back of this telephone is a hollow casting, highly finished in black and handsomely striped, this being mounted on a half-inch oak backboard, as shown in the accompanying illustration. The space between this backboard and the front plate of the casting is sufficient for mounting the condenser which the company also manufactures. The ringer is attached, as shown, and when the shelf is raised this ringer tips forward on hinges, so that it is accessible for any adjustment or other attention which may be necessary. This also opens up the entire box in such shape as to make it easy to reach the hook contacts, induction coil and other parts. The cabinet-



COUCH & SEELEY'S COMMON-BATTERY TELEPHONE.

work is finished in oak, unless specially ordered.

This telephone is equipped with the Couch & Seeley regular long-distance coal-grain microphone and bipolar receiver, each of which well-known devices is guaranteed against deterioration for five years. The company has been furnishing this common-battery telephone to a limited number of exchanges for some time, but has not placed it on the open market heretofore because it wished the instrument to be given a thoroughly practical test, and indeed changes have been made since putting out the first instruments of this type, which, while not increasing their efficiency, have simplified the construction and arranged all parts in such a manner as to make them especially accessible to the inspector. The company is now placing this instrument on the market as its standard type. Various forms of desk sets are also made by the company for common-battery purposes and for use on any of the various common-battery systems employed.

A bill introduced in the Michigan Legislature seeks to regulate the prices that any telephone company doing business in the state can charge subscribers. A schedule, based on the population, has been arranged as follows: Cities under 5,000, $18 for business telephones and $6 for house telephones; between 5,000 and 10,000, $24 and $7; between 10,000 and 20,000, $24 and $8; between 20,000 and 40,000, $30 and $10; between 40,000 and 75,000, $36 and $12; between 75,000 and 125,000, $45 and $15; in cities of over 125,000, $60 and $20, which reduces the rates now charged in Detroit, the largest city in the state.

NEW COMPANIES.

The Clinton and Dunn Telephone company of North Carolina has filed articles of incorporation.

The Memphis Telephone company has been chartered at Memphis, Tenn., with $200,000 capital stock, by Leon Hurst, J. S. Warren and others.

E. M. Coleman has purchased a telephone franchise in Louisville, Ky., and will organize a company for the construction of a system.

The Nicholasville Home Telephone company, recently incorporated, has received a franchise for establishing an exchange at Nicholasville, Ky.

The Hardin County Telephone company of Elizabethtown, Ky., has been incorporated, with a capital of $2,000, to construct a telephone system.

The New Berlin Telephone company of New Berlin, N. Y., has been incorporated, with a capital of $3,000, by I. L. Richer, E. G. White and A. H. Phelps.

The Fayette Home Telephone company of Lexington, Ky., has been incorporated by J. R. Allen, T. W. Bullock, J. H. Shouse, Charles Kerr and L. G. Coe.

The Colonial Telephone company of Newburg, N. Y., has been incorporated for $125,000. The directors are Harry A. Bartlett, V. Schoonmaker and W. G. Taggart.

The Austin Telephone company of Austin, Texas, has been chartered, with a capital stock of $100,000, by J. C. Boynton, J. B. Earle, C. H. Rose of Columbus, Ohio, and others.

The Gaffney Telephone company of Gaffney, S. C., has been incorporated, with a capital stock of $10,000, by F. G. Stacy, president and treasurer, and W. B. Du Pre, secretary and manager.

The People's Telephone company of Montgomery City, Mo., has been incorporated for $3,100, by H. Ellis of New Florence, I. Marlow of Americus, W. Crane of Mineola and W. Crockett of Montgomery City.

The Hanover and Henrico Telephone and Telegraph company of Ashland, Ky., has been chartered, with a capital stock of $5,000, by W. C. Saunders, E. S. Campbell, M. D. Hart, E. L. C. Scott and John G. Pollard, to conduct a general telephone and telegraph business.

The Keystone State Telephone and Telegraph company was incorporated at Trenton, N. J., on February 14th, with an authorized capital of $2,000,000, divided into shares of $50 each. The company is empowered to construct, acquire and operate telephone, telegraph and cable lines. The incorporators are Norman Prey, Edward H. Chew and Wilfred B. Wolcott, all of Camden, N. J.

GENERAL TELEPHONE NEWS.

The South Carolina Telephone company desires to establish an exchange at Orangeburg, S. C., and a petition has been signed by many business men requesting the Town Council to rescind its action some time ago in granting a five-year exclusive franchise to the Bell company.

The telephone has been put to a beneficent use in the executive mansion at Springfield, Ill. An instrument was recently installed in the room where the little daughter of Governor Yates was ill with scarlet fever, enabling her to keep in touch with her family and friends while quarantined.

About 150 farmers within 10 miles of Golden Ill., have telephones installed, and by means of the mutual-exchange arrangement between the Houston Telephone company and five other lines centering in the town the subscribers are in connection with all the towns in Adams, Brown, Schuyler and Hancock counties.

The following-named directors of the Telephone, Telegraph and Cable Company of America were recently elected at a meeting of the company in New York city: J. Lowber Welsh, John D. Crimmins, Elverton R. Chapman, Gen. Samuel Thomas, George W. Elkins, Frank M. Riter, Randal Morgan, John C. Bullitt, Jeremiah J. Sullivan and Morgan W. Ayres.

The Southern Illinois Independent Telephone association was recently organized by about 15 of the larger Independent companies in that section. An effort is being made by the association to perfect long-distance connection with St. Louis, which would give to Southern Illinois one of the best telephonic services in the West. The formation of the association has been of much service to that section, giving almost complete connection for the entire territory.

The Queen City Telephone company, operating an Independent system at Charlotte, N. C., has gone into the hands of a receiver. The company's plant is worth about $50,000 and will be sold on March 18th. The largest creditors are the John A. Roebling's Sons company, Trenton, N. J., $2,300; the Sumpter (S. C.) Telephone company, $1,200; the S. B. Alexander Jr., Electrical company, $1,500. The annual receipts of the company are about $12,000. Captain J. F. Robertson is the receiver.

Wave Transmission over Non-uniform Cables and Long-distance Air Lines.[1]

By M. I. Pupin, Ph. D.

Part I.

This paper describes an experimental investigation of a method of constructing cables and long-distance air lines for power transmission by electrical waves, particularly for long-distance telephony and telegraphy. This method is a practical application which offers an experimental test of the general mathematical theory of wave propagation over non-uniform conductors. The paper contains a physical explanation of this mathematical theory and a description of experimental researches bearing upon it. It also describes an experimental verification of long-distance telephony over non-uniform cables.

Physical Theory of Electrical Wave Propagation Over Cables and Long-distance Air Lines

Wave Propagation over Uniform Conductors.—Transmission of electrical energy over conducting wires is a wave transmission when the distance between the transmitting and the receiving apparatus is sufficiently long to permit the development of electrical waves. Such a transmission exists in long-distance telegraphy and telephony. It does not exist to any practically appreciable extent in ordinary transmissions of electrical power by alternating currents over distances which up to the present time have been bridged over by electrical power-transmission lines. In cases of wave transmission considered here the conductors will be called wave conductors. The circumstances attending wave transmission are considerably different from those attending ordinary electrical transmission, and should be carefully differentiated from them. In ordinary transmission the reactions set up in the receiving apparatus are the most essential reactions which the force impressed by the transmitting generator has to overcome. The reactions set up in the transmitting line itself are small in comparison to it. The case is analogous to the transmission of power from the piston of a steam engine to a motor connected to the engine by a short, stiff piston rod. The reactions set up in the piston rod itself are small in comparison to the reactions which the motor opposes to the driving pressure. Hence, neither the elastic nor the kinetic reactions of the piston rod, nor the reactions due to internal frictional resistances in the rod are seriously thought of when we analyze the reactions attending this case of power transmission. But consider now what will happen if we increase the distance between the piston and the receiving motor and consequently increase the length of the piston rod. We can no longer consider the rod as a perfectly rigid connection between the driving pressure of the piston and the reactions of the receiving motor. The rate at which the piston delivers energy at any moment is not equal to the rate at which energy is delivered at the receiving motor at that moment. There is a lag in phase. The energy transmitted is first stored up in the piston rod and then delivered from the rod to the receiving motor. While it is stored up in the rod it exists partly as kinetic energy of the moving mass of the rod and partly as potential energy, due to the rod's elastic deformations. The process of transmission consists in successive transformations of the kinetic into the potential energy of the rod, and vice versa. These transformations being progressive, the energy is propagated along the rod, and we say that the propagation is a wave propagation, in order to state in a single word that the progressive motion along the rod is a periodic one. Analogous conditions exist when electrical energy is transmitted by a periodically varying electromotive force acting on a long conductor. The transmission is not a direct one; the transmitted energy is first stored up in the medium surrounding the transmission line, and from there it is transferred to the receiving apparatus. While it is stored up in the medium it exists there partly as magnetic energy stored up in the field of magnetic flux and partly as electrical energy stored up in the field of electrical flux. The process of propagation consists in the progressive transformation of the magnetic into the electrical energy, and vice versa. When the electromotive force impressed by the transmitting generator is a periodic one, the propagation will be in the form of electrical waves. The expression "electrical wave" is nothing more nor less than a brief statement of the physical fact that in the case under consideration the energy which at any moment is stored up in the medium surrounding the transmission line is distributed periodically over this line. The current and the potential also vary periodically. At points of maximum magnetic energy the current is maximum, and at points of maximum electrical energy the potential is maximum. Roughly speaking, points of maximum current are points of minimum potential, and vice versa

Wave Length.—Consider now the distance between any two consecutive points of minimum current or minimum potential. This distance is a half wave length. Suppose that the impressed electromotive force is a simple harmonic of frequency 600 periods per second. Say that we find the wave length to be 18 miles, the velocity of propagation will be 10,800 miles per second, considerably less than the velocity of propagation of light through a vacuum. To some this numerical illustration may seem as highly improbable, for we are accustomed to hear much of electricity being propagated with the velocity of light. But it should be remembered that this is true under certain particular conditions only. The velocity of propagation of electrical waves of telephonic frequencies over conducting wires may be anything from the velocity of light down to a few inches, or even less than an inch, per second, depending on the inductance resistance and capacity of the line. The smaller the velocity the shorter, of course, will be the wave length for a given frequency. The wave length, as will be seen presently, plays a very important part in this investigation. It is considered here as one of the characteristic constants of wave propagation. I am not aware that previous investigators of the propagation of long electrical waves have devoted any serious attention to this characteristic constant.

Attenuation Constant.—There still remains another constant which, with the wave length, completely defines electrical wave propagation. It is called here the attenuation constant. To bring out its physical meaning, consider two consecutive half wave lengths at any moment. The one nearest to the transmitting apparatus shall be denoted by A and the other by B. The wave energy stored up in the medium surrounding A is greater than that stored up in the medium surrounding B. Hence wave energy is gradually dissipated during its propagation from the transmitting to the receiving apparatus, and therefore the amplitudes of both current and potential become smaller as the energy progresses along the transmission line. Let U be the amplitude of the current at the transmitting end and U_s be the amplitude at a distance s, then if the line be considered infinitely long

$$\frac{U_s}{U} = e^{-\beta s}$$

where e is the base of Naperian logarithms. The constant β is called here the attenuation constant. The mathematical expression for β is well known

$$\beta = \sqrt{\tfrac{1}{2}\, p\, C\, [\sqrt{p^2 L^2 + R^2} - p\, L]}$$

where L, R, C are the inductance, resistance and capacity, respectively, of the wave conductor per unit length, and p is the frequency speed. Much confusion exists in the minds of physicists as to the real significance of this constant and as to the true cause of current attenuation. It is usually stated that the capacity of the line, acting as it does somewhat like a shunt, is the cause of all the trouble experienced in electrical wave transmission. This statement contains a small part of the truth, only, and for that reason may and actually has become misleading. The fact that a conductor possesses inductance and capacity shows that the medium surrounding it is capable of storing up energy, which, indeed, is a blessing; it cannot possibly signify that energy propagated along it will be dissipated; and if capacity cannot cause a loss of energy, how can it possibly cause an attenuation of current? The dissipation is due to imperfect conductivity of the wire, and to that alone. Inductance and capacity regulate it; they do not cause it.

Consider now the manner in which this regulation is effected. The dissipation of the energy transmitted occurs at the time when it is stored up in the medium as magnetic energy; for if the medium surrounding an element ds of the transmission wire contains a quantity dW of magnetic energy, then a current x must flow in that element such that

$$dW = \tfrac{1}{2}\, L x^2\, ds$$

Let dH be the rate of dissipation in that element, then

$$dH = R x^2\, ds$$

Suppose now that by some means we increase L to n^2 L, the medium surrounding the elements ds will store up the same amount dW of magnetic energy with one n^{th} of the current, for

$$dW = \tfrac{1}{2}\, n_2\, L\, (x/n)^2\, ds$$

Let dH_1 be the rate of dissipation in this case, then

$$dH_1 = R\, (x/n)^2\, ds = dH/n_2$$

It follows, therefore, that during the transmission of a given quantity of energy over a conducting wire the dissipation will be diminished by increasing the inductance of the wire, for if the wire have high inductance, then small currents are required to transmit a given quantity of energy, and small currents incur small ohmic-resistance losses.

By increasing the inductance the efficiency of transmission is increased just as effectively as by increasing the conductivity of the transmission wire.

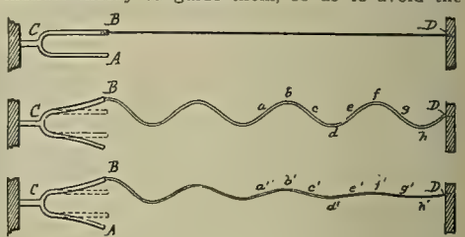
Distortionless Wave Conductors.—Another important advantage is gained by increasing the inductance. The expression for β given above shows that attenuation depends on frequency; it increases with it. Hence, in telephonic transmission where waves of complex harmonic frequencies are propagated over the line, there will be distortion of the waves, because upper harmonics will be attenuated more vigorously than the lower frequencies. This results in a distortion of speech, which is noticed in long-distance telephonic transmission as defective articulation. Some instructive experiments bearing upon this point will be described presently. High inductance obviates this difficulty. To illustrate—suppose that the inductance is large in comparison to the resistance, the expression for β will reduce to

$$\beta = R/2 \sqrt{C/L}.$$

It is independent of the frequency. All frequencies are attenuated alike, so that high inductance not only diminishes attenuation, but also renders the circuit distortionless. Such a circuit is the ideal circuit for telephonic and telegraphic wave transmission.

Mr. Oliver Heaviside of England, to whose profound researches most of the existing mathematical theory of electrical wave propagation is due, was the originator and most ardent advocate of wave conductors of high inductance. His counsel did not seem to prevail as much as it deserved, certainly not in his own country. I trust that the physical view of attenuation described above in the terms of the dissipation of energy which is transmitted over the wire will help to elucidate Mr. Heaviside's theory of high-inductance wave conductors.

Wave Propagation over Non-uniform Conductors.—But Mr. Heaviside's proposition to employ wave conductors of high inductance contained a serious difficulty which his mathematical theory was not capable of overcoming. The difficulty is this: How can a wave conductor be constructed so as to have a high inductance? Ordinary circuits can be endowed by as much inductance as may be required by simply introducing a coil of proper dimensions, with or without an iron core, into it. But this will never do in the case of a wave conductor; for a coil introduced that way will act by reflection as a barrier to electrical waves. Acting on a suggestion made by Mr. O. Heaviside[1] in 1893, wave-propagation experiments over long-wave conductors containing a certain number of coils in series at periodically recurring points have actually been tried by telephone engineers; the results obtained have invariably proved most disappointing. I shall return to this point later on, in connection with the description of experiments given further below. Suffice it to state here that all attempts to increase the inductance of a wave conductor by the introduction of inductance coils at periodically recurring points failed, because they had no mathematical theory to guide them, so as to avoid the



FIGS. 1, 2 AND 3. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

difficulties of wave reflection by inductance coils introduced that way. It is hardly worth while to enter here into a discussion of the many other attempts at increasing the inductance of a wave conductor by devices which had neither theory nor experiment to recommend them. In fact, most of them were absurd on the face of it.

The first mathematical theory dealing with wave propagation over conductors of this kind was presented by the author before this institute on March 22, 1899.[2] A more complete theory is given in the second part of this paper. The main features of this theory are extremely simple and can be explained by a simple mechanical illustration. Consider the arrangement of Fig. 1. A tuning fork has its handle (C) rigidly fixed. To one of its prongs is attached a flexible, inextensible cord (B D). One terminal of the cord is fixed at (D). Let the fork vibrate steadily, the vibration being maintained electromagnetically or otherwise. The motion of the cord will be a wave motion. If the frictional resistances opposing the motion of the cord are negligibly small, the wave motion will be approximately that of stationary waves, as in Fig. 2. The direct waves coming from the tuning fork and the reflected waves coming from the fixed point (D) will have nearly equal amplitudes, and by their interference form approximately stationary waves. If, however, the frictional resistances are not negligibly small, then there will be dissipation of the propagated wave energy. Hence the direct and the reflected waves will not have equal amplitudes, and, therefore, their interference will not result in stationary waves. The attenuation of the wave is represented graphically in Fig. 3. Experiments will show that, other things being equal, increased density of the string will diminish attenuation, because a larger mass requires a smaller velocity in order to store up a given quantity of kinetic energy, and smaller velocity brings with it a smaller frictional loss. This is a striking mechanical illustration of a wave conductor of high inductance. It should be observed here that an increase of the density will shorten the wave length.

Suppose now that we attach a weight, say, a ball of beeswax, at the middle point of the string, in order to increase the vibrating mass. This weight will become a source of reflections and less wave energy will reach the point (D) than before. The efficiency of transmission will be smaller now than

1. A paper read at the seventeenth general meeting of the American Institute of Electrical Engineers, Philadelphia, May 19 1900. Dr. Pupin is professor of mechanics at Columbia University, New York. His method of using inductance coils in long-distance telephony has attracted widespread attention.

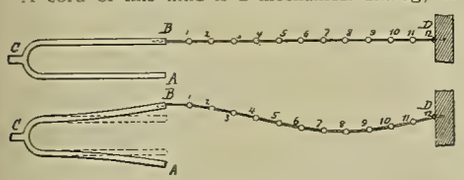
1. Heaviside, O.—"Electromagnetic Theory," vol. i., p. 435.
2. Pupin, M. I.—"Propagation of Long Electrical Waves," Transactions A. I. E. E., vol. xvi., p. 93, 1899.

before the weight was attached. Subdivide now the beeswax into three equal parts and place them at three equidistant points along the cord. The efficiency of wave transmission will be better now than it was when all the wax was concentrated at a single point. By subdividing still further the efficiency will be still more improved; but a point is soon reached when further subdivision produces an inappreciable improvement only. This point is reached when the cord thus loaded vibrates very nearly like a uniform cord of the same mass, tension and frictional resistance. Such a loaded cord with a tuning-fork attachment is represented in Fig. 4.

If an increase in efficiency of wave transmission over a cord thus loaded is to be obtained, it is evident that the load must be properly subdivided and the fractional parts of the total load must be placed at proper distances apart along the cord, otherwise the detrimental effects due to reflections resulting from the discontinuities thus introduced will more than neutralize the beneficial effects derived from the increased mass.

The problem of finding the proper distance at which the loads should be placed is a definite mathematical problem of analytical mechanics, but, unfortunately, it was never solved. Fig. 5 represents a cord carrying loads at proper distances apart. Experiments with cords of this kind will soon convince one that the distance between the loads should be considerably smaller than one-half of the wave length of the wave which is to be transmitted. So that though a given cord may be properly loaded for some wave lengths it will not be properly loaded for shorter wave lengths. It is impossible to load a cord in such a way as to make it equivalent to a uniform cord for all wave lengths; but if the distribution of the loads satisfies the requirements of a given wave length, it will also satisfy them for all longer wave lengths. It should be observed now that the wave length which is considered here is not the wave length of the cord without the loads, but the wave length which the frequency under consideration will have on the properly loaded cord, or, what is the same thing, on a uniform cord of the same mass, tension and frictional resistance as the loaded cord. This point is of fundamental importance, for the wave length corresponding to a given frequency may, and generally will be, much shorter on the loaded cord than on the cord without the loads.

A cord of this kind is a mechanical analogy to



FIGS 4 AND 5. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

an electrical wave conductor. The mathematical law in accordance with which such a cord moves is the same as that in accordance with which the electrical current is distributed over the wave conductor under the action of similar forces. The reason for that is not far to seek. We have the same reactions in both cases, viz: Kinetic or mass reaction, tensional reaction and resistance reaction in the case of the cord; electro-kinetic reaction, capacity reaction and ohmic-resistance reaction in the case of the wave conductor. The mathematical form of these reactions is the same in both cases, hence one is an exact analogy of the other.

The insertion of inductance coils at periodically recurring points along the wave conductor produces the same effect upon electrical wave transmission as the distribution of the small loads along the stretched cord of Fig. 4 produces upon mechanical wave transmission along the cord. The mathematical theory of wave propagation over non-uniform conductors of this kind is given in another paper. This theory is, of course, at the same time the mathematical theory of wave propagation over a loaded cord, described above. The main object of this theory is to find an answer to the question: Under what conditions are non-uniform conductors described in these two sections equivalent to their corresponding uniform conductors? The answer which the mathematical theory gives to the question just proposed is definite. To formulate it, introduce here a convenient technical term. Consider the distance between two consecutive inductance points, that is, the points at which the inductance coils are introduced. Denote it by l, and let the wave length which is to be transmitted be λ. Now introduce an angle ψ such that

$$\psi / 2\pi = l / \lambda.$$

The angle ψ shall be called the angular distance between the inductance points, or inductance sources. The angular distance 2π corresponds to the wave length. The law which determines the degree of equivalence between a non-uniform conductor and its corresponding uniform conductor can now be stated as follows: A non-uniform conductor is as nearly equivalent to its corresponding uniform conductor as $\sin \psi/2$ is to $\psi/2$.

It is evident that ψ is inversely proportional to the wave length, so that for a given distance between the reactance points the degree of equivalence diminishes as the wave length diminishes. If a wave of complex harmonic frequency, such as occurs in telephony, be transmitted over a non-uniform conductor, then the action of the conductor will be different for the different components of this complex harmonic wave. If, however, the non-uniform conductor acts with sufficient approximation as a uniform conductor toward the highest important frequency of this complex wave, then its approximation to a uniform conductor will be even higher for the lower frequencies, and thus for all the frequencies of the wave. A numerical example will illustrate this point more clearly. It is well, however, to state more fully the meaning of the expression "equivalence between a non-uniform conductor and its corresponding uniform conductor." All that we can predicate of a wave of a given frequency is that it has a certain wave length and a certain attenuation constant. Hence, if a wave of given frequency has the same wave length and the same attenuation constant on a non-uniform conductor as it has on the corresponding uniform conductor, then the two conductors are equivalent to each other. If these two quantities differ by, say, three per cent., then an approximate equivalence up to within three per cent. exists.

Consider now the following numerical example: A twin conductor, such as employed for telephone cables, has a length of 250 miles. Let its constants have the following values per mile:

Inductance = 0.
Resistance = 9 ohms.
Mutual capacity = .074 microfarad.

According to the high but definite standard which the New York Telephone company employs, the limiting distance of telephony over such a cable is 39 miles. According to the lower standard which is maintained in long-distance-telephone work, the limit would be 78 miles. The results obtained by me experimentally seem to verify these figures. I find that at a distance of 100 miles telephony over such a cable is very poor, in fact, impracticable, and at a distance of 125 miles impossible. It is proposed now to decrease attenuation and distortion over such a cable by the insertion of inductance coils at periodically recurring points. The attenuation constant β in this case is given by the formula

$$\beta = \frac{R}{\sqrt{2}}\sqrt{\frac{C}{L}}.$$

Say that it is required to have $\beta = .015$. Assume that the introduction of the inductance coils adds nine ohms per mile, so that R = eight ohms. These values of R and C require L = .056 henry. The attenuation factor at a distance of 250 miles would be $e^{-250\,\beta} = \frac{1}{40}$ (roughly). That is, 2½ per cent. of the current leaving the transmitting end will reach the receiving end. This is quite sufficient for telephonic purposes; but it should be observed that better efficiency of transmission could be obtained by making L larger. Notice now that the attenuation factor for this cable without the coils would be, for a frequency of 600 periods per second, roughly, $\frac{1}{25 \times 10^4}$ that is, with a given initial current, the current at the receiving end would be 6,000 times larger with the coils than without them.

The next step is to find the wave length for the highest important frequency in telephony over a uniform wave conductor having L = .056 henry, R = 18 ohms, C = .074 microfarad. The best telephone practice assumes that 750 periods per second is the highest frequency of any importance. The wave length corresponding to this frequency over a uniform conductor of this description is obtained from the formula,

$$\lambda = \frac{2\pi}{p\sqrt{2\,L\,C}} = 14.6 \text{ miles},$$

approximately.

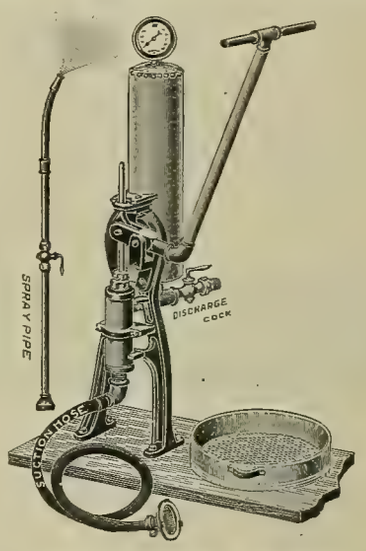
Suppose now that at each mile we place a coil of inductance L = .056 henry and a resistance R = nine ohms. The angular distance ψ for frequency 750 periods per second of the non-uniform conductor thus obtained will be $2\pi/14.6$. The degree of equivalence of this non-uniform conductor to its corresponding uniform conductor is measured by the degree of equivalence of $\sin \pi/14.6$ and $\pi/14.6$. Now $\sin \pi/14.6$ differs from $\pi/14.6$ by less than one per cent. of the value of $\pi/14.6$; hence for a frequency of 750 periods per second the wave length and the attenuation constant on the non-uniform conductor will differ from the wave length and attenuation constant on the corresponding uniform conductor by less than one per cent. of the values of these constants. Such a difference cannot be detected by any of the experimental methods which are at present available for investigating wave propagation. In telephonic transmission the ear could not detect it. For lower frequencies the differences will be even considerably smaller. Hence, the non-uniform conductor thus obtained will represent a uniform, non-attenuating, distortionless conductor for telephonic transmission.

It should be observed here that in the case of a submarine cable of, say, 2,000 miles, the attenuation constant should be much smaller than the value of β given above, in order to have a sufficiently small attenuation factor. Now the capacity per mile of a submarine cable is about four times as large as the capacity of the telephone cable just described. Hence, both on account of the long distance and also on account of the much-increased capacity, the inductance per mile will have to be much larger than in the case just discussed. But high inductance and large capacity will give a very short wave length. For instance, if in the case of the submarine cable having six times the capacity we employ an inductance six times as large as in the case of the telephone cable, we shall obtain for the frequency of 750 periods per second a wave length of only $14.6 \div 6 = 2.43$ miles. Hence, since the inductance coils will have to be placed apart at one-sixth of the distance employed in the case of the telephone cable, the distance between them will be about 880 feet. The distance between the inductance coils depends entirely on the circumstances of each particular case. But in all cases the rule given above contains the necessary and sufficient directions.

[*To be continued.*]

Star Paint Pump for Power Houses.

Among the devices used in whitewashing and painting by machinery that are worthy of attention is the machine manufactured by the Star Brass Works of Chicago and shown in the accompanying illustration. Whitewashing in the old way, with a brush, has a great many drawbacks, chief among which is the expense, while whitewashing and painting by machinery not only overcomes the majority of the former drawbacks, but cuts the expense of applying more than 75 per cent. The machine is especially applicable for use in whitewashing and



STAR PAINT PUMP FOR POWER HOUSES.

painting large surfaces, such as the walls of car barns, power stations, etc.

Two men, with the Star machine, it is said, can do as much work in one day as 25 can do with brushes. With the machine the operator is enabled to fill up all cracks and crevices completely, which it is almost impossible to do with a brush. In the manufacture of the machine the Star Brass Works have produced a pump with few turns, while a high grade of construction and the use of the best material have been adopted throughout. The barrel of the pump is made of brass and will not corrode from the whitewash. Each machine is thoroughly tested before leaving the factory, thereby enabling the makers to guarantee them. All duplicate parts of the machine can be had at the Star Works factory.

Electric Railway in Jamaica, W. I.

F. L. Wanklyn, general manager and chief engineer of the Montreal electric street railway, has returned from his recent trip to Jamaica, West Indies. His visit to that island was for the purpose of inspecting the property of the West India Electric company, he being chairman of the board of construction. The company has now, he says, 23 miles of electric road in operation, and the whole system is in excellent condition. In respect to the roadbed, Mr. Wanklyn states that he has never seen anything better, for all the experience derived in building other roads in Canada and the United States came into play while the Kingston (Jamaica) road was being built, and the result has been most satisfactory. Besides the laying of rails in the city of Kingston, one line has been built northward, six miles long, another six miles to the eastward, while the third section, extending a like distance to the northeast, has also been laid, and the whole road has become most popular with the people. The cars are all open and the traffic is continually on the increase. Steel ties are used, as the wooden ties are quickly destroyed by the ants. Almost all the labor employed is colored, the conductors and motormen doing good work.

The Chicago and Western Railway company has been incorporated, to build a road from Chicago to Aurora, Ill. The capital is $10,000 and the incorporators are G. M. O'Connell, George Gillette, F. W. Lans, F. A. Well and J. T. Cordial, all of Chicago.

Church Expansion and Anchor Bolts.

A line of expansion bolts and anchor bolts for use in masonry and brick construction is being manufactured by Isaac Church of Toledo, Ohio, that possess many valuable points. The expansion-case, square-head bolt is illustrated in Fig. 1 of the accompanying pictures, while Fig. 2 shows a sectional view of the same bolt. The manufacturer asserts that the guide of the bolt to the nut is perfect and that it never misses connection or causes delay by failing to enter the nut and catch the thread. The case is designed to re-enforce the nut, and the contact of the case with the sides of the hole in the brick or stone re-enforces the case, thereby adding strength to the whole method of fastening.

The simplicity of construction and manner of applying are said to be characteristic features of the bolt. All that is required to apply the bolt to use is a hole in the brick or stone work, a little larger than the outside of the case, so that the case containing the nut may be inserted therein. The work to be fastened is then put in place, the bolt put through the work into the case, and then turned the same as in ordinary cap screws until the desired tension is acquired. The work can be taken down and the case and nut removed by slacking the bolt and driving the nut back to the bottom of the case; the bolt is then removed and the case hooked out, which can be easily done when the nut is at the bottom of the case. This method of fastening does away with the use of lead, brimstone, cement and wood plugging. The manufacturer says that the value of time saved will pay for the improved method, to say nothing about the more perfect fastening. It can be used in all kinds of weather, and in all positions, where lead, brimstone and cement cannot—that is, in overhead fastenings.

Among other varieties of expansion bolts made by Mr. Church is a double-end, square-head bolt, in which both ends of the expansion case are expanded with an equal amount of force. The expanding case being the same diameter as the body of the bolt, the user is enabled to bore the hole for the bolt after the work is in place. This is desirable in fastening door-jambs to brickwork and many other cases where it is not convenient to take down the work after it is fitted in place, and it does not require as large a hole in the brickwork. The duplex bolt is used in the construction of power houses, public buildings, vault work, and for any fastening which is desired to be fastened so that it cannot be removed when once in place.

The Church anchor bolt, sometimes called a toggle bolt, shown in Fig. 3, is used in fastening any kind of materials or fixtures to hollow-tile arches or partitions in fireproof buildings. The method of applying is to take any sharp-pointed tool of steel or a nail-set, and punch a hole through the tile, which is easily done. The bolt is then put through the article to be fastened and the screw entered into the ball nut in the anchor head, just enough to allow the head to swing parallel with the bolt. Inserting it in the hole when the head has passed through into the hollow space in the tile, the head will fall to a position at right angles with the bolt, and form an anchor; the work is then held with the head against the tile to prevent the head from turning, and the bolt screwed up, the screw passing through the head, as shown in Fig. 3. The fastening is then complete. There are many other places where this bolt can be used which will readily suggest themselves to the mechanic.

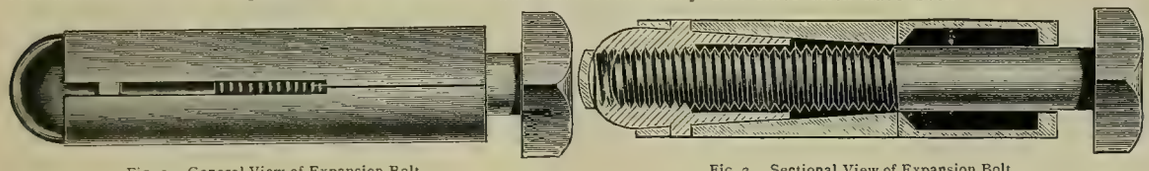


Fig. 1. General View of Expansion Bolt.

Fig. 2. Sectional View of Expansion Bolt.

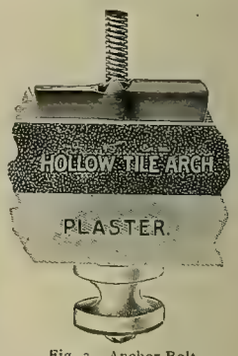


Fig. 3. Anchor Bolt.

CHURCH EXPANSION AND ANCHOR BOLTS.

TRIFLING TECHNICALITIES.

A little New England boy, noting the green-glass insulators on the telegraph poles, asked: "Papa, are those glass bottles on the poles what the ink is in that writes the telegraph messages?"

At the automobile establishments some funny things happen. The other day a man, who did not look like a farmer, surveyed the sample exhibited in a New York store, read its name and then asked in a confidential tone: "Say, where is the difference between this and the horseless carriages I've read about? Is this an improvement?"

This is an extract from an advertisement in a Chicago daily paper: "A pain is never without a cause, and the cause is usually serious. Do you want Dr. Blank to tell you what it is? Then come to-day. He will light up the inside of your body with the wonderful X-ray and tell you what the trouble is. With this powerful and mysterious light he can see, and with his scientific remedies he can cure your ailment."

An electric line is proposed from Union to Glenn Springs, S. C., to connect with the Glenn Springs railroad and Charleston and Western Carolina railway. The line is to do a considerable freight business.

CORRESPONDENCE.

New York Notes.

New York, February 16.—The first step has been taken toward obtaining the sanction of the municipal authorities for the construction of the Brooklyn extension of the rapid-transit subway. Controller Coler and the Rapid Transit Commissioners appeared before the council this week to advocate the extension. The cost is placed at about $8,000,000.

The sub-contractors on the section of the rapid-transit tunnel in Lenox avenue between One-hundred-and-thirteenth and One-hundred-and-fourteenth streets encountered a stream of fresh running water several days ago, which temporarily stopped work on the section. The first pump available was one of a capacity of 250 gallons a minute, and this was run for a week without causing any appreciable diminution of the volume of water in the excavation. Then a larger pump was obtained, taking out about 850,000 gallons a day, and now much difficulty is experienced in disposing of the water delivered by the pump. It will probably be necessary to build a sewer under the tunnel tracks to connect with the One-hundred-and-tenth street sewer. This expense will probably not be borne by the contractors.

An arrangement has been made between the Rapid Transit Commission and the Fire Department whereby a certain number of fire badges will be issued to those in charge of rapid-transit work, so that in case of fire along the line of the subway there may be no clash between the two departments.

At the New York Institution for the Instruction of the Deaf and Dumb successful use has been made of the audiphone invented by M. R. Hutchison, a native of Mobile, Ala. This instrument was described in the Western Electrician of May 6, 1899, and is being exploited by the Akouphone company of New York. By its use persons who have been totally deaf since birth have been enabled not only to hear, but also have been taught to articulate after hearing their own voices. It is said that Mr. Hutchison has experimented upon 4,000 deaf mutes in several institutions, and has failed to find a single case where he has been unable to convey the sound of spoken words in some degree.

The report of the Metropolitan Street Railway company for the quarter ended December 31, 1900, showed gross earnings of $3,635,930, an increase of $70,250; operating expenses, $1,699,640, a decrease of $58,370; net earnings of $1,936,290, a gain of $128,620, and a balance of $947,910, a gain of $36,390. The total surplus to credit of profit and loss was $2,081,131. The Third Avenue road reported gross earnings, $551,735; operating expenses, $327,508; net earnings, $224,227; other income, $5,893; total income, $230,120; fixed charges, $440,824; deficit, $210,704; deficit previous quarter, $150,867; total deficit, $718,388.

A motorman has sued the Bergen County Traction company for $20,000 for the loss of two toes about three years ago. In the course of the trial in the Supreme Court of Hudson County a fully equipped trolley line in miniature was erected on the counsel's table in the court room. The cars were operated electrically and a complete block-signal system installed together with some miniature trees, to show how one of the latter might be blown against the signal tower and turn a signal set for "stop" to make it read "go ahead."

The Automobile Club of America has issued a challenge to the world for a race from New York to Buffalo about the first of September. Prizes amounting to $5,000 will be offered. The maximum speed allowed will be 15 miles an hour, and the minimum, six miles an hour, as the race is intended to be a contest of endurance rather than of speed. The route will probably be through Albany, and will be about 450 miles in length. At Buffalo a 100-mile race will be held over a course including some of the best streets, and in this race the speed will be unlimited. The club is now installed in its new quarters at Fifty-eighth street and Fifth avenue, and has a membership of over 300.

A wealthy New York grocer, who has become an automobilist, owns a favorite pair of horses to which he is very much attached. As they are getting too old to do hard service he drives them to his automobile, using the power furnished by the latter on hills and rough roads, and allowing the team to do the work where the traveling is not hard.

It was reported in Wall street this week that the Postal Telegraph-cable company was about to acquire the Western Union Telegraph company by the issuance of bonds to guarantee the stock of the latter. The rumor was, however, denied by a high official of the former company.

It is stated that a syndicate headed by Albert and Tom L. Johnson of Cleveland has purchased the right-of-way for a trolley line from New York to Philadelphia, and that it expects to have cars running by the middle of summer. It is said the syndicate is sole owner of the Philadelphia and Bristol Railway company and the Philadelphia and New Jersey Railroad company, familiarly known as the Shaw company. It is also said to control the Princeton extension, and to have secured the Delaware Bridge terminals.

The Yonkers and White Plains Railroad company has been incorporated, with a capital stock of $50,000, to construct and operate a street surface-railroad line from Yonkers to White Plains. The directors are Freeman H. Merrett and W. Jay Wilson of White Plains, R. J. Bellew, B. B. Riley, H. D. Lent, W. J. Fisher, H. C. Merrett and J. E. Lattimer of Tuckahoe, and Charles Husenberry of Yonkers.

M. L. G.

Canadian Intelligence.

Ottawa, Ont., February 16.—The Niagara Falls, Wesley Park and Clifton Tramway company has appointed a committee to arrange for the construction of the road. The plan is to establish a belt line, running in connection with the Niagara Falls Park and River railway.

The Stave Lake Power company of British Columbia is negotiating with a view to securing privileges for the installation of poles and wires. The company agrees to expend $400,000 in building dams, power houses and other works, and in transmitting power from Stave Lake to Vancouver.

The annual meeting of the Cataract Power company of Hamilton, Ont., was held on February 11th. The gross receipts of the company, including those from the electric street railway, the Hamilton and Dundas railway and the Radial railway, have been $421,311. After payment of operating expenses, interest on bonds, franchise, taxes, etc., as well as two dividends on the preferential cumulative stock, a balance of $29,689 remained to the credit of profit and loss. Hon. J. M. Gibson is president, John Moodie, treasurer, and John Patterson, secretary.

Hon. Mr. Mulock, postmaster-general of Canada, has given notice of a bill to amend the Pacific cable act, passed at the last session of the Dominion Parliament. This bill is for the purpose of arranging Canada's share of the financial obligations for the construction of the cable. Fears are entertained, in some quarters, that some of the Australian governments may succeed in their efforts to make connection with the Eastern Extension cable, and, in that way, alter the basis of the whole Pacific cable scheme. The Eastern Extension has been all along standing in the way of the speedy carrying out of the all-British Pacific cable project, although the Canadian government has been using its strongest efforts to counteract this.

Mr. Wanklyn, general manager of the Montreal street railway, states that by the end of next May the company will have ready 25 new double-truck, open cars, which will seat 65 people. He expects that the full complement of these cars for next summer's work will reach 320 cars. He also stated that besides preparing for 5,000 additional horsepower from Chambly, the company would have two new steam units of 1,500 horsepower each. One of these units is being made in Philadelphia, Pa.

There is a keen conflict going on just now in Toronto street-railway circles regarding the proposed enlargement of the system to provide radial railways for the districts around that city. William Mackenzie is said to be strongly in favor of the expansion policy, while James Ross of Montreal, who is said to hold a controlling interest, is leading the opposition. The Metropolitan electric-railway purchase has been hanging fire for some time because of this division of opinion.

For the past few weeks a deal has been going on at St. Catherines, Ont., which means the consolidation of the electric-power and light-generating establishments of the city, and ultimately placing them in the control of the Cataract Power company of Hamilton, Ont. John Knox, representative of the Lincoln Light and Power company, a newly organized corporation and connected with the Cataract company, has purchased the Cooke

& Sons electric-power and lighting plant at St. Catherines. For some time the negotiations have been going on between the St. Catherines Electric Light company and Thomas Nihan of the same city. When this transaction is closed it is understood that the two powers will go under one management. Mr. Nihan is also mentioned as the purchaser of the St. Catherines, Marritton and Thorold electric street railway. The activity in electric-power circles is probably owing to the fact that the lighting contract for the city must be renewed next fall and there will be a big fight for the new contract.

The first power at Shawinigan Falls, Que., was turned on February 7th, and the town, which two years ago did not exist, but now has a population of over 3,000 persons, was lighted by electricity. The initial use of electricity at Shawinigan is notable in that the development of power from water there, with the exception of Niagara Falls, offers more scope than at any other point in the world. The company has completed the hydraulic development of 75,000 horsepower, which is about 25,000 more than has as yet been developed at Niagara. An electrical installation for 10,000 horsepower is being put in place from which the company proposes to take its supply for the city of Montreal. A. V. W.

Southern Developments.

Charlotte, N. C., February 16.—J. S. Carr of Durham, N. C., and Samuel Register of Richmond, Va., are interested in the Durham Traction company, recently incorporated. Work will begin within six months.

The difference between the City of Augusta, Ga., and the electric-railway company over an effort to repeal an ordinance relieving the latter from repairing and repaving the parts of the streets occupied by its tracks has been compromised. The company will pay the city a tax of $1,666 for the use of the streets annually.

The City Council of Greenville, S. C., has refused to turn over a bond of $3,000 to the electric-railway company because the company has fallen short by 368 feet of completing the five miles of track guaranteed by January 15th. The matter will come up at a subsequent meeting of the council.

On February 4th the Richmond (Va.) Traction company, after receiving authority from the city engineer, tore up certain tracks belonging to the Richmond Passenger and Power company. The latter company took out an injunction, stopping the work and causing the track to be replaced.

It is stated that the Cape Fear Power company has succeeded in getting upon a firm financial basis and in the near future will be enabled to furnish power from the Buckhorn Falls, on Cape Fear River, near Fayetteville, N. C. W. M. Morgan is one of the promoters.

The House of Representatives of South Carolina has passed a bill allowing the Twin City Power company the right to build a dam across the Savannah River, near Parksville, in Edgefield County. This company was incorporated July 31st with a capital of $1,000,000, by Samuel Saylor of New York and others. They propose to develop electric power. Congress has given the company leave to erect the dam, provided it does not interfere with navigation and fisheries.

The Hampton Roads Railway and Electric company has begun laying tracks at Newport News, Va. The system will include Newport News and reach Old Point Comfort and Hampton.

A petition has been filed in the Superior Court in Atlanta, Ga., by the Georgia Electric Light company, seeking certain amendments to its charter. One section asks for power to increase the capital stock to a sum not exceeding $2,000,000. The privilege is also asked of reducing the capital stock by the redemption of the preferred stock or otherwise, provided it is not reduced below $1,000,000.

The House committee of North Carolina has reported favorably on bills to charter the Yadkin Falls Electric company and a company to build the proposed electric railway between Weaverville and Asheville, N. C. L.

Northwestern Notations.

Minneapolis, February 16.—The Moscow (Idaho) Electric Light and Power company contemplates stringing a heavy transmission wire to Pullman, Wash., to furnish that place with light and power.

The electric-light company of Decorah, Iowa, contemplates putting in a storage battery to furnish light for those who desire it after midnight. The demand is so limited that it would not pay to operate the plant.

The health commissioner of St. Paul has notified the superintendent of the street-railway company that the street cars must be kept in a sanitary condition and that they must be aired at the end of each trip.

Charles Jorgenson will install a private electric-light plant for the Hotel Albert at Albert Lea, Minn.

The Electric Light and Power company of Oshkosh, Wis., has made a reduction of 35 per cent. in the charge for lighting public buildings in Oshkosh, Wis.

The estimated cost of an electric-lighting plant at Madison, Wis., to furnish light for the state buildings there is $156,220. The operating expenses are placed at $20,000, which is just half what the present cost of light is per annum. It is probable that an appropriation will be made for such a plant.

Business men of Alden, Iowa, have arranged to establish an electric-light and heating system.

The electric-railway company of Muscatine, Iowa, is erecting a modern power plant, which will be fitted with modern machinery for light and power.

Over 200 citizens of Everett, Wash., have petitioned the council to establish a municipal electric-light and water system.

The Electric and Steam Railway company of Ottumwa, Iowa, has bought up all the available shares of the old Wapello County Agricultural society. The company proposes to extend its tracks to the grounds and hold a fair and races each year.

Ludwig Gutt of Peoria, Ill., contemplates establishing a factory at Oconomowoc, Wis., for the production of meters and other electrical machinery.

A right-of-way will be secured at once for the proposed electric line between Rockford, Ill., and Janesville, Wis.

The electric plant of the Big Fork Electric Light and Power company, near Kalispell, Mont., is approaching completion. The plant will be able to produce 3,000 horsepower, and can be tripled if necessary. The turbine wheels will be direct-connected to two 180-kilowatt dynamos.

The Street Railway company of Sheboygan, Wis., has secured the needed right-of-way for its projected line to Elkhart Lake, Wis., 25 miles. It is expected that work will be started on the construction in April from Sheboygan Falls.

The Seattle and Tacoma Railway company will start construction at once on the projected electric line between those cities.

Frank L. Damé, superintendent of the Railway and Power company of Tacoma, Wash., was recently presented with a valuable gold watch, chain and charm by the employes of the company. The gift was valued at $220. Mr. Dame has been superintendent since 1895, and vacates his position on the return of Mr. Mitchell, which will be about February 20th.

The Everett Improvement company of Everett, Wash., has bought the property and franchise of the Everett Railway and Electric company. E. P. Burch, a Minneapolis man, was the leading mover of the latter company, which has just secured a franchise and started work. The old company now agrees to improve and extend its system. Mr. Burch has been retained as consulting engineer and purchasing agent.

The Waterloo and Cedar Falls Rapid Transit company is completing arrangements for an extension of its line from Cedar Falls, Iowa, to Denver, Iowa, by way of Janesville.

O. S. Martin of Mount Ayr, Iowa, and his brother, W. E. Martin, of Atlantic, Iowa, contemplate establishing a modern electric-light and water system for Atlantic, to cost, completed, $40,000.

Lyman Waterman of Omaha recently appeared before the council of Creston, Iowa, and explained the plans of the company he represents for an electric line from Des Moines to Creston, by way of Winterset.

Beacon, Iowa, has voted a franchise to the Street Railway and Land company of Oskaloosa, Iowa, for street lighting and an electric railway. It is probable the company will construct a line from Oskaloosa to Beacon.

The street-railway company of Council Bluffs, Iowa, has just put in service five handsome new cars, carrying double trucks, with air brakes, electric heaters, call buttons and other conveniences.

The Twin City Rapid Transit company will soon put in service in St. Paul 30 new cars. They will be double-truck cars, and will supplant the old cars on the Grand Avenue line. An equal number will be put on in Minneapolis.

The council of Albert Lea, Minn., has submitted a new contract for street lighting, and requires the company to furnish light on all dark nights.

The contract for lighting the state capitol building at Madison, Wis., has expired. The Gas and Electric company of Madison has submitted a new proposition to light the capitol for $5,500 a year.

There is talk at Spokane, Wash., of building an electric line from that city to Priest Rapids, where connection would be made with a line of steamers on the Columbia River to Portland. A line of electric railways is projected to cover the wheat country in Lincoln and Douglas counties.

H. M. Thatcher has been granted a franchise for an electric-light and power system in Pomeroy, Wash. R.

Information from Indiana.

Indianapolis, February 16.—George H. Mayer of Chicago, secretary of the Consolidated Water and Light company, has filed a petition in the Knox Circuit Court for the appointment of a receiver for the Vincennes City Electric Light company. The respondent company has a 10 years' franchise to furnish light for the city of Vincennes, but is indebted to the Chicago concern $6,913.16. Elias J. Julian, present manager of the local company, was appointed receiver. The Fort Wayne Electric Works have a claim of $23,000 against the company.

The Lea-Hooven Manufacturing company and the Anderson Tool company are consolidating, under the name of the Anderson Tool, Light and Power company. The capital stock will be increased $50,000.

The report is current that Trowbridge & Niver, a firm of brokers in Chicago, have negotiated for the purchase of the Mead Electric company's plant at Marion, incorporated for $100,000.

Horace C. Stillwell, general manager of the Central Traction company, has returned from New York, and announces to the people of Kokomo, Indianapolis and intervening towns that he has arranged all the details of construction on the electric line from Kokomo to Indianapolis and that the company is ready to begin work with suitable weather.

The Fort Wayne and Southwestern Railroad company, now building an electric line from Fort Wayne to Huntington, has arranged to extend the line to Wabash. This decision was reached the past week, after a franchise was granted by the Wabash council. The company also announces that it will build its line from Huntington, southwest through Warren to Marion, as originally contemplated. President Reed has just returned from the East, where he has been hurrying up the new cars, as the grading on the first section is completed and it is the purpose to get the line in operation by May 1st.

A bill has been introduced in the Legislature to create the office of railroad commissioner, at a salary of $2,500. Power is given him to require safety appliances at dangerous crossings or to stop the running of trains over any bridge or stretch of track he considers dangerous. The bill gives him jurisdiction over street and interurban railways, as well as steam roads. Officials are required to testify when called on.

The Gamewell Fire Alarm company of New York is the only bidder for the construction of the new electric fire-alarm system for Indianapolis. The council appropriated $65,000 for the work and the Gamewell bid is $63,500, with extras, making the cost $69,400. The board has taken the bid under advisement.

The Western Indiana Electric Railway company has been granted a franchise over the Rockville road by the Hendricks County commissioners, for a term of 50 years.

Arrangement has been made whereby the Oil Belt Traction company will gain an entrance for its cars to Marion over the tracks of the Marion Traction company, and the Ohio and Indiana Traction company's cars will enter Marion over the tracks of the Union Traction company.

An electric railroad is proposed between Celina, Ohio, and Marion, Ind. The route takes in such towns as Bryant, Pennville, Roll and Montpelier.

The interurban line that reaches from Indianapolis to Anderson, Muncie and other gas-belt towns will be extended to Newcastle. Eastern capitalists are behind the project and have already secured the right-of-way through Henry and Delaware counties.

Work has begun on the first interurban electric railway out of Evansville, and also the first interurban road in Southern Indiana. The first division lies between Evansville and Boonville, a distance of 18 miles. The proposed line will parallel the Southern railway and the promoters have met with stubborn resistance, but have secured franchises through the different counties for an extensive system. When completed the promoters promise a passenger rate of one cent a mile.

Senator Flemming has introduced a bill in the Legislature providing that electric lines shall not have the use of the highways. The bill has created a stir among the interurban companies that are formed and are being formed. The bill has an emergency clause, and is not to affect companies and lines already formed and which have franchises.

The City Council of Bedford has granted a franchise to the Bedford street-railway and to the Bedford Light, Heat and Power company to operate a hot-water-heating system.

House bill 417, now pending in the Legislature, provides that when a passenger on a street car is not able to obtain a seat he need pay only half fare. It is claimed the bill will pass.

The commissioners of Montgomery County have granted two 50-year franchises for electric roads through the county. One company is headed by F. M. Ayers of Indianapolis and the other by I. C. Elston. One road comes in from the south and the other from the east, forming a junction at Crawfordsville.

A. N. Dukes, who claims to own the Erie towpath between Wabash and Peru, and several farmers owning land along the road selected by the Wabash River Traction company as a route over which to build an electric line between the two cities, attempted to block the scheme by appearing before the commissioners with a remonstrance, claiming that the road would be a detriment to their property. After hearing the arguments of both sides the commissioners instructed F. C. Boyd, president of the company, to proceed with the work, as the road will prove a benefit rather than a detriment.

The Indianapolis council has instructed the Board of Public Works to compel the interurban lines to comply with the rules and regulations regarding fares and transfers that govern the Indianapolis Street Railway company, or else not to permit them to enter the city limits. It was charged that they had entered the city without authority, and had made rules regarding fares to suit their own convenience, without any adequate return to the city. This action is regarded as indicating that the coun-

cil will not ratify a franchise that does not provide for the same fare and same rule of transfers that apply to the local company. F.

PERSONAL.

Professor William Dewitt Alexander, who for 30 years has been at the head of the Survey Department of Hawaii and for many years surveyor-general, has resigned, to accept a position on the United States Coast and Geodetic Survey. He will have charge of that branch of the department which has to deal with Hawaii and Samoa.

The many friends among the electrical people of the West of C. S. Colton will be interested to know that he has just received the appointment to the position of assistant manager of the Cleveland (Ohio) works of the Westinghouse Electric and Manufacturing company. This makes Mr. Colton assistant to the present manager, R. D. Beatty, of the Cleveland Westinghouse Works. Mr. Colton, it will be remembered, succeeded F. E. Drake with the old Walker company on Mr. Drake's appointment as director of machinery and electricity to the Paris Exposition, and since then he has been Mr. Beatty's "right-hand man." The appointment as assistant manager was well earned.

ELECTRIC LIGHTING.

An issue of $30,000 bonds for an electric-light plant at Ilion, N. Y., is contemplated.

The Orange Electric Light and Ice company of Orange, Texas, will soon install an entire new equipment.

Messrs. W. and C. Miessner are preparing to purchase new machinery for the electric-light plant at Huntingburg, Ind.

The plant of the Sayville Electric company of Sayville, L. I., will be largely increased in capacity within a short time.

The Consumers' Electric Light and Power company of Haddonfield, N. J., has been incorporated, with $100,000 capital stock.

The Delaware state Legislature has passed a bill authorizing the issuance of $4,000 electric-light bonds for the town of Dover.

Arthur L. Satterwhite, manager of the electric-light plant at Emporia, Va., desires proposals for a 500-light, 140-volt alternator.

The city of Beresford, S. D., has granted a 20-year franchise to Crill, Wagner & Co. for a lighting plant to be built in the spring.

The lighting plant of Frank Filer in Ludington, Mich., valued at $24,000, was recently sold to Justus S. Stearns, who will increase its capacity.

The Paris (Texas) Light and Power company is advertising for bids on a 100-kilowatt, 200-volt generator, to be delivered in the spring.

The Atlanta Railway and Power company of Atlanta, Ga., has received a franchise for the construction of its proposed electric-light plant.

The Chico Gas and Electric company of San Francisco, Cal., has been incorporated for $100,000 by J. Martin, F. H. Pierson and H. U. Roeding.

Captain T. M. Brady of Canton, Ga., will install an electric plant for lighting his marble works, and probably make it large enough to light the town.

The Electric Light and Gas Works company of Bath, Pa., has placed a mortgage for $100,000 on its plants, the proceeds to be used for improvements.

Bids will soon be asked for by the city of Chattanooga, Tenn., for the lighting of the county bridge, jail and courthouse. The work will cost about $2,500.

The Warren Electric Light and Power company of Warren, Ohio, is preparing to replace its 100-kilowatt alternator with a 200-kilowatt machine of similar type.

There is an item in the sundry civil bill before Congress of $74,000 for an electric-light plant for the buildings of the Department of the Interior, at Washington, D. C.

The Elkins-Widener syndicate is reported to have secured control of the Lyons (N. Y.) Electric Light and Power company. A new plant is building at Clyde, N. Y.

The Jacob Tome Institute has purchased the plant of the Port Deposit Electric Light company at Port Deposit, Md., and will enlarge it by installing new generators.

Sealed proposals for furnishing an electric-light plant at Fort Adams, R. I., will be received by Major George W. Goethals, Corps of Engineers, Newport, R. I., until March 14th.

It is reported that the Milwaukee Light, Heat and Traction company has bought the property of the South Milwaukee Electric Light and Power company of the owners, F. W. Rogers and H. M. Green.

Sealed proposals will be received until March 11th, for delivering apparatus for an electric-light plant for Fort Williams, Me. Information will be furnished intending bidders upon application to Major S. W. Roessler, United States Engineer, 537 Congress street, Portland, Me.

The Huntington Electric Light and Power company of Huntington, Ark., has been incorporated, with a capital stock of $8,000, by William Harper, J. H. Thompson, H. Mayer, H. F. Rogers and others.

The Youngstown Consolidated Gas and Electric company at Youngstown, Ohio, contemplates the enlargement and improvement of its plant. Bonds to the amount of $600,000 have been issued for that purpose.

The Elkhart Electric company of Elkhart, Ind., has been incorporated, with $100,000 capital stock. The directors are James S. Dodge, Martin V. Beiger, Charles S. Tenny, James Dushane and Charles F. Hewitt.

The Mackinac Park Commission has given a franchise to H. C. Noble, F. C. Andrews and H. Warren of Detroit for the electric-lighting and waterworks system of Mackinac Island, Mich. The cost of the work will be $100,000.

City Electrician Ellicott of Chicago has asked for $1,085,000 as the annual appropriation for the lighting of the city's streets. Of this $400,000 would be spent on the electric system and the remainder for gas and gasoline lighting.

The city of Lake Providence, La., will build an electric-light plant and waterworks to cost $17,500. Plans and specifications have been prepared, and bids will be opened in February. Information will be furnished by G. M. Franklin, mayor.

The Southern Incandescent Lighting company of Fairfax Court House, Va., has been chartered, with R. C. L. Moncure, president, and James P. Machen, Jr., secretary and treasurer, and wishes to correspond with manufacturers of incandescent lamps. The capital stock is $5,000.

The Baltimore and Ellicott City Light and Power company, reported recently as organized by George L. Mowen of Baltimore and others for the operation of the electric-light plant at Ellicott City, Md., will increase the capacity of the works by 400 lights and later install an entirely new plant.

The Creston Gas and Electric company of Creston, Iowa, states that under the new street-lighting contract with the city arc lights are furnished on a moonlight schedule for $76 each a year for all-night service. The city has ordered 26 new lamps and is considering a further addition to the service. The old contract provided for lights at $100 each, all night and every night. A recent statement by a correspondent of the Western Electrician to the effect that 23 lamps were operated for $820 was an error.

Sealed bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 5, 1901, for the electric work for the hospital building, hospital out-building, surgeon's house, bath and laundry building, kitchen and restaurant building, boiler house, connecting corridor and covered way (including ferry house), central lines and outdoor lighting, at the United States Immigrant Station, Ellis Island, New York harbor. Copies of the drawings and specifications may be obtained at the above-mentioned office or from Boring & Tilton, 32 Broadway, New York city.

At the meeting of the Chicago City Council on February 18th an ordinance was passed directing the corporation counsel to investigate the alleged discriminations of the Chicago Edison company and to advise the council as to the respective rights of the company and the consumers. It is charged that the company's rates are not equitable and uniform. It is also contended that as the consumer pays all the cost of installing the service it is unjust for the company to decline to serve him unless he bind himself to pay a rental of at least $1 a month whether electricity be used or not.

At a recent meeting of the directors of the Evansville (Ind.) Gas and Electric Light company it was decided to abolish the office of general manager, made vacant by the death of H. Wilkiemeyer, and to separate the gas and electrical departments. A general superintendent will have charge of each department. Mr. J. W. Gillett, chief electrician of the company, was promoted to the office of general superintendent of the electrical department. Some $30,000 has been expended in the reconstruction of the plant under Mr. Gillett's supervision. The company will shortly be in the market for a 150-kilowatt, 500-volt generator.

The Pittsburg and Lake Erie Railroad company will soon have in operation a modern lighting and refrigerating plant at Pittsburg. It is placed opposite the new station of the company and will furnish electric power for fans, elevators and illumination, distilled water for coaches and artificial ice for the inmates of the building and for use in the passenger coaches, so that the Pittsburg and Lake Erie will be about the only road in the country having the means of producing ice, electricity and pure water for its terminals without having a contract with other corporations. It is the intention to have the electric-lighting circuits extend as far as McKees Rocks, so that the yards at that place and the new shops and roundhouse can all be electrically illuminated.

ELECTRIC RAILWAYS.

It is reported that H. A. Everett of Cleveland is investigating the street-railway systems of Washington, D. C., with a view to securing an interest there.

A double-track electric line, 134 miles in length, is proposed to connect Rome and Naples, Italy. The road will run along the coast, taking in the coast towns.

The Spartanburg Electric Railway, Gas and Power company has finished surveying for a line from Clifton, S. C., to Converse, S. C., and the extension will be built at once.

The Interstate Railway Light and Power company of Paris, Ill., has been incorporated for $5,000, to construct an electric street railway. The directors are A. J. Hunter, W. T. Blackburn and C. P. Hitch.

The South Side Elevated Railroad company of Chicago is said to have ready for installation an efficient burglar-alarm system for its stations, which will operate large gongs along the route in case of a hold-up in one of the stations.

The Milwaukee Common Council has been asked for a franchise for the Milwaukee, Burlington and Lake Geneva Railroad company. The ordinance introduced provides for a road to be operated by electrical or other power, an exception being made of steam.

It is reported that the Boston and Worcester Street Railway company is extending its lines, and that the line through from Boston to Worcester is nearly provided for. It is thought that there will be a continuous trolley line from Boston to Hartford by the end of this year.

Major D. W. Sanders of Louisville, Ky., has filed articles of incorporation of the Louisville, Anchorage and Power Valley Electric Railway company. It has a capital stock of $10,000, which may be increased to $750,000. H. H. Bechtel of Cincinnati is president of the company.

It is reported that all of the street-railway properties of the Massachusetts Electric companies south of Boston are to be consolidated under the title of the Old Colony street railway. John Graham will be vice-president of the new company and Robert S. Goff, general superintendent.

A company is being formed to build an electric line from Clinton, Ind., to Paris, Ill., a distance of 30 miles. The road is expected to cost $250,000, and is to engage largely in the carrying of freight, as the country to be opened up is rich in coal and is also a populous farming district, without adequate railway facilities.

A project is on foot for building an electric railroad from Piracicaba to Villa Americana, in the state of São Paulo, Brazil. The last-named station is in the old American colony of Santa Barbara. The estimated cost of the line is said to be $2,500,000. Permission to build it has been asked of the São Paulo Legislature.

Robert Jemison, vice-president of the Birmingham Railway and Electric company of Birmingham, Ala., states that the improvements contemplated by this company include the substitution of electric for steam power on about 30 miles of its road. The company will soon be in the market for the necessary electrical equipment.

The Northwestern Elevated Railroad company of Chicago has asked for a franchise amendment permitting it to build an incline at Wilson avenue and run a surface extension by overhead trolley to the city limits. It is the intention to extend the line to Evanston, eventually, and establish an express service from Evanston to the downtown district.

A company to build a trolley line from Adams, Mass., through Berkshire County, to the Connecticut state line, passing through Lenox, Stockbridge and other summer resorts, has been formed, with a capital of $1,000,000. Among the stockholders in Lenox are Thomas Post, William D. Curts, Capt. John S. Barnes, David Lydig and Mrs. Anna A. Bradford.

The rumors of consolidation of Chicago electric-railway properties have been revived. It is now asserted that Thomas F. Ryan of New York has purchased the Yerkes holdings in the Lake Street, Northwestern and Union Elevated Railroad companies, and that the consolidation of these properties with the North Side surface lines of Chicago may follow.

The Tyler Railroad company has been organized to build an electric line through the northwestern section of West Virginia between Sistersville, on the Ohio River, and West Union, in Doddridge County, an estimated distance of 25 miles. Mr. H. W. McCoy of Sistersville, one of the directors of the company, states that the first section will be built between Sistersville and Middlebourne during the present year.

It is reported that the Chicago and Milwaukee Electric Railway company is trying to obtain the use of the Chicago, Milwaukee and St. Paul tracks between Evanston, Ill., and the terminus of the Northwestern Elevated at Wilson avenue, Chicago, in order to be able to put on a through service over

the elevated road to the downtown loop. This would take the place of the special service now operated by the Chicago, Milwaukee and St. Paul between Evanston and Sheridan Park.

It is announced that the controlling interest in the street-railway combine recently organized in Detroit has been sold by R. T. Wilson of New York to H. A. Everett of Cleveland and several Detroit capitalists. The consolidated company has outstanding stock to the amount of $12,500,000, and $11,000,000 in bonds, while an additional $1,500,000 issue of stock was authorized at the annual meeting for the purchase of new equipment.

The Owosso and Corunna Electric company of Owosso, Mich., has been granted franchises for extensions to take in the towns of Vernon and Durand which will increase the length of the line from the present four miles to 20 miles. The engineering work will begin immediately. The present road will be practically rebuilt, and 60-pound rails will be laid as soon as the frost is out of the ground. The line runs through a good farming country and it is planned to do a freight, as well as passenger, business.

Articles of incorporation have been filed between the Chicago and Joliet Rapid Transit company and the Joliet Railroad company, forming the Chicago and Joliet Electric Railway company, with principal office at Joliet, Ill. The capital stock of the company is $605,000. The Chicago and Joliet Rapid Transit company now has double tracks from Joliet to a point within 10 miles of Chicago. Its plan is to connect with the Archer avenue line of the Chicago City Railway company in June. A number of cars almost as large as railroad coaches have been purchased.

It is reported that J. P. Morgan has secured an option on the entire unissued shares of the British Electric Traction company, amounting to $4,000,000, in consideration of underwriting $1,500,000 of the concern's preferred stock. The total assets of the company amount to $8,500,000. The corporation is interested in 380 miles of electric-railway undertakings throughout Great Britain and Ireland, including lines in Birmingham, Brighton, Wolverhampton, Swansea, Cork and many other important provincial and suburban points. The net profits for the 15 months ended March, 1900, were reported as $650,000.

The Continentale Gesellschaft für Elektrische Unternehmungen of Nuremberg, Germany, has issued reprints from Engineering and the Zeitschrift des Vereines Deutscher Ingenieure describing the suspended railway erected by this company in Elberfeld, Germany. The company wishes it known that the chief advantage of the system is the free suspension of the cars, permitting the trains to take sharper curves than would be possible on ordinary railways, without endangering the trains and without slackening speed. The company believes that the system will have extensive application to long-distance, rapid-transit roads.

A London dispatch to the New York Times dated February 16th reads as follows: "Due probably to the severe wear and tear of its rolling stock, upon which there has been much comment in financial circles recently, the company owning the Central London underground railroad, better known as the 'Tuppenny Tube,' has decided to try American motors instead of the heavy electrical engines now employed, and has ordered from the licensees here of an American company three small motors mounted on bogie trucks under the carriages. If the experiments are successful the old locomotives will be abandoned. The idea is due to a trip to the United States just made by the company's engineer."

PUBLICATIONS.

The Colonial Electric company, Ravenna, Ohio, manufacturer of Orient and Colonial incandescent lamps, is sending out, with its compliments, an attractive calendar bearing a half-tone reproduction of a delightful child-study, entitled "Wake up, Mamma."

The B. F. Sturtevant company of Boston has issued an attractive brochure giving an illustrated description of the heating and ventilating system installed by the company in the roundhouse of the Chicago and Northwestern Railroad company at Clinton, Iowa.

"Let Us Cast Your Anchor" is the suggestion of W. N. Matthews & Bro. of S. Louis, in presenting to the trade an attractive catalogue on Stombaugh guy anchors, for which they are exclusive sales agents. The catalogue discusses the merits of this device for guying poles, fences, smokestacks, etc.—in fact, everything to be guyed—and devotes considerable space to an account of tests made on the Stombaugh anchors by Professor R. C. Carpenter of Cornell University.

A 26-page booklet issued by the American Steel and Wire company gives a comprehensive list of the products of the company. Among the great variety of materials produced and articles manufactured are the following: Raw material, pig-iron, steel ingots and billets, wire rods, steel plates, sheets, shapes and bars, horseshoes, shafting, round, flat and odd-shaped wires, wire nails and tacks, wire fencing, barbed wire, stretchers and fence tools, wire ropes, springs, etc. The company also manufactures a great many different kinds of electrical wires and cables, both covered and bare, and rail bonds.

The Chicago and Alton Railway company has issued a pamphlet entitled "The Largest Photograph in the World of the Handsomest Train in the World," in which is given an illustrated description of a great camera and its construction and the process of taking the photograph of an Alton train. Copies of the pamphlet may be obtained by sending the necessary postage to George J. Charlton, general passenger agent of the Chicago and Alton Railway company, Chicago.

The art of catalogue making has to-day reached a high degree of perfection, and electrical and allied manufacturers are responsible for many of the best productions in that line. Of recently issued catalogues, the 1901 edition of the McRoy Clay Works, Brazil, Ind., is particularly noteworthy, as well for its arrangement and editing as its typographical and mechanical execution. The booklet is devoted to a general account of the characteristics, uses, advantages and methods of laying of the McRoy vitrified-clay conduit, and a fine set of illustrations drawn from actual photographs show various installations of the conduit and otherwise illustrate its uses. The catalogue, which is entitled "Fifteen Million Feet Under Ground," fits into a paper case. Both case and cover are of clay-tinted paper and bear in relief a draped female figure with the word "Tanagra."

ELECTRICAL SECURITIES.

The stock of the Boston Edison Electric Illuminating company is to be increased from $4,320,000 to $5,000,000 to pay off floating indebtedness and refund a mortgage on the property.

SOCIETIES AND SCHOOLS.

Palmer C. Ricketts, formerly director of the Rensselaer Polytechnic Institute at Troy, N. Y., has been elected president and trustee of the institution, to succeed Hon. J. S. Peck, who recently resigned.

S. G. McMeen, chief engineer of the Central Union Telephone company, Chicago, Ill., will lecture before the engineering students of Purdue University, Lafayette, Ind., on February 27th, his subject being "Modern Developments in Telephony."

At the ninth joint educational meeting of the Robert Fulton Association of the National Association of Stationary Engineers, Chicago, on February 16th, an address on "Electricity in the Service of Man" was presented by Samuel G. McMeen, chief engineer of the Central Union Telephone company.

At the December meeting of the Engineers' Society of Western Pennsylvania the following-named officers were elected for the ensuing year: President, H. W. Fisher; vice-president, Professor F. C. Phillips; secretary, C. W. Ridinger; treasurer, A. E. Frost; director for one year (to take place of Gustave Kauffman), C. B. Connelly; directors for two years, J. M. Camp, Richard Hirsch. In connection with a discussion of the proposed Carnegie technical school in Pittsburg a committee composed of F. Z. Schellenberger, W. E. Snyder, C. F. Scott, C. B. Albree and C. B. Connelly was appointed to make a report to the society as to the nature of school most needed in Pittsburg, with the purpose of submitting suggestions to the Carnegie committee.

Nearly 50 representatives of the International Correspondence Schools visited Scranton, Pa., early in February and were entertained by the schools. Many of them had never been at the home office and they were deeply interested in what they saw. A day was spent by the visitors inspecting the school buildings, which are among the largest and finest in Scranton. Several meetings were held and addresses made by T. J. Foster, president of the schools, and by a number of the principals. In the evening a banquet was given at the Hotel Jermyn, which was attended by the officers, directors and principals of the schools and the visitors, covers being laid for 80 persons. Almost every visitor brought a letter from a student with whom he was personally acquainted, and the reading of these letters telling of benefits secured by students was a feature of the gathering.

MISCELLANEOUS.

By action of the Chicago City Council, at its meeting on February 18th, the salary of the city electrician was raised from $4,000 to $5,000 per annum.

A plan is being considered by the Board of Penitentiary Commissioners of Joliet, Ill., for obtaining power for the institution from the Desplaines River, about 1,000 yards distant.

The New York World recently offered a prize of $25 in gold to the heaviest motorman employed in operating a street car within a radius of 25 miles of that city, a second prize of $10 in gold for the second heaviest motorman, and a prize of $10 for the lightest motorman. The first prize was carried off by a Brooklyn man, who weighed 347 pounds. The second prize was carried off by a New York man, weighing 325 pounds, and the third was also awarded to a New Yorker, who weighed 98 pounds.

Improvements proposed for the Capitol at Washington will, if carried out, necessitate the removal of the power plant from the basement, and it is proposed to put up an additional building south of the Capitol grounds to be used for the storage of documents and to accommodate the power plant. The new building will cost about $700,000.

It is reported that the interests which have recently purchased the Buffalo and Depew trolley line in Western New York are also back of the Buffalo, Rochester and Niagara Falls Railway company, the water company which desires to furnish Lockport with water and the Niagara, Lockport and Ontario Power company, and that these properties will probably be consolidated.

Two opinions have been handed down by Judge Thompson of the United States Circuit Court Southern District of Ohio, in cases involving the Tesla split-phase, alternating-current motor. Both suits were brought by the Westinghouse Electric and Manufacturing company against the Dayton Fan and Motor company and infringement was charged in one case on patent No. 401,520 and in the other on patents Nos. 511,559 and 511,560. The disputed claims of all the patents were sustained and decrees were accordingly entered in both suits for the complainant.

Judge Bradford of the United States Circuit Court, District of New Jersey, has handed down a decree in the suit brought by the General Electric company against the Walker company, charging infringement of United States letters patent No. 394,999 issued to Edwin W. Rice, Jr., and No. 462,973, granted to Elihu Thomson and William O. Wakefield. These patents relate to improvements in brushes and brush holders, and each of them contemplates the use of a brush of block form, spring-actuated, and moving in a slot or socket of a brush holder. The court holds the second claim of the Rice patent good and valid in law and enjoins the defendant from its infringement. The bill against the Thomson and Wakefield patent is dismissed, the court holding that the patent is wholly wanting in patentable novelty.

TRADE NEWS.

The Mercantile Electric company of St. Louis, Mo., with a capital stock of $100,000, has been incorporated by Charles G. Dubois, James W. Johnson and others.

The Adams Construction company of Buffalo, N. Y., has been incorporated, with $5,000 capital, to build electrical equipments. The directors are H. S. Wasson, J. O. Munroe and W. J. Jamison.

The building heretofore occupied by the Helios-Upton company in Peabody, Mass., will be taken by the American Aaron Electricity Meter company, which will install new machinery and manufacture electric meters.

The Helios-Upton company's factory at Peabody, Mass., formerly the works of the Standard Thermometer company, is to be moved to Philadelphia, where the principal office of the Helios-Upton company is located.

The Cahill Electric Typewriter company of Washington, D. C., is contemplating an increase of capital stock and the removal of its plant to Worcester, Mass. It was intended to move to Bridgeport, Conn., but the Worcester Board of Trade has been trying for some time to secure the plant for Worcester. The present plans provide for a total capital of $250,000.

The Springfield Plumbing company, 302 Boonville street, Springfield, Mo., which is in the market for electrical supplies, announces that it will be pleased to receive factory quotations on weather-proof wire and rubber-covered wire of all sizes, open-circuit carbon batteries complete, iron-box bells and annunciator wire in sizes of Nos. 16, 18 and 20. These quotations must be from the factory.

H. M. Shaw & Co., 115 Broadway, New York city, manufacturers of Shaw's non-arcing lightning arrester, have secured the exclusive management and control of the Medbery insulation, so well and favorably known to the street-railway trade. This firm is in position to supply promptly all the designs of overhead material at prices consistent with high-grade workmanship. Many of the larger street-railway companies in the United States and abroad have used Medbery insulation for many years, and can attest to its good qualities.

An American exchange has been established in the city of Guadeloupe which has for its object the introduction of various lines of American manufactures not known in that market and the substitution of American for other foreign goods in lines that have already been established. The address of the exchange is "The American Exchange, Pointe a Pitre, Guadeloupe, West Indies," and it is understood that the financial responsibility of the concern is all right. The manager speaks and writes English, and is said to be thoroughly

acquainted with trade relations between Gaudeloupe, the United States, France and England. The goods to be handled will include steam engines and fittings of all kinds, steam and small pumps, machinery of various kinds, tools, corrugated iron, light portable railroads, etc. An additional opening may be found for electrical machinery, as there are a number of improvements already under consideration in Guadeloupe for the electric lighting of towns and cities, the establishment of steam and electric railroads, etc.

BUSINESS.

The Western Electric company, Chicago, is carrying a large line of construction material of use to central stations and street railways. Bulletins of this material are being sent out.

The Electric Appliance company, Chicago, announces that it owns the factory making Crystal Lake cross-arms, pins and brackets. The company claims, therefore, to be in a better position than any other western supply house for making prompt and satisfactory shipments.

The Emerson Electric Manufacturing company of St. Louis announces that its factory is fully engaged in the manufacture of desk and ceiling fans for the season of 1901, and that the demand for Emerson apparatus has necessitated a considerable increase in factory facilities and machinery.

Recent installations of engines built by the Ball Engine company of Erie, Pa., include a 300-horsepower, cross-compound, self-oiling engine for the United Railways and Electric company's plant at Baltimore, Md., and a 150-horsepower engine of similar type for the Center Star Mining company of Rossland, B. C.

The American Bridge company announces its sales during the month of January as the largest of any month since its organization, aggregating over 60,000 tons. The company is at present getting out about 20 bridges for the Erie Railroad company, while among the contracts on hand is one to furnish Cooper & Wigand about 2,800 tons of structural steel for the Kingsbridge power house on the Third Avenue railroad, New York city. The Gillette-Herzog branch of the American Bridge company will furnish the steelwork for the large steel building to be shipped to the Montezuma Copper company at Nacozari, Mexico.

The Bois d'Arc Pin company, with office at Beaumont, Texas, has one factory in operation at McKinney and is building another at Clear Lake, Texas. The company asserts that Bois d'Arc timber is harder and stronger than any other wood and will last longer than steel or iron. It makes insulator pins only.

The Non-polarizing Dry Battery company is now established in its new quarters at 447 Broadway, New York city. The company reports that it is turning out a much better battery than heretofore and that its business is increasing materially. It recently received a large order from the United States government for batteries to be shipped to Manila. The company's railroad, telephone and gas-engine business is also increasing.

ILLUSTRATED ELECTRICAL PATENT RECORD.

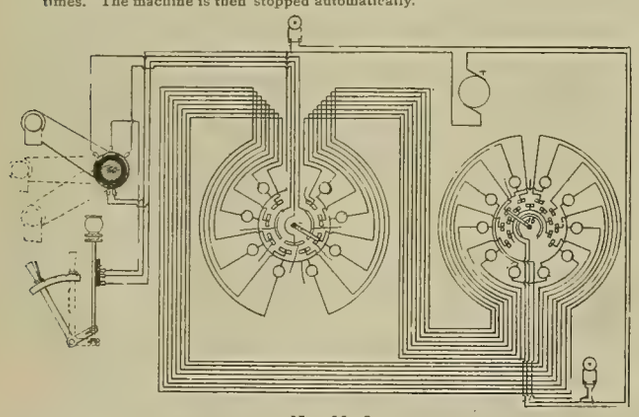
Issued February 12 1901.

667,727. Automatic Alarm System. Felix McGloin, New York, N. Y., assignor to the Automatic Fire Alarm company, New York, N. Y. Application filed May 21, 1900.

The protective circuit is arranged, when disturbed, to put in operation a talking machine which transmits a message over a telephone circuit.

667,728. Talking Machine. Felix McGloin, New York, N. Y., assignor to the Automatic Fire Alarm company, New York, N. Y. Application filed June 6, 1900.

In addition to the talking mechanism an electrical device is used to enable the message to be repeated several times. The machine is then stopped automatically.



No. 667.859

667,729. Electric Brake Mechanism. Frank C. Newell, Chicago, Ill., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed August 26, 1899.

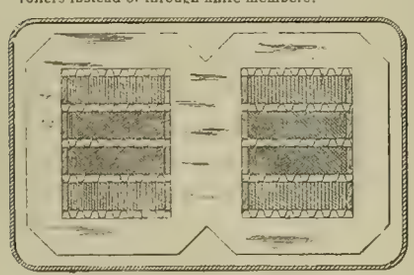
A magnetic rail-shoe is used, which acts to apply a wheel-shoe at the same time.

667,730. Electric Brake. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed May 2, 1900.

In this brake the wheel-shoes are set by the application of the magnetic rail-shoe, but provision is also made for setting the wheel-shoes with greater force against one pair of wheels than against the others.

667,764. Electric Switch. David R. Bruce, London, England. Application filed July 28, 1900.

The contacts are made through a flexible conductor and rollers instead of through knife members.



NO 667,996.

667,805. Signaling Apparatus. William A. Swaren, Chicago, Ill., assignor of one-half to Hamilton C. Kibbie, Oblong, Ill. Application filed January 2, 1900.

Movable conductive slides are each capable of a number of operative settings. A battery has electrical connection with circuit-closers adapted to engage with the conducting slides and a signaling device.

667,859. Ship's Telegraph. Frank W. Wood, Newport News, Va. Application filed July 11, 1900.

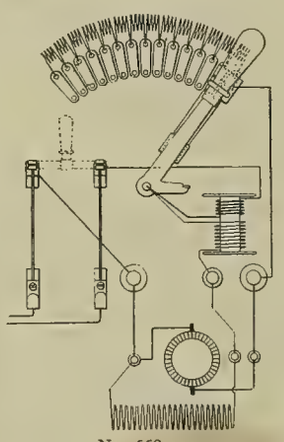
A signal-transmitting circuit is used to send signals from the bridge to the engine room, and the controlling mechanism of the engines is so connected electrically to another circuit that when the order has been correctly executed it is repeated automatically by an indicator on the bridge through the medium of the second circuit mentioned. (See cut.)

667,882. Feeder-wire Insulator. Charles K. King, Mansfield, Ohio. Application filed December 10, 1900.

The pin has one or more lugs at its end. The insulator has a central bore to receive the pin and one or more passages opening into the bore to permit the passage of the lugs. A washer retains the insulator upon the pin.

667,889. Electric Spark Coil. Stephen B. Morss, Rahway, N. J. Application filed March 21, 1900.

The coil embodies a hollow core in which a battery cell is placed. The winding surrounds the hollow cylindrical core.



No. 668,030.

667,903. Trolley Switch. Charles P. Cornell, Baldwinsville, N. Y. Application filed June 29, 1900.

A support has a fixed way with diverging flanges. A movable switch section between the flanges is provided with divergeing ways movable into and out of alinement with the fixed way. The switch section is held flexibly in one of its shifted positions, and forced to its other shifted position by the interposition of one of the flanges of the trolley.

667,904. Closed-conduit Electric Railway. Léon Dion, Boston, Mass., assignor to the Electrical Safety Traction company of West Virginia. Application filed August 6, 1900.

The surface conductor is composed of insulated sections, and is energized by a movable conductor contained in the closed conduit and arranged to be raised by a magnet carried by the car.

667,966. Elevated Electric Railway. Lewis A. Brown, St. Louis, Mo. Application filed October 22, 1900.

The invention deals with an elevated-railway truck, comprising a plate carrying a supporting plate movably mounted above it. Motors are carried by the plate for rotating a traction wheel carried by the first-mentioned plate. Guide wheels are suspended from the plate, and springs hold the guide wheels in position at all times.

667,980. Terminal Socket. Ernst W. G. C. Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric company of America, Chicago, Ill. Application filed October 11, 1899.

The socket is divided longitudinally into sections and arranged to be adjustable in size.

667,996. Transformer. Ferdinand Schwedtmann and Waldo A. Layman, St. Louis, Mo. Application filed June 1, 1900.

The insulation is composed of alternate sheets of smooth and corrugated insulating material, forming conduits for the passage of an insulating or cooling fluid. (See cut.)

668,022. Signal-controlling Relay. Herbert E. Shreeve, Dedham, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed October 1, 1900.

An iron core of annular cross-section surrounds one end of a central core but is magnetically separated from it. An armature is mounted at one end of the cores in the magnetic circuit of both. A helix for the central core wound over its non-surrounded portion excites it for the attraction of the armature. An auxiliary exciting helix for the annular core wound to excite it maintains the attraction of the armature.

668,030. Means for Stopping Electromotors. James J. Wood, Fort Wayne, Ind. Application filed October 15, 1900.

A magnet for a motor controller adapted to remain inactive during the normal range of current variations, and to respond to either a minimum or maximum current, has a double winding comprising a series coil and a shunt coil wound to receive currents in like direction so as to co-operate in the magnetization of the magnet, the former coil being connected in series with the motor armature and the latter in shunt so as to receive a counter current from the armature. (See cut.)

668,044. Telephone Switchboard and Circuit. Francis L. Gilman, New Bedford, and Charles H. Herzig, Boston, Mass., assignors to the New England Telephone and Telegraph company of New York. Application filed November 6, 1900.

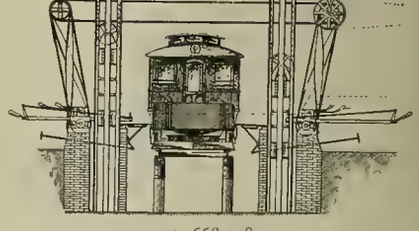
In a telephonic central-station switching system, regular switch sockets for a portion of the sub-station circuits are placed on the upper part of each section of the switchboard, and answering switch sockets for the circuits are grouped in the lower part of the sections, with line signals for the circuits associated with them. Special switch sockets for another portion of the sub-station circuits are also placed on the switchboard, between the regular and the answering sockets and the line signals, together with additional or answering sockets and line signals associated with them.

668,057. Trolley Wheel. Francis E. Shaughnessy, assignor to Thomas C. Knowles and George J. Thomas, all of Newton, Mass. Application filed July 17, 1899.

The trolley wheel is mounted on a spherical bushing so that it can rotate at various angles.

668,108. Transfer Apparatus for Electric Batteries. Cyprien O. Mailloux, New York, N. Y. Application filed December 29, 1899.

The subject of this patent is an apparatus for substituting one battery for another upon a vehicle. A transfer battery carrier has two or more battery-supporting shelves or sections and is adapted to change its position to allow a battery to be withdrawn from the vehicle on to one of the shelves and another battery to be shifted from another shelf to replace the one removed from the vehicle. Horizontally reciprocating rods mounted at the side of the path of the battery carrier shift the batteries to or from any shelf. (See cut.)



NO 668,108.

668,109. Storage and Transfer System for Electric Batteries. Cyprien O. Mailloux, New York, N. Y. Application filed April 24, 1900.

A battery carrier conveys batteries to and from the position occupied by a vehicle drawn by battery power. A transfer table moves to and from the battery carrier, and a transfer car carries the batteries between the table and a transfer rack. A motor mechanism shifts batteries to and from the transfer car and propels the car.

668,140. Rheostat and Circuit-breaker. Henry B. Cutter, Philadelphia, Pa., assignor to H. Ward Leonard, New York, N. Y. Application filed February 24, 1899.

A spring-actuated, resistance-controlling switch is in series with the contacts of the circuit-breaker, but mechanically independent. An electromagnetic device normally restrains the resistance-controlling switch.

DESIGN.

34,084. Bracket for Telephone Stands. Ray V. Griggs, Chicago, Ill. Application filed November 5, 1900. Term of patent, seven years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, MARCH 2, 1901. No. 9

Power Development on the James River at Richmond, Va.

The Virginia Electrical Railway and Development company of Richmond, Va., will commence the operation, about the middle of this month, of a waterpower plant absolutely modern and up-to-date, and in the construction of which so many unique and original features have entered that a description of it will prove of unusual interest.

The James River rapids at Richmond, Va., whose power will be developed, from time out of mind have been a fruitful subject of discussion for industrial writers, and if all that has appeared in print about the waterpower could be pasted together in one long column, it would probably reach from bank to bank of the river a dozen times. But while it is estimated that the river will yield about 22,000 horsepower, the citizens of Richmond have simply enjoyed, hitherto, the knowledge of their valuable possession, and listened to visitors' remarks upon it, and wondered that such power was not utilized to more advantage. but have never made use of more than one-quarter of the power for the development of the city. The Virginia Electrical Railway and Development company now controls practically the whole of this power, and is about to convert 14,000 horsepower into electrical energy.

The power station will be located just at the head of tidewater on the James River, on a site formerly owned by the Haxall-Crenshaw Flour company, once the largest establishment of its kind in the world. Between this site and the head of the rapids, or upper falls of the river, two miles above the city, there is an available head of 80 feet, but 25 feet of this head only will be used.

A dam, 1,600 feet long, of simple, concrete-masonry construction, with an average height of eight feet and width from seven to eight, equipped with a movable crest, will be thrown across the river, which will divert the whole of the ordinary flow of the river into a canal 2,200 feet long, leading to the power house. The site of the dam is shown in Fig. 3, on the next page.

In the contract drawings and specifications the dam consisted of a continuous concrete structure, built to an elevation one foot above the old Haxall dam. The short time in which these drawings and specifications were drawn up did not permit of a thorough study of the situation, and after such study was made, it was seen to be very advantageous to maintain a higher level of water above the dam than this structure would have done. A permanent structure, higher than the old Haxall dam, would, however, have entailed a threat of serious damage in extreme freshets to the property above the dam, mainly to that of the Tredagar company. The damage would even perhaps have been a serious question with the structure shown on the contract drawings, since it was intended to be one foot higher than the dam appurtenant to the property bought by this company, and since also the head-gates shut off a channel between Brown's Island and the North Shore, which was formerly a discharging arm of the river in times of freshet. On this account it was finally determined to change the form of the dam entirely and to build a masonry structure to a height one foot below the old Haxall dam, with piers at intervals built above the highest expected freshet level, and from a bridge on them to build piers to operate movable gates, which could be lowered to maintain the level desired in ordinary stages of the river, and which could be raised to allow a free discharge of the freshets without raising the freshet level above what existed formerly. This construction is shown in Fig. 4. There will be 10 horizontal headgates, 18 by eight feet, to control the flow of the water into the canal.

The section of the canal is rectangular, 50 feet wide by 13 feet high, with corners rounded with a three-foot radius curve, and a concrete lining throughout. The discharge of the canal will be 6,000 cubic feet per second, at a velocity of nine feet per second. The climate being very temperate and the water of a very high velocity, no provision has been made against anchor ice.

The construction of the power house (shown in Fig. 1) will be in several points in advance of the practice of the day. The superstructure is of concrete blocks, instead of brick, each block being molded before set in place, and as the work was unusual and peculiar, it was undertaken by the company instead of by contract. About 3,000 blocks were made and used.

Fig. 1. Power House.

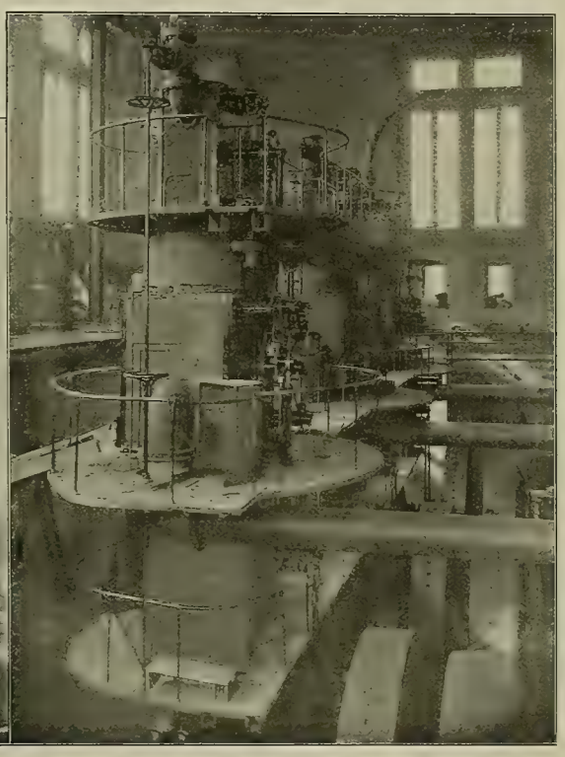


Fig. 2. Interior of Power House Showing Steam-engine Auxiliaries.

POWER DEVELOPMENT ON THE JAMES RIVER AT RICHMOND, VA.

Another distinctive feature is that the boiler room is directly over the wheel chambers. These chambers are formed by heavy arches, supporting the boiler-room floor, and the arches are supported on intermediate pillars. There will be eventually 12 pairs of Stilwell-Bierce & Smith-Vaile turbines, 51 inches in diameter, working under a 25-foot head, and each pair will develop 1,200 horsepower when running at 140 revolutions per minute. The wheels discharge into draft tubes formed in the concrete, turning almost a right angle by an easy bend, and thence running under the floor of the generator room to the tail race. A draft tube is illustrated in Fig. 5.

Each pair of turbines will be direct-connected to a 700-kilowatt, 550-volt, 14-pole, compound-wound, direct-current unit (running, of course, at 140 revolutions per minute). These machines are of the latest railway type, and are furnished by the General Electric company, under rigid guarantees in regard to overload capacity and heating effects of the armature and field coils and of the commutator. The machines furnish current for street railway and power, and by use of two balancing sets, a 235-470-volt, three-wire system for light and power is obtained.

The switchboard is built of black, marbleized slate, having three sets of bus-bars and the necessary switches, wattmeters, etc., for control and regulation of the different feeders and systems. There are altogether 36 panels in the board, consisting of nine railway feeder panels, one wattmeter panel for the railway, 10 generator panels, one booster panel, two balancer panels, one wattmeter panel for the light and power, and nine feeder panels for light and power.

Owing to the droughts which sometimes visit Virginia, and also to back-water in time of flood, an auxiliary steam plant is being installed.

The initial installation in the boiler room consists of two batteries of Babcock & Wilcox water-tube boilers, two boilers to a battery, each boiler capable of delivering 520 horsepower, or a total installation of 2,080 horsepower at a normal rating and at 150 pounds' steam pressure. These boilers will draw into a stack made of solid concrete (Fig. 1), 175 feet high above the grate bars and 11 feet inside diameter. The room will be entered by a track, and coal will be dumped from cars before the grates. For the feed water two 10 and 6 by 12-inch duplex Knowles steam pumps were installed, feeding through a Berryman heater.

From the boilers the steam is carried into a 14-inch steam header, located in the generator room on brackets placed on a partition wall, and thence to the engines. Directly underneath the steam header is the 36-inch exhaust header. Three feet over the top of the latter header is a gallery from which are operated the different valves of the steam and exhaust headers.

Each armature is mounted on a shaft driven on one side by an engine or on the other by two turbines, as may be necessary. The engines (Fig. 2) were built by the E. P. Allis company, and are tandem - compound, steeple, condensing, of 1,200 horsepower each, having cylinders of 20 inches' and 40 inches' diameter by 42 inches' stroke. The condenser, made by the Henry R. Worthington company, is located in the condenser pit on the outside of the building. An air pump and a centrifugal pump, in the generating room, are part of this equipment.

Starting from the station, an underground and overhead system was put in. The ducts of the underground system were manufactured by John T. McRoy, and are both four and six-duct conduits, all of six-foot lengths, laid in sections of 64-duct 36-duct, 24-duct, 16-duct, 12-duct and 10-duct, starting from the 64-duct at the station and decreasing in size from one manhole to another, till they drop to the 10-duct at the furthest manhole.

The feeder cables of the underground system were manufactured and installed by John A. Roebling's Sons company; they are rubber-covered, lead-encased, and range in size from 250,000 circular mils to 600,000 circular mils, with a length of about 25,000 feet.

The underground mains are 200 Edison main tubes, of which there has been installed about 70,000 feet. The overhead feeders have a length of about 50,000 feet and range in size from 250,000 to 500,000 circular mils. The overhead mains have a length of about 30,000 feet, range in size from No. 4 B. & S. to 250,000 circular mils, and are connected to the underground mains at three points.

The power house occupies an ideal and a very unusual location for a central waterpower station,

the center of distribution of power and light being not more than half a mile away.

The Virginia Electrical Railway and Development company, as its name implies, will make development a feature. In connection with the riparian rights, the company purchased large tracts of land on both sides of the river, and, following the plan of the Niagara plant, will inaugurate a similar system of making business by offering these tracts, which are crossed by two great railroads and

FIG. 3. POWER DEVELOPMENT ON THE JAMES RIVER AT RICHMOND, VA.—SITE OF DAM.

accessible by several others and steamship lines, free to manufacturers who will locate thereon and use a sufficient amount of power, rental of land being covered by rental of power. Power will be furnished at low rates. These tracts are forever free from municipal taxation. Already the company has been the means of inducing a bag factory to locate there.

As said above, the company controls practically the whole of the 22,000 horsepower of the river, and in view of the opportunity it will afford to economize by means of electrical intermediates applied to street railways, street lighting and the multifarious industries, great and small, of a city already conspicuous for its manufactures, the prospect of the company is exceedingly bright.

Contracts have been made with the largest manufacturing enterprises, hotels and consumers in the city, among which may be mentioned the Richmond Traction company, Richmond Locomotive and Machine Works, William R. Trigg Ship Yards, Jefferson Hotel, Murphy's Hotel and all of the department stores. The station will therefore be the great hub from which will diverge innumerable spokes of industry.

The company is capitalized at $1,000,000, and has a bonded indebtedness of $1,500,000. Mr. E. L. Bemiss, vice-president and general manager of the Edison Electric company of New Orleans, La., one of the ablest and most successful business men of the South, is president. Mr. W. M. Habliston, vice-president, is also vice-president of the National

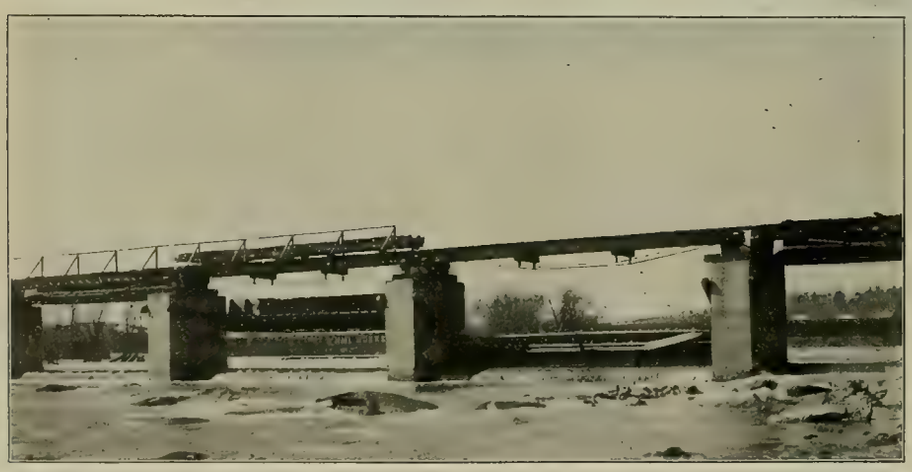


FIG. 4. POWER DEVELOPMENT ON THE JAMES RIVER AT RICHMOND, VA.—VIEW OF DAM, SHOWING MOVABLE CREST.

Bank of Virginia. Mr. Everett Waddey is secretary.

In the construction department, Mr. Reuben Shirreffs, formerly hydraulic engineer of the Chesapeake and Ohio railway, and recently of the Metropolitan board of Boston, a man of distinguished ability, is chief engineer. Edward J. Willis, inventor of the Willis planimeter, and one of the best construction engineers in the country, was steam and electrical engineer during the early part of the work. Mr. J. P. Pope, formerly with the New Orleans Edison Electric company, is superintendent, and adds to a thorough technical knowledge a practical experience of several years.

Throughout the work Mr. Frederick Sargent of Chicago has been consulting engineer.

The Field for Telegraph Inventors.

Seemingly an attractive field for young inventors during the last two or three years has been the devising of printing-telegraph systems and apparatus intended to effect great improvements over the present methods of telegraphy. One of the latest of these inventions has been produced in Omaha and is known as the Pearne printing telegraph. This apparatus, which was mentioned in a recent issue of the Western Electrician, depends for its operation on "four grades of currents supplied by storage batteries at either end of the line." Although a test of this system is said to have resulted successfully on a 554-mile line, it is perhaps doubtful if the invention possesses the characteristics of simplicity, accuracy and cheapness, which are necessary to the construction of an apparatus that will prove commercially practicable.

Discussing the subject opened by a consideration of the inventor's efforts to introduce radical improvements in methods of telegraphy, a prominent telegraph engineer made some interesting observations in conversation with a representative of the Western Electrician. "When Morse invented his telegraph key and sounder," said he, "and paved the way for reading by sound, he produced probably the simplest system that could be devised, and a system which has stood the test of years. The country is to-day covered with an army of skilled telegraph operators, and to introduce any one of the many so-called 'revolutionary' telegraph systems that are being put forward would necessitate either the employment of new help or the training of old employes, and this would scarcely be compatible with present conditions. Then, too, the substitution of more complex and necessarily more expensive devices at each telegraph station would mean a very large initial expenditure, and the doubtful advantages gained in the automatic recording of messages and possibly more rapid transmission would be more than offset by the expense of keeping the systems in repair. It would be well for the many inventors who aspire to produce efficient and economical telegraph apparatus and who, as a rule, are unfamiliar with the conditions met with in the operation of a successful telegraph system, to make a thorough study of the situation and seek the advice of experienced telegraphers before they devote their time, money and energy to the peffection of apparatus which in itself may be interesting as a mechanical or electrical contrivance, but which is destined to find no place in the commercial field of telegraphy."

The Enclosed Arc Lamp Patents.

Considerable interest has been aroused by the announcement that the General Electric company has secured control of the Marks enclosed-arc-lamp patents. One manufacturer points out that the continental patents anticipate the Marks patents by one year. Another believes that the General Electric company would not have bought the patents unless convinced that they were valid and thinks that all manufacturers of enclosed-arc lamps except the few licensed companies will be prohibited from manufacturing enclosed lamps.

Mr. Conway Robinson of Elwood, Ind., when asked for his opinion of the situation, said: "The

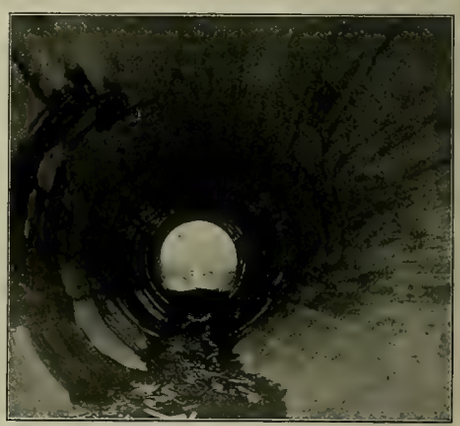


FIG. 5. POWER DEVELOPMENT ON THE JAMES RIVER AT RICHMOND, VA.—DRAFT TUBE IN POWER HOUSE.

Marks patent on enclosed-arc lamps, as I understand it, covers a 'gas check' in the passage for the egress of gases from the inner globe, and several ways of constructing this gas check. This passage is usually the hole through which the movable carbon enters the inner globe. Any lamp which has a simple hole through the inner-globe plate for the passage of the movable carbon, and no gas-check arrangement, evidently does not infringe this patent. It seems, however, that as the patent is quite broad and clear it will affect those manufacturers who have been using devices made on the principle of the gas check. The patent will probably not give a control or monopoly of the enclosed-arc-lamp business. It is possible to use a plain, round hole, which, however, gives inferior results, or two or three other methods of construction. One of these devices, recently invented by me, gives even better results than any device heretofore brought out, and yet operates on a different principle. As the necessity arises, it is probable that still other methods of accomplishing the same result will be devised by others. There are at least two of these methods which suggest themselves and are evidently practicable."

Canadian Electrical Association.

A meeting of the executive committee of the Canadian Electrical association took place at Montreal on February 12th, at which arrangements were made for the annual convention to be held at Ottawa. It was decided that the dates of the convention should be June 19th, 20th and 21st. A local committee was nominated to arrange for papers and topics for discussion, and also to make the necessary arrangements for the meeting, which gives promise of being a most successful one.

Improvements in the Service of the Chicago City Railway Company.

On Friday, February 22d, the five new cars recently received by the Chicago City Railway company were put into service, their first duty being the transportation of a party of prominent city and railway officials on an inspection trip over a part of the route which will be served by the new rolling stock. The cars are built after designs by Captain Robert McCulloch, general manager of the road, and are put on largely as an experiment. If they prove acceptable to the public and are successful in the busier thoroughfares, it is the intention of the company to increase the number. Fig. 1 is an outside view of one of the cars, showing the substantial construction and graceful lines embodied in the design.

Besides their unusual size, Captain McCulloch has embodied in the new cars some novel features of construction, which are of interest. The main sills are each built up of two 8 by 2½-inch channel irons, mounted to form a double channel, but with sufficient space left between them to receive the window sash when dropped. This enables the arm rail of the window casing to be placed only 25 inches from the floor, as the sash may be dropped several inches lower than is possible in other cars. By this means it is intended to make the equipment equally serviceable for summer and winter use.

The new cars are 47 feet over all, with 34-foot bodies, and the outside width is eight feet seven inches. The seats are arranged crosswise, 13 on each side, giving seating room for 52 persons. The interior is finished in mahogany, with the ceiling decorated in white, and the lights, 18 in all, are arranged along the sides below the ventilators, as shown in Fig. 2, which gives a good general idea of the interior arrangement. The window posts contain push-buttons for signaling to the conductor, and the car is heated throughout with electric radiators. The curtains are of pantasote. The vestibules on both platforms are stationary, and are fitted with double folding doors, which will be replaced by gates during warm weather. The headlights are placed underneath the hood and inside the vestibules, directly over the head of the motorman. The cars are mounted on double trucks, fitted with 33-inch wheels. Four G E 67 motors are used for each car, each rated at 38 horsepower, and these are connected to a G E K12 controller. Two trolley poles, the bases for which are shown in Fig. 1, are provided. The equipment includes Christensen air brakes. The prevailing color of the exterior is red, with trimmings in yellow. The new cars will be put on the Wentworth Avenue and Halsted Street lines for weekday service, and on Sundays they will run on Indiana avenue between Eighteenth and Fifty-first streets.

The placing of these cars in service is the first

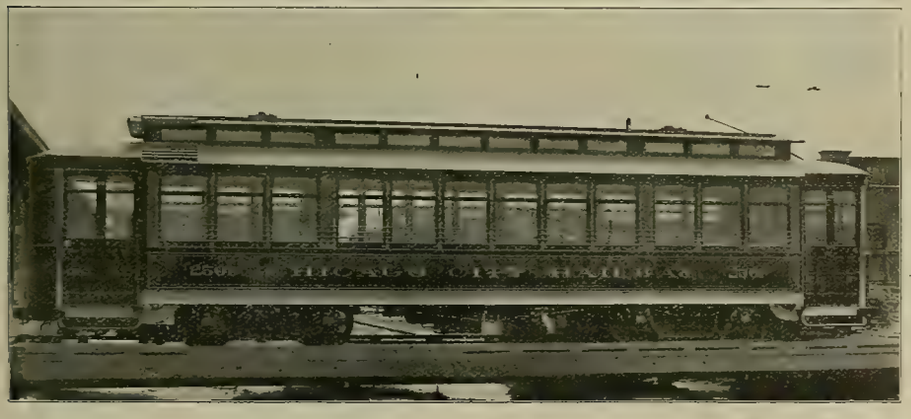


FIG 1. IMPROVEMENTS IN THE SERVICE OF THE CHICAGO CITY RAILWAY COMPANY.—NEW TYPE OF ELECTRIC CARS.

of a number of improvements contemplated by the Chicago City Railway company, if it can obtain a franchise extension including permits for the conversion of the existing cable lines to the overhead-trolley system. The Wabash avenue and State street cables are now overloaded by the necessity for hauling the heavy Indiana avenue and Archer avenue motor cars as trailers north of Eighteenth street, and the officers of the company contend that the temporary trolley line on State street two years ago gave conclusive evidence of the improvement in service that could be effected by the change. The additional changes proposed by the company are a loop for the Wentworth avenue and Halsted street lines in Madison, Dearborn, Washington and Clark streets, to abolish the switching necessary at present, and the erection of a single central power station at Thirty-ninth and Halsted streets, as already announced in the Western Electrician. In all, the proposed improvements will involve an expenditure of about $8,000,000. To provide funds for this work, D. G. Hamilton, president of the company, states that it must be possible for the company to finance 20-year bonds, necessitating a renewal of franchises for from 20 to 30 years, according to the rate of compensation demanded.

Lease of the Consolidated Street Railways of Cincinnati.

One of the most important street-railway transactions ever recorded in Ohio was completed on February 21st by the signing of the papers leasing the properties of the Cincinnati Street Railway company to the Cincinnati Traction company. The officers of the latter company, incorporated with

FIG. 2. IMPROVEMENTS IN THE SERVICE OF THE CHICAGO CITY RAILWAY COMPANY.—INTERIOR OF NEW CAR.

a capital stock of $2,000,000, to operate the street-railway lines of Cincinnati, are as follows: President, Hugh J. McGowan, president of the Indianapolis Street Railway company; vice-president, J. Benson Foraker, Jr.; secretary and treasurer, W. T. Irwin; executive committee, W. Kesley Schoepf, Hugh J. McGowan and W. T. Irwin. The first-named gentleman in the list is a well-known street-railway man, having in the past had charge of the properties of the large railroad companies in Pittsburg and Washington. The directors are William L. Elkins, P. A. B. Widener, Randal Morgan, Hugh J. McGowan, W. Kesley Schoepf, William Cooper Procter, W. T. Irwin, Jacob G. Schmidlapp, J. B. Foraker, Jr., H. M. Levy and David G. Edwards. The superintendent of the new company is John Harris.

A meeting of the stockholders of the Cincinnati Street Railway company at the offices resulted in an almost unanimous vote to lease the property to the new company, and after the meeting adjourned the papers were signed by the officers of both companies. The property passing under the control of the new company is worth about $20,000,000. The terms of the contract are that the new company shall pay the old company 5¼ per cent. on its capital stock the first year, 5½ per cent. the second year, 5¾ per cent. the third year, and six per cent. per annum thereafter. In addition, $10,000 per annum will be paid for the maintenance of the old company and its expenses. All expenses for maintenance and extensions will be paid by the new company. It is asserted by Mr. Morgan and other representatives of the Philadelphia syndicate that a central power house will be built close to the Ohio River, for the reason that coal can be secured economically there. The capital stock will in all probability be increased as rapidly as money is needed for the operation of the plant, but, while the Elkins-Widener-Morgan-Dolan syndicate will keep sufficient to control the business, a great deal of the stock will be sold to Cincinnati parties, if they wish it. The lease has been recorded and a check for $1,400,000 has been forwarded to pay for the stock taken by the Philadelphia syndicate in the new company.

It is stated that the action of the stockholders was due to the determination of Mr. Kilgour, president of the Cincinnati Street Railway company, to resign from active management of the company and their inability to find a suitable successor.

Pole-climbing Contests of Signal-service Men.

The Military Athletic League of North America, under whose direction the annual military tournament at Madison Square Garden, New York, is held, is this year going to repeat the electrical contests between the signal-corps men of the National Guard. The contests last year were among the most spectacular and spirited events of the tournament. The underlying principle and object of these contests is to interest the men of the Signal Service in rough electrical-construction work in the field—not an easy task when it is considered that the majority of the members are without any electrical experience, except what they may acquire in connection with their training as signalmen. The contests have had the effect of stimulating interest, because they appeal so strongly to esprit du corps—a most powerful incentive to action for soldiers always. The contests thus far have been confined to pole climbing, using ordinary climbers and following the methods of the professional linemen, yet they have been the means of

TROPHY WON BY CORPORAL M. C. SULLIVAN IN POLE-CLIMBING CONTEST.

creating a lively interest in all branches of electricity as applied to army signaling.

The first event of the kind ever held in the world took place at Madison Square Garden, New York city, last spring, in the presence of General Miles, Governor Roosevelt and 20,000 people. It was won by the team representing the First Signal Corps, National Guard of New York, stationed in New York city. This was a team affair, in which six men of the First Corps competed against six men of the Second Corps, National Guard of New York, stationed in Brooklyn, the trophy being a silver cup. The winning team was composed of Corporals M. C. Sullivan, R. H. Gray and E. J. Carney and Privates E. J. Barker, C. Mulliken and A. D. Proudfit.

The next event was an individual affair and occurred in connection with the interstate military tournament, held at West End, N. J., last August, and was won by Corporal M. C. Sullivan of the First New York Corps, Corporal F. W. Smith, Second Signal Corps, National Guard of New York, being second. The trophies were medals, gold for first prize and a silver one as second prize. These medals are believed to be the first ever competed for under military orders in which electricity is concerned. The accompanying illustration shows the design of the medals. Corporal Sullivan has been very active in this work, and he has been enabled to instill into his comrades a good deal of active working knowledge which will be of much importance to them should the country ever need their services in the field.

Waterpower Privileges as Riparian Rights.

In the Supreme Court of the state of New York Justice Childs has rendered a decision that is of far-reaching importance. It has to do with the taxation of waterpower companies and their rights. The case in which the decision has been rendered is that in connection with the city of Niagara Falls, through its board of assessors, and the Niagara Falls Hydraulic Power and Manufacturing company. In the matter of waterpower development Niagara leads the world, and naturally any question that affects the power companies there or has to do with the taxation of their rights has an especial significance everywhere power is developed from a stream.

The assessors of Niagara Falls levied an assessment of $825,000 on the Niagara Falls Hydraulic Power and Manufacturing company, and this the company attempted to have reduced to $337,000 by appeal to the court. In order to secure this reduction of nearly a half-million dollars, the company secured a writ of certiorari, the contention of the company in the certiorari proceedings being that the right to draw water from Niagara River is a franchise, and as such is not assessable; that the assessment of its property as a whole, including such water rights, is illegal; that its property must be treated as though no water right or privilege was attached to and used in connection therewith; that the true basis for assessment is the cost of reproducing the company's property, exclusive of any water right.

Judge Childs gave a full description of the company's property and also outlined the company's contention as above described, and, on the facts before him, rendered a decision which at Niagara Falls is deemed of great importance.

In his decision Justice Childs says:

"The relator (the company), as riparian owner and owner of lands under the waters of Niagara River, adjacent to its uplands, from which the water is immediately taken, has the right to the use of the waters of the river for manufacturing purposes and to divert the same for that purpose, returning it to the river, as it does, after passing over its own land * * * * * [cases cited], subject only to the paramount right of the state to utilize these waters for a public use, without compensation to such riparian owners, all riparian rights remaining unimpaired until the exercise of such paramount right by the state. This being so, it appears that the relator, as riparian owner, has the right to take waters from the Niagara River for manufacturing purposes, not interfering thereby with the navigability of the stream, such right being in no sense in the nature of a franchise by a corporeal hereditament, nor depending either upon grant or prescription, * * * * and this view of the relator's rights is confirmed by the act above quoted [act of 1896], which, in terms, confirms and defines the riparian rights of the relator, and is wholly inconsistent with the claims of the relator as to the nature thereof. The fact that the state might destroy relator's riparian rights does not convert such right into a mere franchise. Interference with the relator's rights by the state is a contingency too remote to require serious consideration.

"We learn from the map in evidence that Niagara River at all the points affected by the extent of the relator's rights is an unnavigable stream and will so remain; and when it is considered that not even the state is at liberty to interfere with the riparian rights of the relator arbitrarily, but that such interference, if attempted, must be in the interests of some substantial right of the state affected by the exercise of the right of the relator to use the waters of the river, the claim of the relator appears to be wholly unfounded.

"Having reached the conclusion that the relator, in the use of the waters of the river, is in the enjoyment of its riparian rights, acquired before 1896 and confirmed by the act of the Legislature of that date, it became unnecessary to examine the other question argued.

"The stipulation of the parties submitted on this argument to the effect that 'if it is decided as matter of law that the relator's water rights and rights to take water from the Niagara River are elements which the assessors may have properly considered in fixing the valuation upon relator's said property, the assessment made by them of relator's said property for the year 1900 shall not be reduced,' renders it unnecessary to examine the basis upon which the assessors have fixed the value of the relator's property, and included the same in the roll.

"The relator's writ should be quashed and set aside, with costs to the defendants."

By this decision, it will be seen, waterpower privileges may be assessed as riparian rights pertaining to the property to be taxed.

National Electric-light Convention to Be in Niagara Falls.

Contrary to the custom of the last few years, by which the annual meetings of the National Electric Light association have been held in Chicago and New York alternately, the convention of this year will be held at Niagara Falls, N. Y. Following the custom, the meeting would have gone to New York this year, but doubtless the change in plan may be ascribed to the Pan-American Exposition at Buffalo. The date of the meeting is May 21st, 22d and 23d, and the headquarters of the association will be at the International Hotel.

United States Steel Corporation.

The combination of the large steel interests of the country was given definite form on February 25th by the incorporation of the United States Steel corporation in New Jersey, with a nominal capital of $3,000. The incorporators are Charles C. Cluff, William J. Curtis and Charles MacVeagh. The objects of the corporation, as set forth in the charter, are broad in scope, and include a general mining and manufacturing business in iron, steel and copper, the ownership and development of mining and timber lands, including coal properties, and the construction and operation of railroads and canals, together with the necessary equipment, excepting that the corporation may not operate a railroad or canal in New Jersey. The right is reserved to increase the capital stock at any time.

It is understood that the total issue of the company's securities will amount to $1,100,000,000, $300,000,000 in five per cent. bonds, $400,000,000 of seven per cent. preferred stock and $400,000,000 of common stock. It is announced that in addition to the steel properties already mentioned in the Western Electrician as being involved in the combination the Morgan interests have secured the Dominion Iron and Steel company of Sydney, N. S., for a consideration of $56,500,000.

Iowa Electrical Association.

The first annual convention of the Iowa Electrical association was held at the Savery Hotel at Des Moines on February 20th and 21st. Under the general topic, "Central-station Heating—Mechanically and Financially," three papers were delivered as follows: "The Evans System," by D. F. McGee of Red Oak; "The Holly System," by J. W. Walsh of Davenport, and "The Yaryan System," a paper written by C. C. Hammond of Mason City and read by W. B. Keffer. Discussions were led by J. S. Bellamy of Knoxville on "The Gasoline Lamp," and by O. T. Watkins of Oskaloosa on "The Renewal of Incandescent Lamps." Other papers presented were: "The Regulation and Control of Wiring," H. S. Towners, Des Moines; "An Analysis of the Cost of Supplying Current and the Various Systems of Rates," Isaac B. Smith, Cedar Rapids, and "The Operation of Massachusetts Law," by L. W. Reynolds of Boone. There were informal discussions on "Experiences with Mechanical Draft," "Pounds of Coal Required to Produce One Kilowatt-hour," and "How Can Delinquent Bills be Prevented Without a Net Loss of Business?" About 25 members attended the convention, and the former officers were re-elected as follows: President, W. J. Greene of Cedar Rapids; vice-president, H. H. Caughlan of Ottumwa; treasurer, George S. Carson of Iowa City; secretary, W. B. Keffer of Des Moines; executive committee, the officers and C. H. Walsh of Burlington, L. W. Reynolds of Boone, and W. S. Porter of Eldora.

The arrangements being made for the inauguration of President McKinley at Washington on March 4th include an elaborate court of honor, beginning at the Treasury building and extending to Seventeenth street, along Pennsylvania avenue. The court will be elaborately lighted at night by electricity, and the lighting scheme will take in the White House.

Lehigh Telephone Company's Exchange at Allentown, Pa.

The Lehigh Telephone company has for the last year operated an Independent telephone system in Allentown, Pa. It was incorporated September 13, 1899, with Thomas Dougherty as president; Wilson J. Hartzell, vice-president; F. S. Hersch, treasurer; Fred E. Lewis, secretary, and F. A. Demarest, manager. The outside construction work was begun on January 3, 1900, and the work was carried forward at so rapid a rate as to permit of the first instruments being installed about April 1st, at which time Mr. Demarest had already placed 800 poles throughout the city of Allentown, 30 of which were 70-foot distributing poles. The system is further equipped with 12 100-pair aerial cables, these being divided into 15 or 20-pair cables for entering the different distributing boxes. Another cable of 75 pairs was run about five miles to Catasauqua, an adjoining town.

Before all of this work had been done, however, the Lehigh Telephone company, through its engineer and manager, Mr. Demarest, made a careful test of all apparatus submitted for use in connection with the exchange equipment. The result of this test was that the American Electric Telephone company of Chicago was awarded the contract for supplying the entire equipment of telephones, switchboards, terminal heads, power board, etc. The switchboard selected was of the magneto-call type, with electric-light, clearing-out signals, and, as is shown by Fig. 1, it is of the multiple type, having an ultimate capacity for 3,000 subscribers' lines. Fig. 2 gives a partial view of the back of the switchboard, while Fig. 3 shows the terminal board, and Fig. 4 illustrates the power switchboard, together with the combined battery-charging and ringing machines.

FIG 1. LEHIGH TELEPHONE COMPANY'S EXCHANGE AT ALLENTOWN, PA —SWITCHBOARD AND CHIEF OPERATOR'S DESK.

The telephones were especially manufactured according to specifications drawn by the Lehigh company's engineer, and the instruments are made with the special object in view for giving service to three, five or more subscribers connected upon one circuit. As a matter of fact, there are only about 150 exclusive lines used throughout the city, the balance being three and five-party lines, the following rates prevailing:

Five-party lines	Business, $18;	residence, $12
Three-party lines	Business, 24;	residence, 18
Exclusive lines	Business, 36;	residence, 24

When the Lehigh Telephone company began doing business it purchased an entire building for its headquarters. The operating room occupies the front of the second floor, with the distributing room and power room in the rear, while the directors' room, offices and work rooms are located upon the first floor.

The cables enter the building under ground, through conduits, and are distributed to the well-known Burns type of combined sneak-current and carbon lightning-arrester terminal. The cross-connecting board, as shown by Fig. 3, consists of an iron frame, to which are fastened hard-rubber strips holding in place double-end connectors, and, as shown by the illustration, the distributing-board

cables are connected to the terminal heads overhead. The switchboard cables pass down under the floor and terminate at the main switchboard in the bottom of the intermediate distributing board, as shown by Fig. 2. These cables, after being connected across to the terminals on the intermediate board, pass through the multiple cable in regular order. Referring to Fig. 2, it will be observed that immediately above the intermediate distributing board are mounted the lamp-signal relays, while above the relays are the hand generators and the cord-connecting rack. A little further up it will be observed that the multiple cables are placed upon a substantial supporting frame-

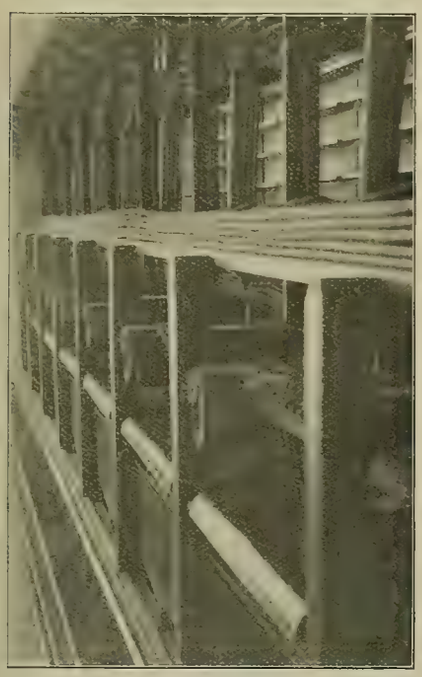


FIG. 2. LEHIGH TELEPHONE COMPANY'S EXCHANGE AT ALLENTOWN, PA —BACK OF SWITCHBOARD.

work; then clear up under the top of the switchboard are the induction coils, as also the line signals, together with their connecting cables.

The front of the switchboard and the chief operator's desk are shown by Fig. 1. The switchboard is built from the finest grade of selected mahogany with a special rubbed finish. As will be observed, the spaces provided for additional multiple jacks are closed by removable panels, these panels being separated by white-holly-faced parting strips. The

FIG. 3. LEHIGH TELEPHONE COMPANY'S EXCHANGE AT ALLENTOWN, PA.—TERMINAL BOARD.

combined ringing and listening keys are mounted upon a key table, which may be swung up, and thus permit of ready access to the circuit-changing keys, for the purpose of inspection or repairs. Behind the keys are placed the connecting cords, and behind these, again, the electric-light, supervisory, clearing-out signal. The small-lamp fronts shown above the clearing-out signals are used for pilot signals. These signals light up whenever a shutter falls, and thus indicate an incoming-call signal.

The chief operator's equipment, shown to the left of Fig. 1, comprises a complete system of electric-light signals, listening-in keys and trunking circuits, etc., permitting the chief operator to have complete control over the operators.

Fig. 4 gives a view of the power board and charging machines, as also a partial view of the storage batteries. At the top and sides of the switchboard there is a series of resistance lamps. These lamps are so connected that when an operator at the main switchboard signals out over a circuit, the signaling current must pass through both lamps in series. When signaling is done on direct circuits, but when party-line bells are required to be operated, a pulsating current is used and permitted to pass through only one of the lamps. This is done because the ringing generator delivers 80 volts from the alternating-current winding and only 40 volts from the pulsating-current winding. The power board is also equipped with a voltmeter and ammeter, as shown. The large central switch is used for the purpose of cutting the main supply current from the driving motor. There are also all necessary switches for controlling the current supply. The dynamotor consists of two Crocker-Wheeler machines, one a 1½-horsepower, 500-volt motor, provided with a separate winding for furnishing the power for ringing purposes, which is an alternating one, and which, by a suitable system of commutation, is transformed into a pulsating current. Connected to this machine by means of a slip coupling is a compound dynamo, one winding giving 20 amperes at 10 volts and another 10 amperes at five volts, both of these windings being used for charging storage batteries.

At the present time the Lehigh Telephone company has about 1,100 telephones connected to its switchboard, and additional subscribers are being cut in every day. The company is building a number of toll lines, and at present has lines to the following-named places: Slatington, Cherryville, Macungie, Emaus, Dorneyville, Wescoesville, Kutztown, Cementon, Coplay, Egypt, Rittersville and a number of intermediate points. The Lehigh Telephone company's construction work and equipment is first class in every particular, and with the proposed extensions it will rank with the strongest Independent companies in the country.

National Carbon Company.

At the annual meeting of the National Carbon company, on February 25th, it was shown that the net earnings of the company in 1900 were $508,739, as against $451,687 in the preceding year. After deducting $315,000 for preferred stock dividends on the $4,500,000 of preferred stock, $150,000 for depreciation and $1,456 for doubtful accounts, there was a balance to surplus of $42,283 for the year. This is less than 1 per cent. on the $5,500,000 common stock. In two years the company has turned over to surplus $78,386.61. President Parmelee, in his address to the stockholders, spoke of the increased demand for carbons for enclosed-arc lamps and the falling off in the open-arc-carbon business. The recent growth of the telephone industry has increased the company's business in batteries and telephone specialties to such an extent as to require the construction of additional factory facilities at Cleveland. A new and large use for carbon has come with the development of the business of the electrical smelting of aluminum and other metals, and the company has acquired a good market for these carbons. The following-named officers and directors were elected: President, James Parmelee; first vice-president, Myron T. Herrick; second vice-president, Webb C. Hayes; treasurer, H. E. Hackenberg; secretary, Henry J. Davies; general manager, D. D. Dickey; directors, John S. Bartlett, Lynn, Mass.; N. C. Cotabish, Cleveland; J. S. Crider, Pittsburg; D. D. Dickey, Pittsburg; H. E. Hackenberg, Cleveland; Hugh H. Hamill, Trenton, N. J.; Webb C. Hayes, Fremont, Ohio; Myron T. Herrick, Cleveland; C. H. Matthiessen, Chicago; James Parmelee, New York; A. M. Young, New York.

Electric-lighting Competition Suggested in Chicago.

A number of property owners on North avenue, Chicago, sent in a petition to the City Council about a month ago for permission to lay the necessary pipes, wires and conduits for the operation of an electric-lighting station. The petitioners desire to furnish their own light from a plant to be erected at their own expense and to compete, necessarily, with the Chicago Edison company, the Edison rates being regarded as unequal and too high. The ordinance, which is to run for 10 years only, provides for a 10 per cent. compensation to the city, obligates the company to build the plant within six months, prevents the company from selling out and provides that the city may buy the plant at any time it chooses on terms to be fixed by arbiters. The ordinance is at present in the custody of the council committee on gas and electric lighting, and may not be passed.

Mr. Yerkes Sells His Chicago Street-railway Holdings.

The sale of the holdings of Charles T. Yerkes in Chicago elevated and surface railways was accomplished early in the week by the signing of the contracts transferring Mr. Yerkes' remaining interests to a syndicate headed by Thomas Ryan and Blair & Co. of New York and the Illinois Trust and Savings Bank of Chicago. The sale involved controlling interests in the Lake Street, Northwestern and Union Elevated Railroad companies and also a large block of the stock of the Chicago Union Traction company. Since the Suburban railroad has virtually been sold to the Metropolitan West Side Elevated Railroad company Mr. Yerkes will no longer hold any interest in traction properties in Chicago. It is announced that the consolidation of the elevated-railway systems of the city will shortly be undertaken, but it is believed that while this combination will be of benefit to the Union Traction company, the latter will not be directly involved in it. The price paid for Mr. Yerkes' elevated-railroad holdings is said to have been $5,000,000 and for the purchase of his Union Traction interest about $1,000,000. It is believed that Mr. Yerkes will give his entire attention for the next few years to his electric-railway projects in London.

Westinghouse Electric and Manufacturing Company.

At a meeting of the stockholders of the Westinghouse Electric and Manufacturing company, held in Pittsburg on February 19th, it was decided to increase the capital stock $10,000,000; making the

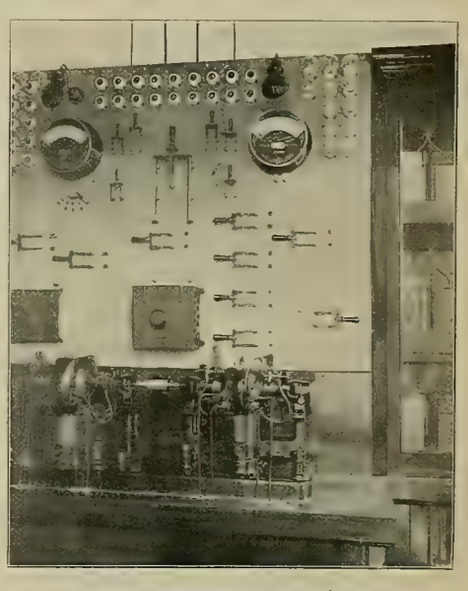


FIG. 4. LEHIGH TELEPHONE COMPANY'S EXCHANGE AT ALLENTOWN, PA.—POWER GENERATORS AND SWITCHBOARD.

total authorized issue $25,000,000, including the $4,000,000 first preferred. It is not proposed to sell more than $3,000,000 of the authorized new stock at this time. On March 31, 1897, the surplus of the company was $2,401,664; on December 31, 1900, the surplus balance amounted to $4,693,197, after having written off from current earnings $2,786,719 and paying, in addition, interest on debenture certificates, collateral trust bonds, dividend scrip and other indebtedness, $891,293; dividends on preferred stock, $1,049,122; dividends on assenting stock, $605,513. The net sales have been as follows: For the year ended March 31, 1898, $4,378,060; 1899, $2,901,760; 1900, $11,963,646. It is thought that this latter figure will be considerably exceeded during the fiscal year ending March 31, 1901. The company has a cash investment of $750,000 in the British Westinghouse Electric and Manufacturing company's stock, as well as other European investments.

Progress at Pan-American Exposition.

The electric wiring of the grounds and various buildings of the Pan-American Exposition at Buffalo is said to be progressing satisfactorily. The Machinery building is complete, so far as the wiring is concerned, and half of the lamps for it are in place. The Electricity building and the Agricultural building have been completed and are ready to light up. On the electric tower a large force of men is keeping up with the construction work, and the structure is being brought to a state of completion. In the courts and canals, in fact, all the open areas, a large amount of underground wire is being laid to serve the lighting posts, each of which will have from 26 to 100 incandescent lamps. The number of incandescent lamps to be used in the exterior lighting effects will be over 500,000.

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The decision of Judge Brown in the Berliner transmitter case gives a sweeping victory to the Independents. The judge's language is very emphatic:

"The patent discloses nothing patentable as an art, method or mode of operation."

"The attempt to expand Berliner's unsuccessful experiments and caveat first into an invention and next into a broad claim for an art, method, principle or process exhibits a remarkable degree of ingenuity, but is not convincing."

"The defendants owe nothing to Berliner."

The court shows that at the date of the application in 1877 Berliner had not made the invention covered in the patent issued in 1891. In other words, Berliner "did not, at the date of the application, intend to describe a speech transmitter." In addition, basic features claimed for the Berliner patent are shown to have been anticipated by early patents of Bell and Edison.

We do not remember ever to have seen a decision in a patent case in which the claim for an alleged invention was so completely demolished. No doubt the case will be appealed, but as it stands the Independents are entirely vindicated, and it is difficult to see how the appellate court can evade the same conclusion as that reached by the cogent reasoning of Judge Brown.

This decision will give a great impetus to the telephone business. It will be read with the greatest interest by telephone men of all shades of opinion. The rescript of the court's opinion was handed down in Boston on Wednesday of this week, as the Western Electrician was going to press, but the forms were held until the rescript, somewhat abridged, but still filling four columns of this journal, could be telegraphed to Chicago. A history of the case, from the pen of Mr. Charles A. Brown of the patent bar of Chicago, is also presented in this issue, together with the action of the Indiana Mutual Telephone association, taken on the day the decision was handed down. We think that sufficient space is given to put the reader in possession of all the salient facts of this very important case.

Several features of the power plant of the Virginia Electrical Railway and Development company of Richmond, Va., described in this issue, are of exceptional interest. The arrangement for operating the movable crest of the dam, the concrete construction of the power house and stack and the interior arrangement of the generating plant are all unusual. The engineering problems appear to have been carefully studied and intelligently and courageously met. The installation is worthy of careful attention on the part of all interested in power development.

The charter of the new United States Steel corporation is very broad, and, among other things, authorizes the company to manufacture all articles made up in whole or in part of iron, steel or copper. This describes electrical machinery very accurately, and shows that the great steel trust may take a hand in the electrical manufacturing industry if it so desires. However, Mr. J. P. Morgan, its moving spirit, is already largely interested in the electrical business and will probably keep the two separate. But there is apparently nothing to prevent the gigantic trust from engaging in electrical manufacturing except the protection of patents. A clause in the charter gives the trust power to erect and operate "electric works," so that it may do electrical operating as well as manufacturing if it wishes. Truly, the scope of the new corporation is no less remarkable than its size.

Apropos of the recent discussions at the conventions of the Northwestern and Iowa Electrical associations regarding the competition of gasoline lighting with electric-illuminating systems, the news of a gasoline-lamp explosion at Canton, Ill., and a fire at Beardstown, Ill., in which a gasoline generator came near causing the wreck of an entire building, is interesting. At the Johnson House, in Beardstown, where a gasoline-vapor-lighting system is in use, the vaporizer is installed in a small room in the basement of the building, near the foot of an elevator shaft. A few days ago the building was lighted up as usual late in the afternoon, and the lights appeared to be burning normally. After a few minutes the room which contained the generator burst into flame, and the draft formed by the proximity of the elevator shaft at once carried the fire to the upper stories of the hotel. Timely use of the fire hose in the building and the quick response of the fire company kept the loss down to a few hundred dollars, but the incident was promptly made the subject of an advertisement placed in a Beardstown daily by the local electric-lighting company. Surely, it will require but few more accidents of this kind to make general the conclusion reached at the Milwaukee convention that central-station managers have little to fear from the competition of systems of this nature.

There is no doubt that the time is coming when a telephone will be considered an indispensable adjunct to every American home in town or country which can make any pretension to comfort or convenience. For years the Western Electrician has been preaching the gospel of cheap and practically universal telephone service. Americans realized the value of the telephone as an aid to business years ago, but it was only when the Independents brought about an era of lower prices that it was realized that the social use of the invention was not to be merely a luxury of the rich but was to be extended to all householders of moderate means. Telephone men can scarcely overrate the amplitude of the field opening before them in the twentieth century. The aim should be a practically universal use of the telephone. Ohio is one state where the network of telephone connections is extending very rapidly. The correspondent of the Western Electrician in that state writes: "The Home Telephone company of West Jefferson is extending its service, and the officers say that within a short time they will have every home in the northern part of Madison county connected up. There is still room for much of this kind of business in Ohio, and it remains to the smaller companies to take advantage of it." There is still room for a really vast amount of this business in all the states. To farmers, especially, the universal use of the telephone will be a boon, counteracting the loneliness of life in the country. The telephone and the electric railway may yet solve the problem of the overcrowding of the cities.

Our esteemed and "militantly British" contemporary, Feilden's Magazine, is tremendously energetic in advocating the industrial progress of its home and country. In its delineations the blacks are very black and the whites are immaculate; there are no gradations. It is the impulsive advocate rather than the well-balanced judge, and it is in sharp contrast, perhaps not entirely unwelcome, to its more staid and dignified contemporaries in England. This ardor of self-confidence does lead it, however, into some amusing contradictions. Thus, in a recent issue, it speaks with the greatest assurance of the United States as a country "where the rule of thumb-still prevails in experiments in which sound scientific knowledge alone should lead the way." On turning over a page or two, however, the reader is informed that "education in Chicago is the best in the world for fitting a youth for the battle of life." These statements are, in essence, entirely inconsistent, and yet they are editorial utterances of the same journal, presented in a single issue. The truth is that, although the United States is a very practical country, the rule of thumb does not "prevail" in its engineering. It is likewise true that while a youth may well fit himself for his life's work in Chicago, education equally as good may be had elsewhere. Generalizations like these are almost always misleading. This particular instance would be of slight importance did it not show, in rather exaggerated form, a tendency on the part of many British writers to indulge in hyperbole when treating American subjects, industrial or otherwise. In presenting its manufactured products to the world the United States is content to be taken for what it is—no better, no worse; with many faults, but with virtues sufficient, it is hoped, to counterbalance the scale. Extravagant praise or sweeping censure are alike undeserved and injudicious.

BERLINER DECISION FAVORS INDEPENDENTS.

[*By telegraph to the Western Electrician.*]

Boston, Mass., February 27.—The long-awaited decision in the famous Berliner patent case, heard late in 1899 before Judge Arthur L. Brown of the United States Circuit Court in Boston, was reported from the bench to-day. Judge Brown dismissed the bills in equity brought by the American Bell Telephone company against the National Telephone company, and also against the Century Telephone company, which asked for an injunction to restrain them from infringing the patent of Emile Berliner, owned by the Bell company, for a microphone attachment used in connection with telephony.

The court holds that the Berliner patent is invalid and so orders a decree in each case for the defendant. It finds that the patent has no patentable invention in it.

This patent was applied for in 1877, was held back in the Patent Office for years and finally was granted in 1891. The hold-up has been the subject of much litigation, collusion between Patent Office employes and parties in interest having been charged, while the claim was made that delay was secured in order that the patent when granted might take priority of other devices on account of its date of application, but might also extend the time within which the telephone monopoly could be continued, by reason of the late date of the grant.

Subsequent to the decisions on this issue came the fight over the merits of the patent between the Bell company and Independent rival companies, among them the National and Century companies, the cases being heard together, by agreement.

The rescript of Judge Brown, handed down to-day, says: "I find the Berliner patent invalid, because at the date of the application, June 4, 1877, Berliner had not made the invention covered by the patent issued to the American Bell Telephone company on November 7, 1891.

"Berliner's application says of the instruments shown in the drawing of the patent: 'These simple instruments will reproduce any musical sound uttered in the neighborhood of one of them; but for the reproduction of special sound, such as speech, they are not adapted.' A clear statement of the reasons is given; the statement is repeated; and it is said, also, of sound waves: 'Nothing of the nature of each wave and the shape of their curves is recorded.' He stated that he accomplishes this by apparatus operating to make and break the circuit. His model and drawings, as well as the text of his application, show that he intended to transmit speech by the erroneous method of interrupting the contact of electrodes and breaking the current.

"This document stands in this case as evidence on the question of invention exactly as it was written. It is conclusive evidence that Berliner had not invented, and did not intend to apply for a patent for, a constant-contact speech transmitter.

"The complainant's attempt to show that statements contained in this document were inserted through the mistake of a solicitor's clerk is a failure. I am convinced that this is not true.

"I find, as a matter of fact, that Berliner did not, before June 4, 1877, succeed in transmitting speech, but, on the contrary, was convinced by his experiments that speech could not be transmitted by the apparatus of the patent in suit.

"I find, also, that he did not at that date intend to describe or claim the apparatus as a speech transmitter.

"In view of the original application, the complainant's case cannot be established without proof of successful experiments by Berliner. The invention set forth in the patent lay in experiment. On inventions of this class the true date of the conception is the date at which the experiment succeeds.

"The complainant concedes that Berliner did not make new apparatus. Proof that the Reis apparatus or Berliner's apparatus or the Morse key is operative in the hands of experts does not establish invention by Berliner.

"He is not entitled as an inventor of apparatus to claim whatever may be found to be within its capacity, because his sole claim to invention is based upon an alleged discovery of a new capacity in old apparatus. If he did discover this, nothing new remains that he did discover or invent.

"He did not 'embody' an invention in apparatus unless he succeded in making the old apparatus perform Bell's process upon the current. The complainant has not proved that Berliner's apparatus will transmit speech under the conditions existing at Berliner's experiments. Berliner's caveat of April 14, 1877, does not establish invention, and does not count as a reduction to practice. It proves a project. Later caveats, the application, the record in the Patent Office and other evidence show the failure and abandonment of this project. Complainant's experts agree that what was stated in Berliner's caveat of April 14, 1877, would, at that date, have been deemed by scientific men impracticable, and that it should not have been predicated upon scientific or theoretical grounds.

"In the telephone cases (126 U. S., 545), the Supreme Court said of an experimenter: 'It was not until after Bell's success that he found out how to use the Reis instrument so as to make it transmit speech. Bell taught him what to do to accomplish that purpose.' Also it was said: 'It was left for Bell to discover that the failure (of Reis) was due, not to workmanship, but to the principle which was adopted as the basis of what had to be done.'

"If it was obvious to Berliner or to persons skilled in the art, upon a reading of Bell's patent, that the Reis apparatus could perform Bell's process, then the case fails as to invention. If what Berliner wrote in his caveat was obvious without experiment, Bell 'taught him what to do to accomplish that purpose.' The complainant avoids the defendant's point that Berliner made no invention in using Reis' old machine by Bell's old method, by evidence that it was not known that such changes as could be effected between solid electrodes would vary the current sufficiently or in the desired proportion. This required discovery through experiment.

"The complainant's contention that its case can be maintained, irrespective of experimental results, is therefore untenable. To claim that Berliner made an invention because scientific men would have deemed it impracticable to practice Bell's method with solid electrodes, and because it was wholly unknown that the current could be made to vary in the proper proportions, and also in the same case to claim that Berliner, in writing his caveat, must, as an inventor, have perceived that his project was necessarily true and that experimental verification was not necessary, is highly inconsistent.

"The complainant's case as to invention must rest upon the ground that what was stated in the caveat was not obviously and necessarily true, that experimental verification was necessary and that Berliner did verify his project by successful experiment, resulting in discovery of facts before unknown.

"The proof is strong to the contrary. It is largely documentary and contemporaneous, and is not met by the inconclusive, argumentative and wholly unsupported oral testimony of Berliner given years after the filing of the application. The absence of any corroboration from the numerous persons who are said to have witnessed Berliner's experiments and the failure to account for the nonproduction of witnesses is a strong fact against the complainant."

The court also holds that the invention described in the patent is radically different from the invention described in the application, and on this point says: "A comparison of the two documents leaves no doubt on this question. The application expressly disclaims speech transmission by the instrument of the patent, and claims, as a speech-transmitter, a double-pin instrument, operating to make and break contact of electrodes. The patent calls for constant contact of electrodes and an unbroken current; the application, for an interrupted contact and a broken current.

"The original application, by changes purporting to be amendments, has been completely transformed into an application for a distinct invention. This transformation is of the most remarkable character and was made after Edison's carbon constant-contact speech transmitter was invented and described in a printed publication. Such amendment is illegal, even if Berliner had made the invention before June 4, 1877.

"The amendments made prior to 1880 cannot support the patent, as they did not introduce constant contact of electrodes. If they did, they are illegal, as introducing a different invention. At the time of the rewritten specification of 1880 the invention had then been in use for more than two years, i. e., from June, 1878."

Claims 1 and 2 of the Berliner patent in suit are held to have been anticipated by Bell's patent and Bell's liquid transmitter. Under this latter ground the complainant claimed for Berliner a new "electrical mode of operation," which the court says was, in fact, Bell's, and also a new mode of treating the circuit, i. e., varying without interrupting it, which also was, in fact, Bell's. And these two claims of the Berliner patent, when read according to their natural significance, the court says, undoubtedly include Bell's liquid transmitter and are invalid for excessive breadth. The court also holds that these two claims of the Berliner patent are anticipated by Edison, because their excessive breadth includes various devices of Edison which, like Bell's liquid transmitter, employ a battery current and a variable contact of electrodes, and variable pressure. These devices of Edison were of February 9 and April 1, 1877.

The court continues: "By claiming 'variable pressure' of electrodes as a method or principle the complainant has attempted to monopolize a feature common to many constant-contact transmitters, and thus to discourage and hamper further invention in the same line of industry. The claims are plain. They cover all forms of varieties, also contact-pressure transmitters before us in this case. I am of opinion that they are void and cannot be saved by the specifications.

"The complainant also claims for Berliner invention in the use of the minute force of a sound wave to vary pressure between electrodes and invention in the discovery that accompanying variations of pressure were corresponding variations of current. This is in the Bell patent as well as in Bell's liquid transmitter, and in various devices of Edison.

"The complainant is certainly not entitled to claim as a novelty the utilization of minute forces, after the Bell patent and Bell liquid transmitter, and in view of the contention that Edison intended to compress a mass of plumbago thereby. Berliner borrowed his apparatus for 'transmitting the impressions of agitated air' bodily from Bell's second patent. As variations of current are proportional to variations of pressure at the diaphragm in all transmitters, it is not remarkable that they are also proportional to variations of pressure at the place in the circuit where the change of contact occurs and where the force exerted upon the diaphragm is expended upon the circuit.

"It is the principle of Bell's magneto instrument and of his variable-contact transmitter that the current shall vary proportionately to the pressure at the diaphragm. It is a principle of the variable-resistance method that the resistance shall vary by pressure exerted upon the circuit and proportionally thereto.

"In the liquid transmitter is the principle that the current shall vary proportionally to the pressure at the diaphragm and also proportionally to the pressure between electrodes; and also that as pressure on the diaphragm and between electrodes is weakened, the current becomes less intense; as it is strengthened, more intense. This was also in the Edison patent before Berliner.

"We are not dealing with claims carelessly drawn by an ignorant inventor, but with the phraseology of experts framed more than two years after public use of the invention, with the intention of asserting that Berliner was the originator of very broad principles that control the practical art of telephony.

"Those principles are Bell's."

The court further concludes that the claim in the patent for a method is invalid. It says: "The claims which cover all forms of variable-contact transmitters are embraced in the Bell patent as well

as in Bell's liquid transmitter, and in various devices of Edison. The patent discloses nothing patentable as an art, method or mode of operation. The method is 'by causing the sound waves to vary the pressure' so as to strengthen and weaken the contact. 'Causing' is accomplished by placing the apparatus where there are sound waves. This is not patentable as an art or method. Producing sound waves is no part of the method whereby existing sound waves are caused to vary. The patent covers no art or skill required in keeping the electrodes in constant contact.

"If Berliner made a discovery it was simply a discovery that such minute variations of contact as could be produced between metallic electrodes would transmit speech to a limited extent. If Berliner or others have succeeded in finding that metallic electrodes can be balanced so delicately that they will transmit speech, this is not a discovery that is embodied in the defendants' transmitters.

"The attempt to expand Berliner's unsuccessful experiments and caveat first into an invention, and next into a broad claim for an art, method, principle or process, exhibits a remarkable degree of ingenuity, but is not convincing."

Assuming that the specification discloses an invention, and that by limitation Claim 2 can be saved, the court holds that the patent is nevertheless limited to the structure therein described, and so limited that the defendants do not infringe.

The court says that the patent does not disclose or suggest any material other than metal, with metallic electrodes, and it is not proven that metallic electrodes are generally suitable for practical use in a speech transmitter.

The defendants' transmitters, having carbon electrodes, are, as apparatus, held to be distinct inventions. The carbon electrode was the invention of Edison, the court says, and it was an equivalent for the metal electrode of Berliner. The complainant sought to hold the defendants' transmitters as infringements by comparing them as embodiments of a principle, art, process or method, discovered or invented by Berliner. The court decides that it has not succeeded in this effort.

The court says: "Testing the merit of Berliner's invention by his advance in the art, by the advance made with metallic electrodes, we see that it is very slight. Metallic electrodes have never come into commercial use. The Berliner instrument made no advance upon Bell's magneto instrument. It is not proven to be superior to the instruments of Edison having solid electrodes. The Berliner patent, or Berliner's caveat, does not contain any suggestion of the thought that was the basis of the invention of the carbon transmitter."

The court concludes: "I am of the opinion that the defendants' transmitters are an invention substantially distinct from that disclosed in the Berliner patent; that the conception by Edison of the use of carbon for speech transmission preceded Berliner's conception of the use of solid metallic electrodes; that from his first conception Edison diligently proceeded upon a line of experiments that led to an invention of remarkable character which borrows nothing from Berliner, has no substantial resemblance to what is shown in the Berliner patent and cannot be identified with it by any ingenious use of language. The defendants owe nothing to Berliner.

"The bill is dismissed."

Action of Indiana Mutual Telephone Association.

[By telegraph to the Western Electrician]

Indianapolis, Ind., February 27.—About 150 Independent telephone exchanges in all parts of Indiana were represented in a special meeting of the Indiana Mutual Telephone association held here to-day. Shortly before noon a telegram announcing the decision of the United States Circuit Court in Boston, in the controversy over the Berliner transmitter, in favor of the Independent companies, was received and the assembly adopted this resolution:

"That the Mutual Telephone association of the State of Indiana, in convention assembled, hereby extends its warmest congratulations to the public in general, and to the owners of telephone properties in particular, upon the decision of the United States Circuit Court rendered upon the Berliner patent in Boston to-day. We also extend our heartiest congratulations and most sincere thanks to the officers of the National Independent Telephone association of the United States, who made the gallant fight against great odds which resulted in to-day's legal victory. The Bell telephone monopoly is now legally dead, as it has been actually dead since the expiration of its basic patents. From this time forward the telephone business will be considered and judged upon its commercial merits only, and all the people who desire telephones may have them without threats of damage suits for infringement."

Afterward the members of the association discussed the effect of the decision, which involves about $75,000,000 of capital. They all felt that conservative capitalists who had heretofore hesitated when investments with Independent companies were offered, because the Bell company charged in the suit that the transmitter used by the Independent concerns is an infringement on the patent it claims to hold, would now be more willing to place their money with the Independent companies. Other questions of interest to those in attendance were taken up. S. P. Sheerin of the New Telephone company of this city said: "I cannot see that the decision or any other factor can increase activity in Independent telephone circles now, for it is already one of the busiest market places in the country, but, like my associates, I feel that it will bring more capital into our ranks, and that is bound to have a good effect in every direction."

The members of the association were entertained by the local telephone men this afternoon after the meeting, and this evening. It is customary for the association to meet in the summer, but a winter meeting was thought essential. R. D. F.

History of the Berliner Case.

By Charles A. Brown.

In respect to the interests involved, the suit of the American Bell Telephone company against the National Telephone Manufacturing company, in the United States Circuit Court at Boston, upon patent No. 463,569, dated November 17, 1891, issued upon the application of Emile Berliner, and for a "Combined Telegraph and Telephone," surpasses any prior patent suit.

This suit has just been decided in favor of defendant. If the claims of the American Bell Telephone company regarding this patent had been sustained, it would have given that company or its successors the absolute monopoly of all forms of telephone transmitters now in commercial use. Some form of transmitter is absolutely essential to the carrying on of the telephone business. By controlling, therefore, this essential detail of telephonic apparatus, the American Bell Telephone company would have been put in complete control of the telephone business of the country, as it is now carried on. When it is considered that throughout the United States there have grown up, in the seven years since the expiration of the fundamental telephone patents, vast interests independent of the American Bell Telephone company—interests which have covered the whole country with a network of wires and have established exchanges in many of the important cities of the country, as well as a multitude of small towns, the importance of this decision may be appreciated. Since the expiration of the fundamental Bell telephone patents, the growth of telephony has far exceeded all its growth prior to that time. There is hardly a farming community in the country which has not its system of private lines. Large and successfully operating exchanges have been established in St. Paul and Minneapolis, St. Louis, Indianapolis, Cleveland, Rochester, N. Y., Pittsburg, Pa., Columbus, Ohio, Akron, Ohio, and many other cities. The interests of the so-called Independent telephone companies, therefore, are vast, not only in amount, but in extent.

The Berliner patent was granted in November, 1891. The application was filed in June, 1877. The application was thus pending in the Patent Office more than 14 years. During all this time the American Bell Telephone company, under its fundamental patents issued to Alexander Graham Bell, had a monopoly of the telephone business in the United States. When the patent to Berliner issued in 1891, it had a life of 17 years before it. It was narrower than the original Bell patent, but still broad enough, covering, as it is claimed to do, the telephone transmitter, which is considered essential for commercial operation of the telephone, to dominate the telephone business. This situation was recognized at once, and it was seen that the result would be that after the expiration of the fundamental Bell telephone patent in 1893, the telephone business would still be controlled by the American Bell Telephone company for 15 years, or until 1908, the date of the expiration of the Berliner patent. This was, upon its face, such an apparently unjust state of things that the attorney-general of the United States, by the direction of President Harrison, caused a suit to be instituted by the United States against the American Bell Telephone company for the purpose of annulling the Berliner patent. In this suit it was held that there could be considered only one ground for attack upon the patent, namely, that of fraud in the Patent Office, in delaying the application for the 14 years during which the application was pending in the office. Judge Carpenter, in the Circuit Court of the United States, sustained the government's contention, and found that there was constructive fraud on the part of the American Bell Telephone company in permitting the application thus to drag along in the office for 14 years. Upon appeal, however, the Circuit Court of Appeals for the First Circuit, and subsequently the United States Supreme Court, reversed Judge Carpenter, and found that there was no fraud proved against the American Bell Telephone company. It is very clear, however, that the American Bell Telephone company reaped the benefit of the delay in the Patent Office, and that the result is a most inequitable one and one never contemplated by the Legislature in enacting the patent statutes.

Prior to the decision of the Supreme Court in the so-called government suit, a bill had been filed in the suit of the American Bell Telephone company against the National Telephone Manufacturing company of Boston, but this suit was not urged to a hearing until after the decision of the Supreme Court. A large amount of evidence was taken in this case on both sides, and there was a final hearing in the case on November 7, 1899, before Hon. Arthur L. Brown, of the Circuit Court of the United States at Boston.

Numerous defenses were set up and urged in this suit, all going to the question of validity of the patent. There was practically no dispute upon the question of infringement. Although infringement by the defendant was not expressly admitted, practically, it was not denied. There were involved in the suit just decided two forms of transmitter, one the solid-carbon form, the other the granular-carbon form.

The decision of the court in favor of the defendant is a decision finding the patent invalid, and therefore relieving the Independent interests of the incubus of which the utmost use has been made by the American Bell Telephone company to deter the investment of capital.

The Berliner transmitter, as devised by Mr. Berliner and described in his patent application, is barely an operative instrument. It would be absolutely commercially inoperative. The public owes the transmitter, as it is in commercial use to-day, not to Berliner, but to others who were working upon the telephone simultaneously with Berliner and who developed the commercial telephone independently of Berliner. Edison, wholly independent of anything that Berliner did, developed a transmitter which was commercially successful. A reward to Berliner, therefore, or to his assigns, would not have been a reward for a public benefit, but simply for being the first in the Patent Office with a crude idea, which, in the light of after-knowledge, was found to be an essential idea in the operation of the commercial transmitter.

The decision of Judge Brown, just rendered, following the decision of Judge Carpenter of the Circuit Court, will have the effect of relieving the apprehension of manufacturers and investors who are interested or likely to be interested in Independent telephone enterprises, on the score of any fundamental patent controlled by the American Bell Telephone company at the present time, and will give a decided impetus to new telephone enterprises, so that it may be looked upon with certainty that there will be more development of the telephone industry in the immediate future than there has been even in the past.

It must not be forgotten, however, that the American Bell Telephone company still controls a vast number of patents upon telephonic apparatus. The number of patents thus controlled by the American Bell Telephone company probably reaches 2,500. It is possibile that, having failed in its effort to control the telephone situation by one broad, underlying patent, it may now be the policy of that company to harass Independent telephone-company enterprise by a multiplicity of suits upon subsidiary patents. There is none of these patents, however, which can be a cause of great apprehension on the part of the Independent telephone interests at the present time.

Wave Transmission over Non-uniform Cables and Long-distance Air Lines.

By M. I. Pupin, Ph. D.

Part II.

Experimental Part.

a. Description of the Experimental Cable.—A so-called artificial cable possessing the above constants was constructed by me for the purpose of testing experimentally the mathematical theory. Previous experiments in this line will be found in the author's paper of March 22, 1899, cited before.

The cable has 250 sections. One of these sections is represented in Fig. 6. It consists of a sheet (A) of paraffined paper. On each side of this sheet is a strip of tinfoil (a b). The resistance of this strip is, approximately, nine ohms. The capacity of the condenser formed by the two strips is

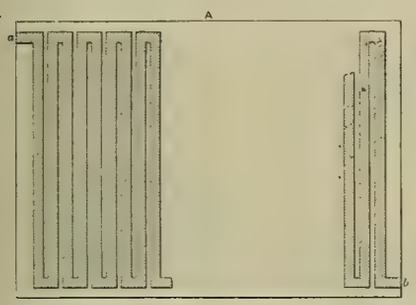


FIG. 6 WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

.074 microfarad, approximately. Two hundred and fifty sections of this kind connected in series represent a cable of 250 miles in length, having a resistance of nine ohms and a capacity of .074 microfarad per mile. That such is actually the case was verified experimentally, as will be shown presently. In Fig. 8 the straight lines (A B C D), (A_1 B_1 C_1 D_1) represent these sections. The upper lines represent one side of the cable and the lower lines represent the other side. The sections can be connected in series by couplers, to which these sections are attached. One of these couplers is represented in Fig. 9. A wooden strip (A B) has holes drilled through it at regular intervals. Through each hole passes a bolt (c), the diameter of which is smaller than the diameter of the hole. Two hard-rubber washers (a) and (b) hold the bolt in place and prevent it from touching the wood. A nut holds the brass plates (d) in place. Two consecutive brass plates (dd) can be conductively connected by the plug (e). Screws, as indicated, connect the terminals (ff) of the condenser sections and of the coils (gg) to the brass plates. These brass plates are indicated in Fig. 8 by numerals (1), (2), (3),.... When the plugs are out, then the consecutive sections of the cable are connected to each other by the inserted coils (see Fig. 8). The plugs being in the coils are short-circuited, and the consecutive

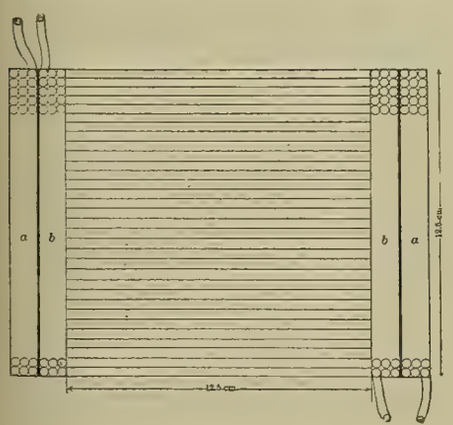


FIG. 7. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

sections of the cable are connected to each other directly by the plugs. In this case we have a uniform cable; in the former case we have a non-uniform cable of 250 miles' length, with inductance coils inserted at each mile. The coils are wound as represented in Fig. 7. The twin coils (aa_1), (bb_1), (cc_1) of Fig. 8 are represented in Fig. 7 by coils (aa) and (bb). These two coils are wound on one spool, and are separated by a sheet of cardboard, indicated by a black line in Fig. 7, which is one sixty-fourth of an inch thick. The coil when finished is boiled in beeswax at a temperature of about 280° Fahrenheit, in order to drive all the moisture out and insure good insulation. The dimensions of the coil are given in Fig. 7. Each coil had 580 turns of No. 20 wire B. & S. The average inductance of one of these coils is .030 henry, and the mutual inductance, .028 henry. Each coil, therefore, when connected into the line, as indicated in Fig. 8, has an effective inductance of .058 henry. This method of bringing the corresponding coils of the two sides of the cable into close relation by mutual induction is not necessary; it is a matter of convenience and economy.

The cable sections are divided in five groups of 50 each, and each of these groups is enclosed in a separate box. Each box represents, therefore, 50 miles of the cable. Fig. 10 is a reproduction from the photograph of one of these boxes. The box marked (A) is the cable box. On two opposite sides are five rows (B) . . . . of binding posts, each row having 10 pairs. They are the terminals of the condenser sections. From these binding posts double cotton-covered wires, which have been boiled in beeswax, lead to the row of brass-plate couplers (Fig. 9), indicated in the picture by letters (a), (b), (c), ... These boxes were made for me by the well-known mechanician, Mr. E. V. Baillard, to whom my sincere thanks are due for the keen interest which he took in this exceedingly laborious work. The rest of the work on the cable was done in the Columbia University laboratory for electromechanics. The insulation per section was about 50 megohms.

b. Theory of the Experimental Method.—The mathematical theory states that up to a frequency of 750 periods per second the waves will have, to within an approximation of one per cent., the same wave length and the same attenuation constant on the cable just described as on its corresponding uniform conductor. This is the side from which experiment has to approach the theory. The method employed in this investigation has, therefore, for its object the determination of wave

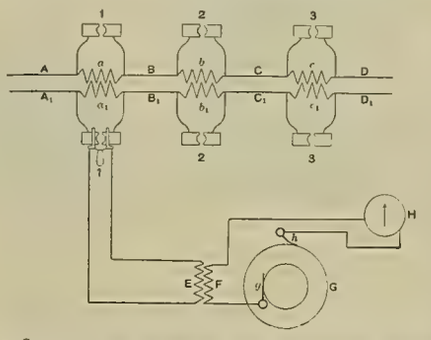


FIG. 8. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

length and attenuation constant. Its theory can be stated as follows:

The current η at any point ξ of a uniform loop can be expressed

$$\eta = A \left\{ e^{\beta\xi} \sin (pt - \alpha\xi) + e^{-\beta\xi} \sin (pt + \alpha\xi) \right\}$$

Let M (η) denote the mean value of the current between $t = t_1$ and $t = t_1 + T/2$, then

$$M(\eta) = \frac{y_0}{2} \left(e^{\beta\xi} + e^{-\beta\xi} \right) \cos (pt_1 - \alpha\xi)$$

Here ξ is the distance from the middle point of the loop. The time is counted from the moment when η is zero at the middle point. If we then determine the mean values from the moment when η vanishes at the middle point, we shall have $t_1 = 0$ and

$$M(\eta) = \frac{y_0}{2} \left(e^{\beta\xi} + e^{\beta\xi} \right) \cos \alpha\xi$$

or, since $\lambda = 2\pi/\alpha$, where λ is the wave length

$$M(\eta) = \frac{y_0}{2} \left(e^{\beta\xi} + e^{-\beta\xi} \right) \cos \frac{2\pi}{\lambda} \xi \qquad (1)$$

y_0 is evidently the mean value of the current at the middle point. This formula forms the basis of the experimental method employed here. From it the wave length and the attenuation constant were determined.

c. Determination of the Wave Length.—1. To investigate the wave length and the attenuation constant of a given frequency, it was necessary to

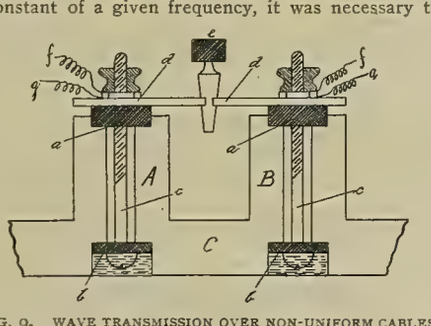


FIG. 9. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

impress a simple harmonic electromotive force upon the cable. This was obtained as follows: A small alternator of 30 poles running at a normal speed of 2,400 revolutions per minute was employed. It gives a complex harmonic electromotive force in which the third and fifth harmonic are quite strong. At the normal speed, the frequency of the fundamental was 600 periods per second. By transformation, as indicated in Fig. 11, the upper harmonics were weeded out by tuning. In this diagram (A) is the alternator. The secondary circuit (D, E, F, G) contains a condenser (F) and an auxiliary coil (E). By adjusting the capacity of condenser (F) and the inductance of coil (E) the impedance of this secondary circuit for the fundamental frequency can be reduced to a minimum, in which case the fundamental current in this circuit is by far predominant. Under these conditions, the electromotive force impressed upon the tertiary coil (H), which connects to the line, is very nearly simple harmonic. This was verified by plotting, experimentally, the electromotive-force curve in the tertiary circuit. The point of resonance was detected by connecting the terminals of condenser (F) to a multicellular voltmeter (K) and watching for the maximum rise of the potential. While the observations which will be described presently were made the reading of this voltmeter was con-

FIG. 10. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

tinually watched. A change in it indicated a change in speed and impressed electromotive force and the observations had to be suspended until the voltmeter returned to the same reading. Considering the variability of the electrical pressure in a university plant, where every one of the many departments draws its current from the same source, it will be readily seen that these observations were somewhat trying.

2. To determine the mean value of the current, a Townsend contact-maker (G), Fig. 8, was used. Its circumference was divided into 30 equal parts, since the alternator had 30 poles. Every other section of the circumference was connected to a ring (g). This ring and the circumference were connected to the rest of the circuit (gFHh) by two brushes (g), (h). The contact-maker was mounted on the shaft of the alternator. The time

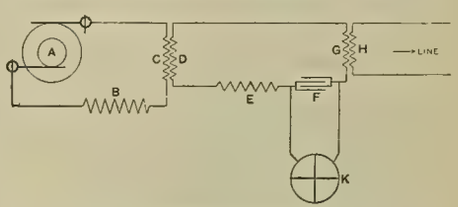


FIG. 11. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

interval, of half a period, during which the contact lasted could be shifted by shifting the brush (h) along the circumference of the contact disk. (H) is a Rowland-d'Arsonval galvanometer, suitably shunted so as to keep the readings within a desirable range. The current readings were obtained as follows: A two-pole contact spring-jack (1), Fig. 8, was inserted across the terminals of an inductance coil, say (a_1), as indicated. The coil was thus shunted by circuit (1E). This circuit contained a small coil (e) and one or two ordinary 16-candlepower incandescent lamps in series with it. The coil acted inductively upon the circuit containing the contact-maker and the galvanometer. A simple consideration will show that the galvanometer reading was proportional to the mean value of the current flowing through the inductance coil (a_1) during the half period corresponding to the position of the brush (h). Suppose now that this brush is set in such a way as to give the maximum reading when the contact spring-jack is across the inductance coil at the middle point of the cable. Then, as shown in equation (1), the reading at any other inductance coil will be proportional to

$$\left(e^{\beta\xi} + e^{-\beta\xi} \right) \cos \frac{2\pi}{\lambda} \xi$$

where ξ denotes the distance of the inductance coil under consideration from the middle point. This expression passes through zero whenever ξ is an odd multiple of the quarter wave length, and the reading passes then from one side of the zero position to the other. The brush (h) was, therefore, set so as to give the maximum reading at the middle point of the line. Then the spring-jack was run along the line and the sign of the readings noted at (1), (2), (3), ..., etc. The number of reversals of readings corresponding to a given length of the line was counted.

The reversals occur whenever ξ is an odd multiple of $\lambda/4$. Suppose that five reversals occurred in the distance of 41 miles. It means that 9/4 wave lengths cover the distance of 41 miles; hence the wave length is

$$\lambda = 18.2 \text{ miles.}$$

This was found to be the case with a frequency

of 600 periods per second. The wave length calculated from the formula

$$\lambda = \frac{2\pi}{p\sqrt{2LC}}$$

$$p = 2\pi \times 600$$

$$L = .058$$

$$C = .074 \times 10^{-6}$$

gives $\lambda = 18.1$ miles.

The agreement between the calculated and the observed wave length was extremely good for this frequency, considering the inequality of the cable sections, which necessitates taking for L and C average values. Following is a table of wave lengths for other frequencies, giving both the observed and the calculated values.

TABLE OF WAVE LENGTHS.

FREQUENCY	λ_{obs}	λ_{calc}
625	17	17.3
600	18.2	18.1
450	24	24.1
260	41.4	41.7
245	44	44.4
230	48	48.2

At the frequency of 600 periods per second the non-uniform cable has 18 coils per wave length. At the lower frequencies the number of coils per wave length is larger, and therefore the cable approximates then its corresponding uniform conductor even more closely than at the frequency of 600 periods per second. But the approximation at this higher frequency is already so close that no difference in the behavior of the cable at the various frequencies experimented with and given above could be detected experimentally. As far as the wave-length determination is concerned, the agreement between theory and experiment is very satisfactory.

3. To determine the wave length on the cable without the coils plugs (see (e), Fig. 9) were put in (1), (2), (3), ... The readings were taken as follows: The two-pole spring-jack was inserted across a pair of plates, say, (1). Then the short-circuiting plug (see (e), Fig. 9) was taken out and the deflection in the galvanometer noted. The number of reversals was counted as before, and from these the wave length was estimated. The value of the wave length thus determined for a frequency of 600 periods per second was 126. Its calculated value was 125. Thus the insertion of the coils reduces the speed of propagation to one-seventh of its original value, since it shortens the wave length to that extent.

[*To be continued.*]

Telephone News from the Northwest.

Gann Valley, S. D., wants telephone connection with the outer world. The town is 22 miles from the nearest railroad station, at Kimball. If some telephone company cannot be induced to build to Gann Valley, the business men will club together and build the line to Kimball.

The Cannon Valley Telephone company of Waterville, Minn., will establish an exchange in Elysian, Minn.

H. D. Alert and others propose a local exchange in Langdon, N. D.

The Wood County Telephone company will extend its line from Pittsville, Wis., to Babcock, via Dexterville.

The Little Wolf River Telephone company has filed amended articles, changing its headquarters from Weyauwega, Wis., to Fond du Lac.

The Hutchinson (Minn.) Telephone company proposes to extend lines to Brookfield, Lakeside, Bear Lake, Stockholm and Lamson this summer.

There is talk at Lamberton, Minn., of forming a stock company by local parties to either buy the present exchange or install a new one.

The Nebraska Telephone company contemplates putting in an exchange at Friend, Neb.

A local exchange is projected for Franklin, Neb.

The Standard Telephone company will build a line from Garnavillo to Elkport, Iowa.

A farmers' mutual line is projected from Competine township to Hedrick, Iowa.

The Pacific States Telephone and Telegraph company is extending connections from Spokane, Wash., to the Slate Creek mining country, which is located in the Cascades of Okanogan County, Wash.

The Michigan Telephone company has transferred the office of the division cashier from Marquette to Detroit, the change taking effect March 1st.

The Missouri Valley (Iowa) telephone exchange will enlarge and extend its system in the spring.

O. J. Jensen has been granted a franchise at Boyd, Wis., for a local exchange.

A telephone war is threatened at West Superior, Wis., by the action of the Douglass County Telephone company in offering free service to the city officials. The company makes the excuse that it has long-distance connections which a great many people desire, and that this will give them an opportunity to secure it, in the city hall. But it is thought to be the initial step toward getting a renewed foothold. When the Independent company became firmly established, the old company's instruments were ordered out of the city hall. The company neglected to remove them and the city took them out.

The Northwestern Telephone Exchange company has brought suit in St. Paul against the Maryland Casualty company, to recover $1,075. The company claims the defendant insured it against loss from damages to employes. On October 14, 1900, O. N. Harrell was injured while setting poles, and secured a verdict of $750. The cost of medical attendance and fighting the case will bring the amount paid up to $1,075, which the company seeks to recover.

R.

Ohio Telephone Notes.

The Central Union Telephone company is giving the Franklin Telephone company a little competition in its work of establishing exchanges in Franklin County by outbidding it in the small towns. The Central Union is setting up a very vigorous opposition to the Independent companies all over the state, but it seems that the results of these fights hardly justify the trouble and cost. In most places there are two systems, and they have so far succeeded in staying. The Independent companies have gained a great advantage from the first by showing a willingness to arrange a service for the small towns and for the country people, which is of benefit to those in the cities as well, by forming a means of communication with those who have business with them.

An ordinance was introduced in the Toledo City Council a few days ago to grant a franchise to Frank F. Graves to build a telephone system in the city. It is a copy of the ordinance granted the Central Union company when that plant was built. Mr. Graves states that he is willing to give a bond of $25,000 to abide by the terms of the contract and do anything else that is reasonable. He states that the money spent in the plant will be practically all invested by Toledo men. Mayor Jones and some others will oppose the proposed ordinance and make the statement that the second ordinance granted for telephone purposes came to naught and the third one will do the same. It is probable that the city will not be long without an Independent system, however, as a new company will reduce the price about half.

At a meeting held a few days ago the stockholders of the Findlay Home Telephone company elected the following-named directors: W. S. Wagner, Tiffin; James B. Hoge and Maxime Reber, Cleveland; J. D. Snyder, W. J. Burket and John C. Firmin, Findlay. The officers are as follows: President, E. C. Taylor; vice-president, James B. Hoge; secretary, J. C. Firmin; treasurer, W. J. Burket. There are now 50 men at work on the new plant, and it is the intention to increase the number to 200 within a short time. The company will use the North switchboard and instruments. It is the intention to connect up several of the small towns within a radius of a few miles at once.

The Central Union Telephone company has received the last of eight sections for its office at Findlay, completing the new switchboard. The manager announces that, with this complete, there will be no more party lines used, but that each one will have an independent metallic line.

At the annual meeting of the City and Suburban Telegraph association, Cincinnati, held last Tuesday, all the old officers and directors were re-elected for another year. The officers are as follows: President, George N. Stone; vice-president, C. H. Kilgour; secretary, W. A. Blanchard; treasurer, John Kilgour. President Stone's report made very interesting reading for the stockholders, the last year being the best one the company has ever enjoyed. Every department has shown an increase and there has been a very satisfactory gain in all classes of service. The gain is placed as follows by Mr. Stone: Unlimited business subscribers, 11.41 per cent.; unlimited residence subscribers, 53.60 per cent.; measured-service subscribers, 38.76; extension telephones, 59.63; city pay stations, 14.24. During the year there were 231,071 local and long-distance toll messages handled, against 207,081 the year before. The number of exchange connections made in the year was 39,334,162, an average of 14.71 calls per day per subscriber. At the last of the year the company had 4,863 miles of metallic-line circuits on poles and 520 miles of poles. There were 345,475 feet of underground cable, containing 6,543 miles of conductors. The treasurer's report gave these figures: Capital stock outstanding, $3,465,000; gross earnings, $599,064.08; gross expenses, $377,265.71; available for dividends, $221,798.37.

O. M. C.

Garton-Daniels Signaling Devices.

"A telephone extension signaling device without magnet coils of any description, that does not insert any extra resistance in the circuit, and that resets itself after every signal, has been considered an ideal arrangement, but has never before been offered on the market," says the Garton-Daniels company of Keokuk, Iowa. This company, which manufactures the well-known Garton lightning arresters for railway, light and power circuits, has recently brought out the device shown in the accompanying illustrations, known as the G.-D. extension circuit ringer. In Fig. 1 the device is shown attached to the front of the magneto box, while Fig. 2 gives a larger view of the device. It will be noted that a lever extending upward is held against the bell-clapper of the magneto. When the bell-clapper vibrates, the extension circuit is closed, reproducing the signal wherever the bell is located. As soon as the bell-clapper of the magneto comes to rest, the circuit is again opened automatically.

In existing forms of extension circuit-closing devices a coil is depended upon to release a shutter, which closes the circuit when it falls. It is necessary to reset this shutter at once, or the battery will soon become exhausted. It very often occurs that a call comes when there is no one to answer, and the bell continues ringing until the battery is run down—a source of annoyance and expense. Then, too, lightning will often throw the shutter at night when no one is around to reset it, and the battery becomes exhausted. This trouble is believed to be obviated entirely by the use of the G.-D. ringer, as it resets itself after each signal. This device may also be used on party lines. The fact that it cuts no resistance into the circuit will appeal to practical telephone men.

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

GARTON-DANIELS SIGNALING DEVICES.

Fig. 3 shows an ordinary drop-shutter, circuit-closing device now being placed on the market by the same company. This device is independent of the action of any magnet. Its action depends on the motion of the bell-clapper of the magneto, the same as with the ringer, but differs from the latter, in that it must be reset after each signal. It is offered by the manufacturer in competition with the present forms, and, it is said, at a lower price. In Fig. 4 this device, which is known as the G.-D. extension circuit-closer, is shown in position on the front of a magneto.

Iowa Telephone Association.

The fifth annual meeting of the Iowa Telephone association will convene in the clubrooms of the Savery Hotel at Des Moines, Iowa, on Tuesday, March 12th for a two days' session. It is hoped that this will be the largest and best meeting ever held by the association. One of the most important questions to be discussed at the meeting will be the matter of checking reports and making settlements between companies for inter-line toll business. Another important subject to be discussed is farmers' lines, their construction and equipment, the rates to be charged, etc. The present officers of the association consist of the following-named gentlemen: President, J. S. Bellamy of Knoxville; vice-president, H. C. Raney of Fairfield; secretary and treasurer, Charles C. Deering of Boone; executive committee, J. S. Bellamy of Knoxville, C. F. Bennett of Waterloo, C. M. McFatridge of Moravia, George N. Bandy of Perry and A. T. Presson of Iowa City.

A lineman of the Chesapeake and Potomac Telephone company was arrested for assault in Washington recently on complaint of A. Grip, the minister from Norway and Sweden. The lineman was at the top of a telephone pole, engaged in stringing wires, when Mr. Grip rode by on his bicycle. Mr. Grip started to ride over a wire, one end of which was on the ground and the other attached to a cross-arm on the pole on which the lineman was working. The latter saw him coming and says that he endeavored to raise the wire for the minister to pass under. The result was that Mr. Grip rode against the wire and sustained a painful injury to the bridge of his nose and to his face.

Indiana Telephone Items.

A war on telephone rates has been begun at Noblesville. The Central Union Telephone company has announced that it will give free communication with every town in the county, and offers the same privilege to farmers having telephones placed in their homes. A rate of 50 cents a month has been established for residences, and a 10-cent rate between Noblesville and Indianapolis. Other reductions are proposed. Although no action has been taken by other companies, it is likely that the competition will be met. This cutting of rates on the part of the Central Union company is said to be due to the fact that the new company, which recently established a plant in the city, is getting the bulk of the business.

A bill has been introduced in the Legislature which regulates the maximum charges for long-distance telephone companies. The distances are divided into 10 classes, and a maximum charge for each class is made. The Central Union and the New Telephone companies have combined to prevent the passage of the bill.

One of the interesting and busy places in Greencastle is the telephone factory of Ewing McLean. Since the increased demand for telephones work in all supply factories has been greatly accelerated. The McLean factory turns out nearly 200 complete telephones a month. Most of them are used in the country and by the local lines, but they often fit up an exchange complete.

The New Telephone company of Indianapolis has contracted for $37,000 worth of copper wire and is preparing to build a line to Logansport, and to extend its line from Shelbyville to Greensburg and from Greencastle to Terre Haute and from Greencastle to Rockville. The New company has 28,000 telephones in service, and on lines with which it has running arrangements there are 24,000 telephones. By this arrangement the New company reaches eight per cent. of the population of Indiana. "We shall go into Chicago as soon as there is an Independent company organized there, and one is sure to be organized," said Vice-president Sheerin. "Our lines will soon be connected with the Independent lines in Ohio and Pennsylvania. We do not care whose instrument a customer uses, so that he uses a good one. If he puts up an instrument that will talk we shall connect him all right. F.

Independent Company in Detroit.

It is said that Henry A. Everett of Cleveland and his business associate, Mr. Moore, are interested in the new People's Telephone company of Detroit. The gentlemen named join hands with Arthur Pack of Detroit in this enterprise, and it is asserted that Mr. Pack will, in all probability, be the president and general manager of the company. The promoters say that they will put in a plant that will cost about $500,000, modern in every respect, and will connect up with the long-distance lines north and south. This will give the Independent companies of Ohio and other central states a much better service toward the Northwest.

MANUFACTURERS AND DEALERS.

F. N. Carroll, Traverse City, Mich., says that he is receiving his share of the pole business. He now has on hand several thousand cedar telephone poles, ranging from 25 to 70 feet in length.

The American Telephone company of Chicago has been incorporated to manufacture telephones and electrical supplies. The incorporators are H. J. Anderson, Harvey Wright and Charles B. Stafford, and the capital stock is $2,500.

The North Electric company of Cleveland, Ohio, calls attention to its ability to cure its patrons of "trouble—the telephone imp," by means of a novel bill file mounted on a pasteboard card. An illustration in colors depicts the "trouble chaser" and the "telephone imp," while some weird verses on the back of the card are dedicated to the latter-named individual. The file is intended as a convenient repository for trouble reports, etc., and is no doubt due to the ingenuity of F. F. Sapp, who is always on the lookout for something new.

Owing to a large increase of subscribers the new Corsicana (Texas) Telephone company has ordered additional telephones and another section of multiple, central-battery switchboard from the Western Telephone Construction company of Chicago. In addition to the central-battery equipments recently furnished Pottsville and Williamsport, Pa., and Corsicana, Texas, the same type of multiple equipment is being made by the Western company for exchanges at Greensboro, N. C., and Binghamton, N. Y. Western express switchboards of 100 lines' capacity have been furnished the Shamokin Valley Telephone company, Northumberland, Pa.; Sebree (Ky.) Telephone company (with large shipments of telephones); Jameson (Mo.) Telephone company; John Bringman, Taylorsville, Ind.; Washington (Iowa) Telephone company; J. W. Sparks, Giddings, Texas (with telephones), and numerous smaller orders for other points. Many orders for Western express No. 1 exchange telephones and Western express No. 3 long-distance telephones continue to be received by the company.

GENERAL TELEPHONE NEWS.

The Farmers', Canton and Norris Telephone company has been granted privileges for erecting poles and stringing lines in Canton, Ill.

The Yukon Telephone syndicate announces that it has 143 telephones installed at Dawson City and 48 more in the surrounding country.

The Long-distance Telephone company of Richmond, Va., expects soon to have Lexington, Staunton, Lynchburg and Harrisonburg connected.

The Farmers' Exchange Telephone company of Camp Point, Ill., has been incorporated, with authorized capital of $2,000, by J. E. Simmonds and Rufus McVay.

The South Carolina Telephone company has purchased the exchanges and 30 miles of toll lines formerly operated by the Southern Telephone and Telegraph company.

E. M. Hungerford, late superintendent of the Billings Telephone company of Billings, Mont., has resigned and disposed of his interest to L. L. Moffett. It is said that a controlling interest in the company may be secured by the Rocky Mountain Bell Telephone company, which has been seeking a franchise in the town.

An antiseptic mouthpiece has recently been invented, which consists of a small, double-bell-shaped cylinder, quite like the rubber mouthpiece now in use. The inner shell of the cylinder is double, and between the perforated sheets is a layer of felt. This felt absorbs an antiseptic solution, which may be renewed from time to time.

At a banquet given last week at the Technical Club in Chicago, each guest was provided with a telephone, and long-distance connections were made with St. Louis, where the alumni of Washington University were dining at the Southern Hotel. Each party was addressed by speakers of the other, and later informal talks were held between the two cities for nearly an hour.

The Oakland County Telephone company of Pontiac, Mich., has completed its first toll line, running to Oxford. A five-cent rate for five minutes is in force, while the Michigan Telephone company's rate is 10 cents for three minutes. Other toll lines will be completed by the Oakland County company as fast as possible, when Pontiac will be given connection with every town in the county for five cents.

The Missouri and Kansas (Bell) Telephone company applied to the City Council of Carthage, Mo., for a franchise at the council meeting held January 28, 1901. The council voted unanimously, refusing to grant the franchise. The Carthage Electric Telephone company has just ordered its sixth hundred-drop, American express board, and has nearly 500 telephones in operation, an increase of 275 within a year and a half. It also has about 25 subscribers on its books for whom instruments have not yet been put in.

Mount Pleasant, Mich, had a number of smallpox cases, which made it necessary to close all schools and churches. On February 24th religious services were held by telephone with about 80 families of the town, many of whom were actually quarantined. The services included music by the full choir, solos, responsive reading of psalms and a sermon by the Rev. G. S. Northrup, who was instrumental in reserving the telephone lines for the purpose. One of the soloists was quarantined at her home, and the clergyman who pronounced the benediction was also a smallpox patient.

Wisconsin Independent Telephone Association.

At the annual convention of the Wisconsin Independent Telephone association, held at Madison, Wis., last month, there were about 40 exchanges represented. Some fine exhibits of telephone apparatus were made by the Standard Telephone and Electric company of Madison, Sterling Electric company of Lafayette, Ind., Eureka Electric, Kellogg Switchboard and Supply and Electric Appliance companies of Chicago, and the Holtzer-Cabot Electric company of Boston, and others. Several valuable and interesting papers were read and discussed at the meeting. On the evening of the first day of the meeting a sleigh-ride party was given by the Standard company to over 50 members and supply men, stopping at Oak Park for a banquet and social gathering. A buttonhole badge in the way of a memento was presented to each member of the association by L. W. Birch of the Electrical Supply company of Madison. On the afternoon of the 14th an illustrated lecture was delivered in Science Hall of the University of Wisconsin, by Dr. Trowbridge, on wireless telegraphy and Dr. Pupin's recent long-distance telephonic invention. This lecture, which was very interesting and instructive, was thoroughly illustrated by apparatus.

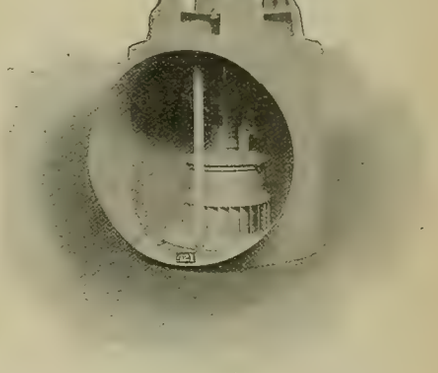
Twelve new companies joined the association at the meeting. The membership of the society now includes over three-fourths of the Independent telephone interests of the state. The following-named officers were elected for the ensuing year: President, A. L. Hutchinson of Weyauwega; vice-president, C. H. Schweizer of La Crosse; secretary-treasurer, H. C. Winter of Madison. The summer meeting of the association will be held at La Crosse and the next annual meeting at Milwaukee in February, 1902.

Third-rail System for Western Michigan.

At a recent annual meeting of the Grand Rapids, Grand Haven and Muskegon Electric Railway company, in Grand Rapids, Mich., the following-named officers and directors were elected: President, J. D. Hawks of Detroit; vice-president, T. F. Carroll of Grand Rapids; secretary, Wallace Franklin of New York city; treasurer, Carl M. Vail of New York; legal counsel, Carroll, Turner & Kirwin of Grand Rapids; directors, W. W. Churchill, H. J. Conant and Wallace Franklin of New York city, J. D. Hawks of Detroit and T. F. Carroll of Grand Rapids. Considerable grading has been done on the road and the work will be renewed in the spring. It is stated that in all probability the third-rail system will be adopted except inside the city limits, where the overhead trolley will be used. The cars will be 50 feet long, will seat 60 persons and will be heated by electricity. Smoking compartments will be provided in the forward end of the cars. Two 150-horsepower motors will constitute the power equipment of each car. The cars will be extra strong and heavy, the axles being 6½ inches in diameter. It is expected that the line will be ready for operation by July 1st. The company has $1,250,000 available for construction of the road. The route will be from Grand Rapids to Muskegon, with a spur from Spring Lake to Grand Haven.

Smith-Vaile Combined Waterwheel and Generator Set.

The accompanying illustration is made from a 33-inch cylinder gate, Victor turbine, which was recently furnished to the Massachusetts Chemical company of Walpole, Mass. While there is nothing novel in the setting of the waterwheel, yet the combination of the waterwheel and the generator is something new in this country. The wheel operates under about 14 feet head, developing about 115 horsepower and running at about 150 revolutions a minute. The wheel is set in a steel flume with cast-iron heads, the water being conveyed to the flume by means of a steel feeder pipe. The flume stands on I-beams across the pit, with the



SMITH-VAILE COMBINED WATERWHEEL AND GENERATOR SET.

customary draft tube leading from the wheel to the tail water.

Floor space in this particular case, however, was valuable, and for that reason the generator was mounted directly on top of the waterwheel shaft, the shaft through the armature being an extension of the waterwheel shaft. The generator is a Thresher, direct-current machine. The weight of the armature is carried by means of a thrust bearing, which is a combination of rings and pressure bearings running in oil. This bearing is mounted on top of the flume cover, immediately underneath the armature of the generator. The whole makes a very complete and unique outfit in its way, and undoubtedly could be used to advantage in many places where light powers are to be developed. The designer and manufacturer of this combined set is the Stilwell-Bierce & Smith-Vaile company, Dayton, Ohio.

The new town of Endicott, which is to be established near Binghamton, N. Y., is to be furnished with a street-railway service by the Binghamton Railroad company, which operates the Binghamton, Lestershire and Union railway, and commutation rates are promised for the accommodation of the people to be employed in the large boot and shoe factory which will be established in the new town.

Holding Capacity of Anchors for Electric-wiring Poles.

By R C Carpenter.

Nearly all important pole lines need lateral support, which is best given the poles by attaching guy wires to some suitable anchorage. Various forms of anchors have been used, varying from bars of iron driven in the ground, flat plates buried some distance, pieces of trees, cross-ties as deadmen and parts of poles as stubs, to complicated and expensive forms. In many cases the lateral pull on poles, due to the weight of the wires, wind stresses, etc., is of such an amount that unless the pole were thoroughly guyed laterally to some anchor, it would not maintain its position. The falling of a single pole in an important line for transmitting electricity of high voltage or for telephone or telegraph purposes would be a serious matter, and would in all probability cause a large amount of damage, both directly and incidentally.

During the last few months the writer had an opportunity of investigating the holding power of a simple anchor, the results of which are believed to be of considerable general interest, as this device can be placed in the ground without any digging and will hold an enormous strain.

The anchors to which I refer are termed, after the inventor, the "Stombaugh guy anchor." They are made of various sizes and consist in each case of one full helix or screw thread of cast-iron, which is attached either to a long bar of steel or to a guy rod, as desired. Fig. 1 shows the various styles of anchors tested. The wrench is employed to screw the smaller anchors into position. Fig. 2 illustrates the use of the anchors in guying fences and poles.

Before making the tests, the writer considerably underrated the holding power of these anchors and was much astonished to find the magnitude of the resistance which they offered.

FIG 2 HOLDING CAPACITY OF ANCHORS FOR ELECTRIC-WIRING POLES.—ANCHORS USED IN GUYING FENCES AND POLES.

The anchors were inserted in both sandy and clay soil, a suitable location being selected near Cornell University at Ithaca, N. Y. For the purpose of drawing the anchors from the ground, a dynamometer was arranged, which consisted, substantially, of a long wooden lever, one end of which was supported on rolling knife edges by a cross-bar, which could be raised or lowered by jack-screws; the other end was connected to a recording dynamometer, which could be raised or lowered by chain blocks. The anchor was attached to a rolling knife edge by a chain yoke connected to the eye of the anchor so as to give a mechanical advantage of eight to one to the arm of the lever connected to the registering dynamometer. The reading of the dynamometer, multiplied by a constant factor, gave the holding power of the anchor. During the operation of testing the long horizontal lever was kept level by raising both ends at the same rate. The arrangement for testing, as described, is very clearly shown in Fig. 3.

During the tests a slight movement of the anchor was always obtained before the maximum resistance was reached. After a movement, which varied from one-half inch to two inches, the resistance fell off very rapidly. The holding power in clay was essentially greater than that in sand, when the average of all cases is considered, the resistance being from 15 to 20 per cent. greater, but the range of testing could not, on account of conditions, be extended so far.

The anchors were, in every case, pulled up very shortly after being inserted in the ground, so that it is extremely probable that the results of the tests are considerably less than would be experienced in practical use, after the ground had settled.

By comparison of these various results, it was found that the resistance of the anchors in sandy ground can be expressed by the formula very closely:

$$R = 100\ d\ h^2$$

in which R is the resistance offered by the anchor in pounds; d is the diameter of the helix of the anchor in inches; h is the depth of the helix, in feet, from the surface. The resistance for clay ground would probably be 20 per cent. more.

As an example, a 10-inch anchor should have a holding power in sandy ground, when three feet deep, of $100 \times 10 \times 9 = 9{,}000$ pounds. This was less than was found with an anchor of this size. In a similar way, the 12-inch anchor, four feet in the ground, should have a holding power equal to $100 \times 12 \times 16 = 19{,}200$ pounds. In an actual test, the anchor in this condition resisted 18,400 pounds. This was about the only case found when the holding power of the anchor was less than would be given by the formula. For these reasons, the formula is believed to be a safe one, especially when it is considered that the resisting power of the anchors will be increased after they have remained sufficiently long for the ground to consolidate.

The following table shows the result of the test in tabular form:

No. of Test.	Diameter in Inches.	Depth in Inches.	Maximum Resistance.	Backward Movement.	Resistance by Formula
1	3½	15	1,000 lbs.	½ in.	550
2	3½	30	2,800 lbs.	.....	2200
3	5	15	1,200 lbs.	¼ in.	780
4	5	30	3,400 lbs.	2 in.	3120
5	5	40	5,800 lbs.	.....	5550
6	6	15	1,000 lbs.	1¼ in.	936
7	6	30	3,800 lbs.	2 in.	3744
8	6	40	6,600 lbs.	1 in.	6650
9	8	15	1,200 lbs.	1 in.	1240
10	8	30	8,800 lbs.	1¾ in.	4960
11	8	40	9,000 lbs.	4 in.	8880
12	10	24	2,400 lbs.	1 in.	4000
13	12	48	18,400 lbs.	1 in.	19200
14	3½	15	1,400 lbs.	½ in.	550
15	3½	30	3,200 lbs.	1½ in.	2200
16	5	15	1,000 lbs.	1 in.	780
17	5	18	2,000 lbs.	1 in.	1125
18	5	40	4,000 lbs.	2 in.	5550
19	6	15	2,200 lbs.	½ in.	936
20	8	15	2,4 0 lbs.	1¼ in.	1200
21	8	19	4,400 lbs.	1 in.	2050

Test 1 to 13 in sand, 14 to 21 in clay, showing the greater resistance in latter.

Several of the tests indicated that the holding power, or resistance, of the anchors, was considerably in excess of the strength of the connecting rods, as furnished by the manufacturers. Taking all in all, the test gave some valuable data as to the holding power of ground anchors, and indicated that great resistance can be secured by the use of simple helix form of anchors.

In general, the anchors are quickly and readily inserted in the ground by first making a hole with a bar for the center portion of the screw, and then rotating the anchor, the effect of the rotation being to screw the anchors into the ground. Wrenches are employed for the smaller anchors, while the larger ones are screwed into the ground by inserting a rod in the eye, and the assistance of a large monkey wrench or S wrench.

[Professor Carpenter, the author of the above report, is professor of experimental engineering in Sibley College, Cornell University. It may be added that W. N. Matthews & Bro. of St. Louis are sales agents for the Stombaugh anchor.]

Fig. 1. Various Styles of Stombaugh Guy Anchors.

Fig. 3. Test in Sand.

HOLDING CAPACITY OF ANCHORS FOR ELECTRIC-WIRING POLES.

Statistics of Massachusetts Street Railways.

In the thirty-second annual report of the Board of Railroad Commissioners of Massachusetts more than the usual space has been given to a consideration of, and statistics bearing upon, the street-railway properties of the state. The average cost of the street railways per mile of main track on September 30, 1900, was $23,433.43 for construction, $8,510.13 for equipment and $11,683.82 for lands, buildings (including power plants) and other permanent property, making a total average cost of $43,637.38 per mile of main track. The total capital investment per mile was $44,273. The total amount of dividends declared the last year was $2,409,874, an increase of $91,476 over the preceding year. Forty-eight out of 118 companies paid dividends ranging from one per cent. to eight per cent., and 70 companies, new and old, declared and paid no dividends. The average dividend rate on the whole amount of capital stock outstanding at the end of the year ($48,971,168) was 4.92 per cent., as against 5.60 per cent. in 1899.

The total number of passengers carried during the last year on the railways of the 118 companies making returns to the board was 395,027,198, an increase of 38,302,985 passengers over the previous year. The total number of miles run by street cars was 81,750,768, an increase of 8,383,533 miles over the previous year. The total number of round trips run was 7,818,427, an increase of 713,584 in number of round trips. The average number of passengers carried per round trip was 51—one more than in 1899.

Ten street-railway companies, viz., the Brockton, Globe (Fall River), Holyoke, Lowell, Lawrence and Haverhill, Lowell and Suburban, Lynn and Boston, Springfield, Union (New Bedford), West End (Boston) and Worcester Consolidated companies represent 66 per cent. of the entire capital investment, operate 55 per cent. of the total railway mileage and carry 82 per cent. of the whole number of passengers carried on all of the Massachusetts street railways.

Gross earnings from operation of the properties considered were $19,999,640 and the operating expenses were $13,159,947, making a ratio of 65.80 per cent. of expenses to earnings. The average of gross earnings, expenses of operation and net earnings of the roads per mile of track were respectively $10,452, $6,878 and $3,574; per car-mile, respectively, 24.46, 16.10 and 8.36 cents, and per passenger, respectively, 5.06, 3.33 and 1.73 cents.

The Desplaines Valley Electric Railway company has been consolidated with the Chicago and Desplaines Valley Electric Railway company, and the new company, with a capital stock of $1.100,000, will build a line from Joliet, Ill., through Lemont, Willow Springs and intermediate towns to Chicago. The directors of the company are Clayton E. Crafts, Samuel G. Decoursey, Henry J. Crowley, Philip H. Gray, George Simpson Eddy and C. L. S. Tingley.

Report of New York State Railroad Commission.

The annual report of the railroad commissioners of New York state for the year 1900 was recently issued, and in it are some interesting particulars relating to the street railways of the state. In a comparative statement are given details and totals from the reports of the street-railway companies of the state for the years ended June 30, 1899, and June 30, 1900. The following figures, taken from the table, give amounts for the year ended June 30, 1899, first, followed by the amounts for 1900: Capital stock, $173,124,740.87, as compared with $182,310,412; gross earnings from operation, $37,518,466.35 and $40,811,563.19; operating expenses, $22,652,924.73 and $23,989,180.24; net earnings from operations, $14,865,541.62 and $16,822,382.95; gross income from all sources, $16,538,662.81 and $18,186,583.30; dividends, $7,076,219.50 and $6,889,565.50.

The percentage of dividends to capital stock of street-surface-railway companies for the year ended June 30, 1900, was 3.77; in 1899 it was 4.67. The number of passengers carried on all the street surface railways of the state, including the few remaining horse railways and the elevated roads in Brooklyn, during the year ended June 30, 1900, including transfers, was 1,081,974,097, an increase over 1899 of 122,684,693. The number carried in the boroughs of the Bronx and Manhattan, New York city, including transfers, was 567,144,099, an increase over 1899 of 57,829,283. The number carried in the borough of Brooklyn (including some carried in the borough of Queens), including transfers and including those carried by the elevated railroads in Brooklyn, was 323,229,639, an increase over 1899 of 45,584,744.

The accidents occurring during the year were considered in the report and the commission renewed its recommendations to railway managers made in former years as to the operation of street surface railways. The brake test made by the board was mentioned, it being the opinion of the commissioners that the time taken for the test was well spent and that the result of the test will be the adoption of better braking systems on electric cars and a reduction of the number of accidents.

The number of tons of freight carried on the street surface railways of the state during the year ended June 30, 1900, was 153,343; during the year ended June 30, 1899, it was 129,040.

There were 17 new street surface railways incorporated during the year, with an aggregate length of 260.75 miles. The average number of persons, including officials, employed on all of the street surface railways of the state (including the elevated railroads in Brooklyn) was 28,075, and the aggregate amount of salaries and wages paid them was $16,968,907.05. The companies owned or operated on June 30, 1900, 5,098 electric and cable box cars, 3,666 electric and cable open cars, 23 air-motor box cars, 22 electric mail cars, 626 electric and cable freight, express and service cars. There were 2,437 other cars in operation. These figures refer to the cars operated on all street surface railways and the Brooklyn elevated railroads.

Knowledge to Be Sought by Experience.

Reference has been made in the Western Electrician previously to the controversy between the London United Tramways company and the authorities of Kew Observatory, which is near London, in relation to the effect of the operation of an electric-railway system with grounded return on the magnetic records of the observatory. The present status of the disagreement has an amusing side. "At last, after weeks of paper warfare," says the Electrician, "matters have taken a practical turn, and, in a moment of luminous inspiration, it has occurred to someone that it would be a good plan to make trial runs of the electric cars, to see what would be their effect on the precious instruments at Kew. Accordingly, what might have been done in the first instance has been resorted to in the last. Cars have been run night after night in increasing numbers, with the object of obtaining practical data upon which the Board of Trade will, we hope, be able to make up its mind what to decide in this vexatious matter."

Proposed Illinois Street-railway Law.

The street-railway bill prepared by the street-railway commission of the Chicago City Council has been presented in both houses of the Illinois Legislature and referred by them to the municipal corporations committees of the respective houses. The bill, which has been approved by the City Council, provides for 20-year franchises, city control and ultimately municipalization, should four-sevenths of the voters decide in favor of city ownership. The commission will not present a subway bill to the Legislature as originally intended, as Corporation Counsel Walker of Chicago has presented an opinion in which he holds that no enabling legislation is necessary, as the city now has all the power required to build subways.

The Chattanooga Electric Railway company, Chattanooga, Tenn., will double the size and capacity of its power house, erecting a new building and installing a direct-connected 500-kilowatt generator and engine, also two 150-horsepower boilers.

CORRESPONDENCE.

New York Notes.

New York, February 23.—The contract for the difficult Forty-second street section of the subway, which was awarded some time ago to Benezette Williams of Chicago, has been re-awarded to the Degnon-McLean Construction company, which has also the contract for the part of the road between City Hall Park and Great Jones street. It is said that some complications arose in connection with the former award and that Mr. Williams failed to qualify. Contractors L. B. McCabe & Brother claim the distinction of having completed the first section of the tunnel. The section extends from One-hundred-and-thirty-fifth to One-hundred-and-thirty-sixth street, along Broadway, and the work has been going on for nearly eight months. The part of the tunnel completed is all ready for the laying of the tracks. The section is to accommodate two tracks, which will not be laid until the rest of the tunnel is finished.

George H. Pegram, chief engineer of the Manhattan Railway company, has filed plans for a brick sub-station, to be used for storing and distributing electric power for the new third-rail system with which the road is being equipped. The station will be erected on the west side of Third avenue, near One-hundred-and-sixty-first street, at a cost of $31,000.

The Brooklyn Rapid Transit company has adopted a system of bonding conductors, in addition to the force of "spotters" employed. Bonds amounting to about $1,000,000 have been issued by a number of surety companies, each standing surety for a certain percentage of the conductors on the road. Each of the conductors is said to be bonded for $500, and if any dishonesty is discovered among those bonded the surety company makes good the loss. The men are obliged to pay $1 a year in payment of their share of the cost of the bond. The same company has in force a rule that all new motormen and conductors appointed must be photographed, the pictures to be filed at the general office and at the division offices to which the men are assigned. The company has found that men who have been discharged for dishonesty or incompetency sometimes get back under an assumed name, and the new rule is expected to remedy this trouble.

The plans for the trolley line from New York to Philadelphia are said to be progressing rapidly. It is stated that the cars will run at a high rate of speed, and that the fare will be $1.

The Sixteenth street station of the Fifth avenue division of the Brooklyn elevated railroad was partially destroyed by fire recently, and a train which was at the station at the time was also injured. The loss was about $2,500.

It is reported that Thomas A. Edison has perfected a new storage battery, which is said to embody a great advance over the present construction in the matter of weight, the claim being made that the capacity per pound of weight is more than twice that of the present battery. A new material is used in place of lead.

There is to be seen at Sixty-fifth street and Columbus avenue an electric sign which offers some points of interest not found in other signs. It is built by the Mason Monogram company, and is composed of 48 sections, each section containing incandescent lamps with suitable reflectors, so arranged and connected up that any section can be made to produce any letter of the alphabet. A separate wire is run to one side of each lamp, and a common return serves for the whole installation. The individual leads from each section are carried to a commutator, the 48 commutators being geared to a motor which operates all of them. By this arrangement words shown on the sign may be changed either instantaneously or gradually, and a whole word may be flashed at once, or spelled out, one letter at a time. The sections, or "monograms," in this sign are four feet in height and each contains 21 lamps.

A statement issued by the Brooklyn Heights Railroad company shows a surplus of $347,113 for the last six months of 1900, and gross earnings during the same period of $5,935,395. M. L. G.

Canadian Intelligence.

Ottawa, Ont., February 23.—The Manchester, Robertson & Allison company has been incorporated at St. John, N. B., with a capital of $800,000, to supply electric light and power.

The City Council of Halifax, N. S., at a recent meeting, decided to install a municipal electric-light plant, at an estimated cost of $100,000. A special committee of the council has been appointed to select a suitable site for the power house.

The fire and light committee of the City Council of Kingston, Ont., recently asked the Kingston Gas and Electric Light company to name a figure which it would accept for its plants. The committee hoped to reach terms without the expense of an arbitration. The company, however, having announced its willingness to accept $373,000, the council considered the proposition too high, and accordingly gave the committee instructions to proceed with arbitration. It is said that the price claimed by the company is double what an arbitration will award.

An important option, involving several millions of dollars, is said in reliable Montreal financial circles to have passed between the syndicate at the head of the proposed lighting and heating combine in Montreal and the majority of the shareholders of the Lachine Rapids Hydraulic and Land company. This latter company is the only one which has not been reckoned with in connection with the establishment of the proposed combine, legislation for which is now pending before the Quebec Legislature.

The value of the stock which the Royal Electric company of Montreal received from the Canadian General Electric company of Toronto for the manufacturing plant of the former company in Montreal is to-day placed at $612,000. The transfer of the plant took place some time ago, but the inventory has not yet been definitely decided. Mr. Rodolphe Forget, president of the Royal Electric company, states that the original amount involved would be about $480,000. The annual report of the Canadian General Electric company, in reference to the sale, says: "In December, an agreement entered into with the Royal Electric company of Montreal, for the purchase of the assets of the manufacturing branch of its business, was approved by the shareholders, and this company is now operating the factory at Montreal. The Royal Electric company takes in payment for the manufacturing assets shares of the company at a premium of $60 a share, and authority has been given for supplementary letters patent increasing the capital stock of the company to $2,000,000, an increase of $500,000, part of which will be devoted to paying for the properties and good will purchased from the Royal Electric company."

There has recently been installed at Liverpool, N. S., an electric marine railway of a novel character. The equipment of this railway consists of a 30-horsepower, induction motor, the motor shaft being geared to a heavy worm shaft. The worm-wheel shaft carries a pinion wheel which gears into another large wheel, on the shaft of which is placed a large, heavy sprocket wheel. Over the sprocket wheel a heavy two-inch chain meshes into the sprocket teeth. This chain hauls the vessel upon a cradle over a track projecting out into the River Mersey to a distance of 500 feet, on a grade of one-half inch to the foot. The track and cradle are built of heavy pine timbers. It formerly took from four to five hours to haul up a vessel by the motive power hitherto supplied by horses, whereas the same work is now performed by electricity in 20 minutes. The present railway is the first one in America, and probably the first one of its kind in the world operated electrically.

The annual meeting of the Canadian General Electric company of Toronto, Ont., was held on February 20th. The report showed that the net profits on operating accounts amounted to $262,903, and the premiums on the new stock to $75,000. These items, with the $58,437 balance from last year, make a total of $396,340. The dividends, 10 per cent. on common and six per cent. on preferred stock, amounted to $127,623; $125,000 has been added to the reserve, making that fund now $265,000, and a further sum of $12,600 has been placed to the credit of profit and loss, making $71,038 carried forward. The prospects for the new year, it was stated, were never better. Directors were elected as follows: President, W. R. Brock; vice-presidents, H. P. Dwight and Frederick Nichols, with the latter as managing director.

A. V. W.

From the Buckeye State.

Columbus, Ohio, February 23.—The injunction suit still stands in the courts here against the Columbus Railway company, and it seems that the citizens' committee, through whose instigation it was brought before the council granted a franchise, is determined to see whether the company has any right to claim a perpetual franchise on any of the streets of the city. This is probably the best time to get a judicial decision on the matter, since it was not included in the ordinance granting a franchise renewal, whatever the scope may be. It is probable, however, that Columbus will have lower fares than any other city in the central states.

The Columbus, Findlay and Toledo Electric Light, Power and Fuel company of LaRue has been incorporated, with a capital stock of $10,000, to build an electric line from Findlay to Columbus. A. J. Jones, J. H. Leonard and others are interested in the matter.

The Cincinnati Automobile company, Cincinnati, with capital stock amounting to $25,000, has been incorporated by Emmett P. Gray, Albert Leisure and others, to manufacture, buy and sell automobiles.

The Findlay and North Baltimore Railroad company, Findlay, has been incorporated, with a capital stock of $150,000, to build a line between Findlay and North Baltimore. The incorporators are O. F. Smith, James A. Bope, William Norris, Ed. V. Bope and Malt Nemeyer.

The Cincinnati Edison Electric company has purchased machinery enough to make its capacity about four times as great as at present. Five dynamos, one of a rated capacity of 30,000 lights, two engines and other apparatus are among the machinery purchased.

The Toledo Southern Railroad company, Toledo, was incorporated a few days ago, with a capital

stock of $25,000. The object of the company, as stated in the papers, is to build an electric railway from Toledo to Dayton, going west of Columbus, probably passing through Springfield and other towns. The incorporators are Ben F. James, George A. Smith, C. R. Painter, L. F. Donnelly and Jonathan E. Ladd.

The Wapakoneta and Kenton Traction company has been incorporated, to build a line between the two towns named in the title of the company. The capital stock is placed at $5,000. W. G. Brorein, H. C. Settage and others are interested in the road.

The Elyria, Grafton and Southern Railway company has been incorporated, with a capital of $10,000, to build a line between Elyria and Grafton.

The right-of-way has been secured a good portion of the way from Wheelersburg to Portsmouth for the Camden Interstate Railway company's extension. It begins to look as if the promoters are in earnest in relation to the building of the road.

Powell Crosley's ordinance for a street-railway line has been brought before the board of legislation at Cincinnati. Because it is framed under the steam-railway law, it is opposed by the Cincinnati, Hamilton and Dayton railway officials, who charge that it will cross their tracks in two places and that it is merely a plan to let the Southern Ohio Traction company into the city. The ordinance will allow the road to carry freight.

The Cleveland, Painesville and Eastern has decided not to build its extension to Geneva, and the application for a franchise in that town has been withdrawn.

The Toledo and Western Railway company has planned to build its road west through a portion of Indiana, and will possibly reach Goshen before next fall. It is said that the company has fully decided to build the road through to Chicago, although the officials refuse to confirm or deny the report. Under the name of the Toledo and Adrian Railway company it will also construct a line from Sylvania to Adrian the coming summer.

There is a report current that a Philadelphia firm will arrange to build an electric line from Fort Wayne, Ind., to Toledo this summer. It is expected that it will connect at Fort Wayne with the Fort Wayne and Southwestern, which will probably be constructed to Indianapolis as soon as possible. These are two of the most extensive electric schemes under consideration in Ohio and Indiana.

The Toledo, Napoleon and Defiance road and the Toledo and Maumee Valley, both of which are seeking franchises in Maumee, have offered to carry passengers from Maumee to Toledo for 10 cents. They have made some close competing offers in other places also.

Nothing further has developed in regard to the consolidation of the suburban electric-railroad companies about Cleveland. The officers of the Cleveland Electric Railway company merely say that such a thing might be possible in the future.

The Tiffin and Southwestern Railway company will build a line from Tiffin to Kenton, and a portion of the right-of-way has already been secured.

The City Council of Steubenville has granted the Pleasant Heights Street Railway company a franchise to build a road on several streets. The Steubenville-Mingo road will begin the construction of a line from that town to Brilliant soon. It will be met by a line from Martins Ferry. Several roads in that section of the country have been projected and may be built within the next year.

It is said that Thomas L. Childs has assigned three-fourths of his interest in the Canton-Akron line, concerning which so much has been said, to other gentlemen, and that more has been done toward getting plans in shape within the last two weeks than ever before. W. H. Hoover, L. E. Myers and C. A. Kolp are now interested in the line.

The Jones Bros. Electric company, Cincinnati, has filed notice of an increase of capital stock from $136,000 to $400,000.

The annual meeting of the stockholders of the Northern Ohio Traction company was held at the offices of the company in Akron on February 18th, when business of importance in extending the scope of the plans was transacted. The stockholders decided to increase the capital stock of the company to $3,500,000 by the addition of $500,000 more of common stock. This was done in order to cover the cost of the rapid-transit line, the purchase of which was ratified, and to provide for the extension to be built to Canton and Ravenna, which was also definitely decided upon. The reports of the officials show that within the last year seven miles of entirely new track have been built, an entire new electric-light and power plant has been installed, an entire electric road and light plant purchased, and work on the branch to Barberton is now under way. The property is in the best condition. The main line has been double-tracked from end to end, and many other improvements have been made. The gross earnings of the company for the year were $425,880. The operating expenses were 61 per cent. and the interest $125,000, but despite this there was paid a dividend on preferred stock of $25,000 and there is a balance of $30,000 to be paid on common stock. There was no change in the directorate of the company and the officers were all re-elected, as follows: President, W. R. Moore; vice-president, Will Christy; secretary, C. F. Moore; treasurer, J. R. Nutt; general manager, L. E. Beilstein. Before holding the meeting a number of the stockholders took a trip to Barberton over the Rapid Transit line and a banquet was served at the Barberton Inn. This property will now be taken off the hands of Mr. H. A. Everett, who has been holding it as trustee for some time.

T. Y. McCray states that he has secured a great deal of private right-of-way for the Mansfield, Mount Gilead and Southern line, as well as for the Mansfield, Savannah and Wellington, and that there is now ample financial backing for both. He says work will commence on them at an early date now.

A case has been brought in the Supreme Court against the Dayton Traction company and the Cincinnati and Miami Valley Traction company to test the right of electric roads to carry freight through the streets of cities. It is said the Cincinnati, Hamilton and Dayton Railroad company is at the bottom of the matter.

The Scioto Valley Traction company has notified the commissioners of Franklin County that they will not be asked to grant a franchise on the Chillicothe pike to it, as a short private right-of-way has been secured. The contract for building the road has been awarded to W. H. Luchtenburg of Columbus, and all the rails and material have been purchased. The commissioners have granted a franchise to the Columbus Southern Electric Railway company to build an electric line through the county on the Chillicothe pike. This company and the Scioto Valley company had been rivals for this privilege.

The State Board of Public Works has authorized Thomas H. Fordyce to construct a power house for running canalboats with electricmotor power and has granted a number of contracts for improvements on the canal, near Cincinnati, to make it ready for use.

The issue of $500,000 preferred stock of the Bullock Electric Manufacturing company, Cincinnati, has all been sold at 107½, and the money secured will be used to enlarge the plant and increase the business. The demand for the machinery and appliances made by the company has necessitated this move, and the company will now be enabled to increase its space to a sufficient size to meet the demands.

The Akron City Council has passed an ordinance making the franchise of the property included in the Rapid Transit lines expire at the same time as that of the Northern Ohio Traction company, so that all the lines will have a franchise for the same length of time.

The Cleveland City Railway company is seeking an extension of franchise, but it seems that it will have the same trouble with the City Council that the Columbus Railway company did. Tom L. Johnson is taking part in that fight also. Henry A. Everett is the president of the company, which is known as the Little Consolidated.

The Columbus, Buckeye Lake and Newark Traction company's property has been sold, so it is said, to eastern capitalists, who will take up the work and complete it as soon as possible. A. E. Appleyard of Boston engineered the deal with General A. J. Warner of Marietta, who purchased the controlling interest of the company some time ago. The business will now be done from the office of the Columbus, London and Springfield company at Columbus. It is believed that these two companies and the Dayton, Springfield and Urbana are under practically the same control, although the officials deny this.

The offices of the Camden Interstate Railway company will be moved from Ashland, Ky., to Huntington, W. Va.

The capital stock of the Central Market Street Railway company of Columbus has been increased from $100,000 to $250,000.

It is said that the Cleveland, Painesville and Eastern road will be extended from Painesville to Ashtabula, a distance of 30 miles. There is also a report current that the Cleveland and Elyria line will be extended on west to Toledo. Henry A. Everett is the leading spirit in both companies.

The Wheeling Traction company, Wheeling, W. Va., is said to be backing the proposed line from Martins Ferry to Cadiz.

The Van Dorn-Elliott Electric company of Cleveland, with a capital stock of $50,000, has been incorporated by J. H. Van Dorn, H. H. Hodell, F. Schneider, W. A. Dutton and W. H. Elliott. They will manufacture armatures and other electrical apparatus. O. M. C.

Information from Indiana.

Indianapolis, February 23.—The Franklin City Council has granted a franchise to Chicago capitalists who own the local waterworks, to put in a hot-water-heating and electric-lighting plant.

The ordinance granting a franchise to the Ft. Wayne and Southwestern Traction company has been rescinded and held in abeyance by the Huntington council. After surveying a site for the power house and barns the company demanded $7,000 as a bonus for locating in Huntington. The city feels that sufficient was done when a 50-year franchise was granted, hence the action.

The Union Traction company, which inaugurated a penny fare at Marion over the lines paralleled by those of the Marion Transit company, reports having sold 1,500,000 tickets in the four months the fare has been allowed. The cars of the Marion Transit company are almost deserted. The Union Traction company was boycotted at first by the trades council, but now the workingmen patronize the penny lines.

The bonds to cover the cost of construction and equipment of the Indianapolis and Greenfield electric line extension from Franklin to Knightstown have been disposed of and work will be begun on March 1st.

It is stated that the Dietrich natural-gas syndicate, which has a monopoly of the natural-gas supply of Indiana, is turning its attention to electric-railway lines since gas is failing.

The city of Indianapolis, having failed in the courts, under its present charter, to compel the railway companies to elevate their tracks, has caused a bill to be introduced in the Legislature providing for the authority to enable the city to do so by ordinance.

The Union Traction company has sold its machinery in the old power house at Anderson to a company that will build an interurban line at some other point in the state. The third 3,000-horsepower engine was started in the new central power house on February 14th, and the time schedule of cars on the lines reduced two hours.

The city comptroller of Indianapolis has just discovered that several electric-power companies are operating plants without a franchise. A number of such companies pay on an average $14,000 a year to the city, and that others had operated three or four years without having been discovered is surprising.

The prospect for active interurban electric-line construction in early spring is exceedingly bright. The lines ready to break ground with the advent of suitable weather are the Rushville and Brookville, the Kokomo and Indianapolis, the Danville and Rockville, the Indianapolis and Martinsville and the Indianapolis and Plainfield.

The following-named bills of interest to electric street-railway companies are pending in the Legislature: A bill giving street-railway companies the right to operate as one system in more than one town or city; a bill authorizing street-railway companies to increase their capital stock by unanimous vote of the stockholders, and a bill permitting street-railway companies to lease other lines. The latter is designed to make it possible for a South Bend line which desires to reach Niles, Mich., to connect at the state boundary with the Niles line, and lease it. F.

Northwestern Notations.

Minneapolis, February 23.—A bill is before the Legislature of the state of Washington which provides that street-car companies shall be required to employ competent men to operate their systems. The test of competency is three days' service on the particular line to which the man is assigned, but an amendment was adopted which allows much less than three days' experience during a strike.

Major Howard and S. C. Hedger have made a proposition to the council of Aberdeen, S. D., to buy the old lighting plant, enlarge it and add incandescent lights.

The light committee of Burlington, Iowa, has been on a tour of investigation to Omaha, Kansas City and St. Louis. The committee concludes that arc lights are superior to Welsbach gas lights and are cheaper for street lighting.

The District Court of Des Moines, Iowa, has entered a decree in favor of the street-railway company, reducing the company's valuation for city assessment from $400,000 to $100,000.

S. F. Gilman, the owner of the flour mill at Valentine, Neb., contemplates putting in an electric-light plant.

Citizens of White Bear, Minn., will petition the Twin City Rapid Transit company for street-car connection. Since the completion of the trolley line from St. Paul to Stillwater, south of White Bear Lake, the villages on the other shore, reached by train, have been given poor connections with the cities.

The voters of that portion of Clinton, Iowa, formerly known as Lyons, will vote soon on selling the municipal electric plant of the old city of Lyons to the Clinton Gas Light and Coke company.

Crookston, Minn., is working to secure legislative action to enable it to issue bonds for an electric-light and water plant.

Local capitalists are considering an electric-light plant for Reinbeck, Iowa.

The Fox River Valley Electric company contemplates extending its line from Appleton to Kaukauna, Wis., if the people of the latter city will hold out inducements. The city line in Appleton will be improved in the spring.

The Gas and Electric Light company of Mankato, Minn., has contracted to extend its wires to the village of North Mankato for street lighting.

The Light, Heat, Transit and Public Service company of St. Cloud, Minn., will have incandescent-light service on about the first of March. Lines will be extended to Waite Park and Sauk Rapids.

The committee on streets of the Assembly in St. Paul approves of the city engineer's plan to have all overhead wires in the business section of town come down by September 1st.

Superintendent J. P. Clark of the Seattle Electric company has resigned, to accept the general management of one of Stone & Webster's large

railway properties in the East. Trainmaster Arthur L. Kempster will be promoted to superintendent.

The Montana Legislature is considering a bill requiring street-railway companies to put vestibules on their cars for the protection of the operators.

George Hewes, for 10 years manager of the Consolidated Gas and Electric company at Faribault, Minn., has resigned and has gone to Des Moines, Iowa, where he has a position with the Edison Electric company. R.

PERSONAL.

Dr. Mayo G. Smith, who was associated with Morse in introducing the telegraph and in constructing the first line between Washington and Baltimore, died on February 21st at Colorado Springs, at the age of 85 years.

Stewart S. Neff, formerly superintendent of the Union Elevated Railroad company of Chicago and until recently consulting engineer of the Boston Elevated Railway company of Boston, has been appointed superintendent of the elevated-railway lines of the Boston company named.

H. H. Windsor has resigned his position as managing editor of the Street Railway Review of Chicago, and expects to engage actively in the organization and construction of street-railway properties, in which work he has been interested for some time. Daniel Royse, associate editor with Mr. Windsor for the last four years, succeeds to the position of managing editor.

Two characterizations in a recent century review of physics by Dr. T. C. Mendenhall are of interest. One relates to William Thomson, "now known as Lord Kelvin, the most versatile, brilliant and profound student of physical science which the century has produced." The other is of a German physician, "Herman von Helmholtz, destined to rank at the time of his death, in 1893, as one of the very first mathematicians of the age, doubtless the first physiologist of his time, and as a physicist with whom not more than one other of the nineteenth century can be compared."

ELECTRIC LIGHTING.

The electric-light plant at Perham, Minn., is to be enlarged.

The town of Eaton, Colo., will issue $2,000 bonds for lighting purposes.

C. Y. Byrd of Live Oak, Fla., will erect an electric-light plant at Valdosta, Ga.

A $25,000 issue of bonds for a lighting plant is contemplated at Independence, Mo.

The mayor of Monticello, Ga., desires bids on a lighting plant, to cost about $5,000.

An issue of $100,000 bonds is proposed at Waco, Texas, for a municipal lighting plant.

The city of Ellisville, Miss., is considering the issuance of $15,000 bonds for a lighting plant.

The city clerk of Lawrenceburg, Ind., will soon advertise for bids for a municipal lighting plant.

Smallwood & Son of Russellville, Ark., will soon be in the market for equipment for a lighting plant.

Citizens of Waterford, Pa., propose an issue of $20,000 bonds for a waterworks and electric-lighting system.

At an election held at Mediapolis, Iowa, recently, it was voted to issue $6,000 in bonds for lighting purposes.

The Clear Lake Electric Light and Power company of Clear Lake, Iowa, has increased its capital to $20,000.

The lighting plant at Brownsville, Tenn., which was valued at $8,000 and was recently burned, will be rebuilt.

The Orion Light and Power company proposes to install a thoroughly modern lighting plant at Orion, Mich.

C. Y. Byrd, Live Oak, Fla., wants bids on the erection of an electric-light plant for a town of 1,700 inhabitants.

The Magnolia Electric Light and Power company has been organized with $10,000 capital stock at Magnolia, Miss.

The mayor of Greenville, Ohio, has been authorized to advertise for bids for an issue of $10,000 electric-light bonds.

Parks & Mueller, owners of the electric-light plant in Hot Springs, S. D., contemplate the purchase of new machinery.

The mayor of Hogansville, Ga., will furnish information relative to a lighting plant there, for which bids will soon be asked.

The Itasca Electric Light and Power company of Itasca, Texas, is in the market for two 45-kilowatt, 110-volt, direct-current generators.

Director Kauffman of the Department of Public Improvements of Columbus, Ohio, is preparing specifications, with the purpose of calling for bids on the city-lighting contracts. The present contracts will soon expire.

The council of Grand Rapids, Wis., has granted the Twin City Electric and Water company a 30-year franchise for a lighting plant there.

L. S. Rogers, West, Miss., wants estimates on a hydraulic plant to generate and transmit electric power for lighting and mill purposes.

The Spring River Electric Power company of Kansas City, Mo., has been incorporated for $50,000, by F. L., Erasmus C. and L. D. Cheney.

William F. Applegarth, P. L. Goldsborough, J. G. Mills and James Wallace are interested in the erection of a lighting plant at Cambridge, Md.

An electric-light plant is to be installed at Ellisville, Miss. The mayor of the city will furnish desired information concerning the requirements.

The Meridian Electric Light and Railway company of Meridian, Miss., has been incorporated for $225,000, by J. Kamper, R. W. Stoutz and W. Ambrecht.

The Bradley Park Railway, Heat, Light and Power company of Peoria, Ill., has been incorporated for $100,000, by W. H. Ballance and J. E. H. Fisher.

The London Power and Electric company has been incorporated by Frank Shelly, Frank J. Danis and Edgar S. Marston, to operate a plant at London Mills, Ill.

The Russell Manufacturing company of Winder, Ga., of which E. J. Adams is superintendent, is in the market for a 50-kilowatt, alternating-current lighting plant.

The Radford Electric Light and Power company of Radford, Va., will shortly place orders for alternating and direct-current motors and a 90-kilowatt, two-phase generator.

The Southern Pacific company has had plans made for the erection of a $40,000 power house at Galveston, Texas, to furnish power and light for its wharves and terminals.

The Niskayuna Power company of Troy, N. Y., has secured five acres of land on the Mohawk River, near the aqueduct, and will shortly erect a large and fully equipped power station.

The electric-light plant at Silverton, Colo., has been purchased by a company headed by F. C. Adams and J. J. Henry. The new company will enlarge the plant and will also install steam-heating apparatus.

At a recent meeting of the City Council of Greenville, Ala., a resolution was adopted instructing the mayor to advertise for bids for $10,000 worth of bonds for the purpose of putting in an electric-light plant.

The officers of the Fond du Lac Light and Power company of Fond du Lac, Wis., elected at a recent meting are: President T. F. Grover; secretary and treasurer, William Kalt; directors, B. Wells and R. F. Allen.

The Enterprise Electric Light, Heat and Power company has been incorporated, with $25,000 capital stock, to erect an electric-light and heating plant at Garner, Iowa. The incorporators are E. C. Abbey, M. B. Cooper and F. E. Blackstone.

The city of Newbern, Tenn., has purchased the plant of the Newbern Water, Light and Power company and asked the Legislature for authority to issue bonds for extensions and improvements. The mayor of Newbern has the matter in charge.

Sealed proposals will be received until March 15th at the office of James K. Taylor, supervising architect, Treasury Department, Washington, D. C., for the installation of a system of wiring for the northwestern extension of the Bureau of Engraving and Printing at Washington.

Contracts will soon be let for an entire lot of new machinery, consisting of engines, dynamos, etc., to equip the plant of the Wichita Gas and Electric Light company, Wichita, Kan. The estimated cost of the new machinery is over $30,000. A. O. Baker is superintendent of the company.

C. Scholz, secretary of the Carbon Coal and Coke company, Cannelton, W. Va., is in the market for a second-hand electric plant of 100 kilowatts' capacity, the generator to deliver power at 250 volts, direct current; a 150-horsepower automatic engine, a tubular boiler to supply steam at 80 pounds and a complete switchboard are also desired.

Sealed proposals for furnishing to the United States Indian school at Santa Fe, N. M., a quantity of electrical supplies, including wire, shades, cutouts, tubes, etc., are being invited by the Interior Department. A full list and description of the articles desired may be obtained upon application to Clinton J. Crandall, superintendent of the school.

The electric searchlight that is to be installed on the Electric Tower of the Pan-American Exposition at Buffalo will be equipped with a 30-inch projector. Although this is much smaller than the largest World's Fair light, it is announced that it will be more powerful. It will be operated on the 360-foot level of the tower and on favorable nights it is expected that the light will be visible for a distance of 50 miles.

About 70 of the 150 arc lamps recently placed on Westminster bridge and the Victoria embankment along the Thames River, London, were lighted for the first time on the evening of February 23d. Gas engines drive the dynamos of this plant, so that the fashionable neighborhood contiguous to the embankment may be free from the smoke nuisance.

The secretary of war, in his annual report covering proposed expenditures for the United States Military Academy, has included an item of $151,525 for the installation of an electric-light plant. The present method of lighting the academy involves the operation and maintenance of two systems—gas and electric—neither of which is effectively or economically organized. It is suggested that a central plant be erected, which should include both heating and lighting facilities.

ELECTRIC RAILWAYS.

The Detroit United Railway company has purchased the Wyandotte and Detroit River electric railway.

The street-railway system of Madison, Wis., has been bought by Phillip L. Spooner of Madison. The road is stocked and bonded for $200,000.

The City Council of Lawrence, Kan., has granted L. M. Erb a franchise to build an electric street railway in that city. The construction of the road will begin June 1st.

The Penn State Construction company of Philadelphia has been granted a franchise to build an electric line from Cumberland to Westernport, Md., a distance of 30 miles.

It is stated that the municipality of St. Petersburg, Russia, has assumed control of the street railways there and that bids will be invited for the electrical equipment of the lines.

The ordinance granting a franchise to L. M. Erb of New York for the building and operating of an electric street railway in Lawrence, Kan., has been passed by the City Council of that place.

The Riverdale, Harvey and Chicago Heights Railway company of Chicago has been incorporated, with a capital stock of $10,000, by Samuel M. St. Clair, George E. Ruther and Myles J. O'Kelley.

G. T. Guernsey, T. H. Stanford and I. B. Wallace of Independence, Kan., have obtained a franchise for an electric railway between that city and Cherryvale, a distance of nine miles. The road will cost $150,000.

The Wilmington City Railway company of Wilmington, Del., will build a new power house on the north side of Brandywine Creek. Plans are now being prepared for the buildings, and machinery costing $75,000 will be installed.

The interurban electric line between Manitowoc and Two Rivers, Wis., for the construction of which a franchise has been granted to T. Higgins of Neenah, will be extended to Mishicott, provided a franchise can be obtained.

A joint resolution was recently introduced in the Michigan Legislature proposing an amendment to the constitution of the state under which can be enacted a valid law permitting municipalities to own and operate street-railway systems.

The newspaper car of the Union Traction company in Philadelphia has been given a thorough test during its two years' service, and is said to give satisfaction. It makes a trip of 14¾ miles in 27 minutes, with about 18 stops, a rate of about 35 miles an hour.

The Byfield car barns of the Georgetown, Rowley and Ipswich street railway in eastern Massachusetts were destroyed by fire recently, together with 21 cars, three snow plows and other equipment. The fire is thought to have started on one of the cars, due to defective insulation. The loss is placed at $75,000.

The Chicago Union Traction company has in operation a newspaper car which starts daily at 4 a. m. from the downtown district and runs to North Evanston, 14 miles, in one hour, where the papers are delivered to the Chicago and Milwaukee Electric Railway company.

The Batavia and Eastern Railway company has been incorporated, to build a road from Batavia, Ill., to a point on the Aurora, Wheaton and Chicago railway, between Aurora and Wheaton, Ill. The capital of the company is $10,000, and the incorporators are L. J. Wolf, W. T. Hapeman, A. T. Long, E. E. Barrett and Charles Jones.

Hudig Calkoen, of the Koloniale Bank, Amsterdam, Holland, writes that the agent of his bank at Soerabaya, Java, wants prices on, and information concerning, high-grade American tramway engines and tramway equipment. Consul Hill of Amsterdam, who forwards the letter, states that the bank mentioned has a sound reputation. Duties on iron and steel products are levied in the Dutch East Indies at 10 per cent. ad valorem, in-

stead of five per cent., which is the tariff for the Netherlands.

The Geneva, Batavia and Southern Railway company, with offices in Chicago, has been incorporated, with a capital stock of $100,000, to build a road from Geneva to Aurora, Ill. The incorporators and first board of directors are: L. J. Wolf, Cleveland, Ohio; E. E. Barrett, Western Springs, Ill.; Charles Jones, Wheaton, Ill.; W. T. Hapeman and A. T. Long, Chicago, Ill.

The railway property of the Freeport General Electric company of Freeport, Ill., against which foreclosure proceedings were commenced in the United States Circuit Court two years ago, is to be sold within a few weeks. W. O. Johnson, the present receiver of the company, will act as special master in holding the sale. Bids will be received at the power house of the company in Freeport on a day to be named later.

Mayor Harrison of Chicago believes that the question of extensions of street-railway franchises in Chicago should be taken up at once by the City Council, and to that end is in favor of appointing a new committee or commission of seven to consider the extension of the franchises exclusively. The mayor is in favor of 20-year franchises and electric-conduit construction, instead of overhead trolleys, in the business district.

A comparatively mild day, followed by a cold night, on February 18th, was responsible for an accident to the Lake Street elevated railroad of Chicago by which the service was tied up for two or three hours early the next morning. The sudden drop in temperature caused one of the copper feeder cables near Campbell avenue to contract and pull out of a sleeve joint. The cable had been in continuous service for four years.

The Muskegon Traction and Lighting company of Muskegon, Mich., has been organized to succeed the Muskegon Street Railway company, the Muskegon Gas Light company and the Muskegon Electric Light company. The officers of the new company are as follows: President, F. A. Nims; vice-president, Liddon Flick; secretary-treasurer, Theodore S. Barber; local treasurer, John J. Howden; local secretary, David D. Erwin; directors, F. A. Nims, J. J. Howden and Louis Kanitz of Muskegon, and Liddon Flick, Theodore L. Barber, E. F. Payne and John N. Conyngham of Wilkesbarre, Pa.

The Tacoma Railway and Power company of Tacoma, Wash., adopted a novel method of disposing of the claims arising out of the accident of July 4, 1900, which resulted in 45 deaths. The stockholders made up a purse of $80,000, which was distributed among the claimants by the officials of the company on condition that the former sign an agreement looking to this fund rather than to the company for payment of their claims. The plan was adopted to avoid the expenses which would have been entailed by litigation, and resulted very successfully, as both sides showed a disposition to be perfectly fair.

George B. Harris was last week elected to the presidency of the Chicago, Burlington and Quincy Railroad company, to succeed C. E. Perkins, resigned. Mr. Harris is also a director of the Metropolitan West Side Elevated Railroad company of Chicago, and his new position is expected to be of possible benefit to the Metropolitan company when the latter completes its Douglas Park extension across the Burlington tracks near Douglas boulevard. He is now in a position to mediate between the two companies in negotiations for the use of the elevated structure to give Burlington trains an entry to the downtown district, a plan that was proposed some time ago, but which has never reached a definite settlement.

The statement has been authorized that William B. Given of Columbia, Pa., and Samuel R. Shipley of Philadelphia, who are interested in the Conestoga Traction company of Lancaster County, Pa., have become the owners of more than a majority of the shares of that company, and that they will incorporate the Lancaster County Light and Power company, which will take and operate all lines of the traction company and the plants of the Lancaster Railway company, the Lancaster Gas Light and Fuel company and the Edison Electric Light company of Lancaster, Pa. These companies represent an aggregate capital of about $5,550,000. The Conestoga Traction company operated 86 miles of electric railway in Lancaster County. It is said that William B. Given, president of the Conestoga company, will be the president of the new company.

The officers of the Lafayette, Purdue and Northern Traction company, recently incorporated in Indiana, by A. A. Purman to consolidate a number of street-railway lines are as follows: President, Hugh A. Holmes of Detroit; secretary, A. A. Purman. The other directors are: W. N. Holmes, William R. Brown, William Nicholls, James Murdock and T. McNary. The company has a capital of $800,000 and intends to consolidate all the street-railway lines in all the more important cities in Northern Indiana, Northwestern Ohio and Southern Michigan, and the interurban roads as well. The deal involves the ownership of most of the interurban lines with which the territory is now being intersected in every direction, and these will be consolidated with city lines. The company, it is stated, has prepared to begin negotiations for the purchase of city lines at South Bend, Logansport and other Indiana cities.

According to the recent report of the Connecticut State Railroad Commission there are 31 electric railways in operation in the state with $12,143,448 of stock outstanding, of which only 37 per cent. has been issued as cash. The bonds of these companies amount to $10,592,800. Figures showing the extent of electric-railway consolidation in Connecticut give 147 miles of street railways in the state eight years ago, whereas now there is 499.8 miles. Of this 379 miles, or about 76 per cent., is owned or controlled by four corporations, and the 35 original railway companies in actual operation and control have been reduced to 15.

AUTOMOBILES.

Plans are on foot for a new automobile club in Chicago. It is believed that there are enough followers of the sport in the city to support two successful clubs, and it is stated that the new organization will have charge of the track events at the automobile show to be held at the Chicago Coliseum the latter part of March.

An automobile line is to be put in operation between Hoquiam and Aberdeen, Wash., on Gray's harbor, and the company has contracted for two electric carriages equipped to accommodate 20 passengers. The carriages will cost about $4,000 each, and which will be built to attain a speed, when loaded, of 20 miles an hour.

Some of the machines being built for the international cup race, to be held under the auspices of the Automobile Club of France, are of unusual interest. It is reported that Germany will send three vehicles carrying 35-horsepower Daimler gasoline motors, one 50-horsepower Denz wagon and a 70-horsepower Canello Durkopp vehicle.

A decision was recently given in the first suit brought to trial in Chicago, for personal injuries sustained in an automobile accident. A suit for $5,000 damages was brought against the Woods Motor Vehicle company for the death of a boy who was struck by a vehicle belonging to the company, in January, 1900, receiving injuries from which he died four weeks later. It was asserted that the operator of the vehicle was negligent, but the evidence showed that he was trying to avoid another vehicle when his cab struck the boy. The verdict was for the defendant.

POWER TRANSMISSION.

By a recent decision of the Supreme Court, to the effect that the city of Chicago had exceeded its constitutional limit of indebtedness by nearly $8,000,000, a proposed issue of bonds is defeated, by which the city was to construct an immense hydro-electric plant at Lockport, Ill., to transmit electricity to the city, taking advantage of the water-power of the drainage canal, which was to be leased from the drainage trustees. Mayor Harrison, with the aid of Corporation Counsel Walker, has submitted to the City Council a plan for the issuing of more city bonds to provide funds to carry out the drainage-canal and other improvements, based on an assessed valuation of one-half instead of one-fifth the actual value of property, which, it is hoped, will provide the necessary funds in accordance with the Supreme Court decision.

A contract was recently closed by the McCloud River Electrical Power company for all the electrical apparatus for a 35-mile transmission system, from the hydraulic generating station on the McCloud River to Keswick, Cal. The Bully Hill mining district and the city of Redding will also be reached by the lines. There will be four 500-kilowatt units, each consisting of a Bullock three-phase, 60-cycle alternator of revolving-field type, and a set of Stilwell-Bierce & Smith-Vaile twin turbine wheels. There will be six sets of these wheels, four being direct-connected to generators and one to each of the two exciters. Current will be transmitted at 32,000 volts. Bullock transformers, having a capacity of 2,650 kilowatts, will be used for stepping up and 2,500-kilowatt capacity will be required in stepping down.

One of the most important of the hydraulic electrical generating plants under consideration at the present time is that proposed by the Highland Canal and Power company of Duluth, Minn. This company purposes to construct a waterpower canal 100 miles in length, ending at Duluth and running through St. Louis and Lake counties, Minn., which will be capable of furnishing 100,000 electrical horsepower. The canal will be supplied from rivers and lakes in a watershed covering 2,500 square miles, through which it will pass. The available head of water will be 776 feet and the power house will be located within the city of Duluth. It is stated that the company will be able to supply power at about two-thirds of the prices charged by the Niagara Falls Power company. There is said to be an immediate demand for 30,000 horsepower of the power available at Duluth and Superior. The proposed canal will also furnish a means of bringing to Duluth a large quantity of timber from the forests through which it will pass. J. T. Fanning of Minneapolis is consulting engineer for the company.

PUBLICATIONS.

An eight-page bulletin has just been issued by the General Incandescent Arc Light company of New York city, describing the G. I. push-button switch, attaching plug and flush receptacle with outlet box, and a new automatic switch.

The Emerson Electric Manufacturing company of St. Louis, Mo., has recently issued a bulletin (No. 3028) describing the new line of direct-current motors, ranging in size from one-fourth to one-half actual horsepower, which the company has just put upon the market.

The sixth edition of the crane catalogue that is distributed by Pawling & Harnischfeger of Milwaukee is a book of 131 pages, and one that shows the character of the work turned out by the firm in the crane line. Most of the catalogue is devoted to electric traveling cranes. A large number of half-tone pictures illustrate different types of cranes and various installations made by Pawling & Harnischfeger. The catalogue is quite complete and will be valuable to anyone interested in cranes of any description.

The official report of the fifth annual convention of the International Association of Municipal Electricians held in Pittsburg, Pa., on September 25, 26 and 27, 1900, has just ben issued. Besides the official proceedings of and papers read at the convention, the book contains a historical sketch of the organization, with portraits of the officers and directors and other information pertaining to the purposes and benefits of the association. The book contains 204 pages and is neatly bound in a flexible leather cover.

A new descriptive catalogue of the Victor turbines manufactured by the Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio, has just been issued by the company. The publication has 183 pages and contains a large number of illustrations of Victor turbine installations that have been placed by the company throughout the country. Special attention is called to the Victor high-pressure turbine, which is a new type of wheel added to the company's already extensive line of waterwheel patterns. The catalogue contains tables and considerable waterwheel data and concludes with a partial list, containing several hundred references, of users of Victor turbines.

SOCIETIES AND SCHOOLS.

The council and committee on meetings of the American Institute of Electrical Engineers have arranged for a conversazione to be given by that body some time in April in New York city. Through the courtesy of Columbia University, the meeting will be held in the electrical engineering department, with the co-operation of Prof. Crocker, Dr. Pupin, Mr. G. F. Sever and others of the staff there. While the conversazione will be largely social in character, a special feature will be the exhibition of the latest electrical apparatus, inventions, etc., in working condition. Mr. T. A. Edison, Prof. Elihu Thomson, Dr. Pupin and others have promised personal assistance in this respect. W. J. Hammer has that part of the programme in hand. Secretary Pope and W. S. Barstow, chairman of the papers and meetings committee, invite all members to contribute features of scientific interest and to give an early notification of what they will do in this respect.

TELEGRAPH.

The management of the Big Four railroad system has issued an order raising the salaries of all operators 12½ per cent.

Construction on the Cape-to-Cairo telegraph line is said to be making fairly good progress. About 100 miles of line to the south of Lake Tanganyika has been completed. Much trouble is experienced in getting supplies transported, and for this reason general use has been made of trees for poles. Much of the country through which the new line passes is thickly wooded.

The entire submarine cable network of the world in 1898 comprised 1,460 lines, with an estimated total length of about 192,634 miles. Of this number of lines, no less than 1,142 lines, with a total length of 22,867½ miles, were under government management; the remaining 319, with a combined length of 169,021 miles, were in the hands of private companies. It is estimated that the total value of this cable network is $1,190,000,000.

The Western Union and Postal Telegraph-cable companies have raised their bids to the Chicago Board of Trade for the distribution of market quotations and offer to pay $30,000 a year for the quotations, where for years they obtained them free. They have also agreed not to furnish quotations to any but approved persons or firms who are known by Board of Trade officers to be conducting a legitimate business. It is understood that an arrangement is being considered whereby a lease of the Cleveland Telegraph company is to be made to the Western Union or one of the companies controlled

by it. At the same time the Board of Trade will preserve its property rights in its quotations, and dictate to whom they shall be furnished.

With a view to accelerating the tardy transmission of telegrams between St. Petersburg and the remote districts of the Russian empire, the imperial authorities have resolved to abolish many intermediary stations. Hitherto, a telegram sent from the capital to Tiflis has had to be dealt with at 14 stations en route, and one sent to Irkutsk has had to pass through 13 stations. As an accelerated telegraphic service, both with the Caucasus and the Far East, is of immense importance at the present time, the intermediary stations have been reduced to four and six, respectively, between Tiflis and Irkutsk.

SPACE TELEGRAPHY.

Tesla has offered to supply the Navy Department with a system of wireless telegraphy, and has been invited to submit his system for trial. The department is not inclined to accept Marconi's proposition to furnish his apparatus to the American navy for $20,000 in cash and $10,000 a year.

MISCELLANEOUS.

John C. Koch, president of the association under whose auspices the Milwaukee Industrial Exposition is held, is planning an extensive electrical exhibit as a feature of the exposition this year.

Under the new tariff law of Venezuela, which went into effect on October 10, 1900, apparatus and machinery for lighting with electricity, and for the production of electric power, also carbons for arc lighting, are admitted free of duty. A similar privilege is extended to telegraph apparatus when permission has been received from the government previous to importation.

The federal court has handed down a decision that the Executive Council of Porto Rico cannot be enjoined in the matter of granting franchises, it being a legislative body, although it acts in franchise matters independent of the House of Delegates. This decision was called forth by an application of Senor Vicente Usera for an injunction to prevent the council granting a franchise to an electric railway in Ponce, represented by J. M. Lothrop.

Members of the fire department of Newport, Ky., recently had trouble with a new horse, which attempted to kick down the stable door and failed to succumb to the ordinary methods of treatment. As a last resort electrical connections were made with the stable door and the horse's bridle in such a way that the animal would receive a severe shock upon touching the door. The horse is said to have been cured after two applications of the remedy.

A London report states that experiments with aluminum as a substitute for paper are now under way in France. It is said to be now possible to roll aluminum into sheets four-thousandths of an inch in thickness, in which form it weighs less than paper. By the adoption of suitable machinery these sheets can be made even thinner, and can be used for book and writing paper. The metal will not oxidize, is practically fire and water proof, and is indestructible by worms.

The commissioners of the District of Columbia have prepared a schedule of license fees to be levied and collected on the various trades, professions, etc., in accordance with a resolution of the United States Senate. In this schedule fees of $5 per annum on automobiles and all passenger vehicles not using animals as a motive power and $2 per annum on automobiles when used for the transportation of merchandise, are suggested. The fee for telephone and telegraph companies is placed at $11 per annum.

Edward A. Brackett of Winchester, Mass., a member of the Massachusetts Commission of Island Fisheries and Game, has adopted a novel method of protecting himself from thieves who have made numerous visits to the corral in which he maintains a brood of Mongolian pheasants. The corral is surrounded by a wire fence and has a roofing also of wire, and the whole network has been put in circuit with an electric generator, insuring a severe jolt to the marauder, either human or feline, attempting to prey upon the inhabitants of the preserve.

A substitute for coal, made by grinding dry peat in a machine, mixing it with certain chemicals and pressing it into brick shape, has been invented, it is reported, by a workman named Montag, employed in the Hemshof dye and soda factory near Mannheim, Germany. It is said that it costs about 25 cents to manufacture 220 pounds of the artificial coal and that it gives a great heat, burns with a bright flame, and leaves no slag and only a small quantity of white ash. Steps are being taken, says a recent consular report, to manufacture the material, in the vicinity of Hockenheim.

At the Imperial Physico-Technical Institute of Charlottenburg (Berlin) a series of tests has been carried out recently on a new alloy of copper, zinc and aluminum which is said to be especially valuable for the construction of standard resistances. The important requirements for this work are high specific resistance and a low temperature coefficient. The new alloy is said to have a mil-foot resistance of about 350 ohms, and for ordinary temperature ranges a negative temperature coefficient of less than one-thousandth of one per cent. The tests have not been continued long enough as yet to enable any statement to be made concerning the aging properties of the alloy.

An Englishman has invented a means of producing white lead and other metallic compounds by the use of the electric arc, the lead to be treated being kept in a molten state. The metal is acted upon by gaseous vapors, which produce carbonate of lead or any other required lead compound, and the fumes produced are blown over into chambers having canvas or fine-fabric cloth covers or roofs where the fine, dry, powdered, white lead falls down and the uncondensable gases pass through the canvas roof, thus dispensing with grinding, washing and drying processes. It is claimed that there will be a saving of at least 50 per cent. in the cost of production by the process.

Professor d'Arsonval of Paris is thus reported: "I continue to assert that liquid air cannot be utilized in running motors because the latter produce only five per cent. of the force spent in producing liquid air. Such motors can only be used in laboratories or in floating companies to drain the money of silly people or for submarine boats, where expense is of no consequence. I do not wish to give the details, but I affirm that the problem of submarine boats has been solved by French engineers. Before the end of the year they will have a new apparatus rendering France independent of coast defenses or battleships. These boats will be able to cross the ocean under water without emerging for the entire distance."

The South Carolina Interstate and West Indian Exposition will be held in Charleston, S. C., opening December 1, 1901, and closing June 1, 1902. The work of constructing the buildings is now in active progress, contracts having already been made for four of the principal structures, of which there will be 11. The South today offers a most engaging field to the electrical engineer. Nearly every small town in the South is clamoring for a cotton mill, an electric-light plant and a street railway. The many waterpowers in the South, for years considered as of little or no value, are being rapidly surveyed, and the active demand for information shows that the union of the turbine and the generator will make rapid strides throughout this section.

It seems to be decided that an aerial bridge 300 feet in length is to be built across the ship canal at the harbor entrance of Duluth, Minn. This bridge will be of peculiar design. A truss, 150 feet high, far enough up to clear the masts of the tallest ships, will span the canal. On the truss will be a carriage running on a track, and suspended from this carriage by wire ropes will be the bridge car at the level of the adjoining streets. The carriage will be operated by electricity and will cross very quickly. The car will be covered and comfortable. The design is the invention of a French engineer, and a bridge similar in general plan is in use in Rouen. The bridge, it is said, will cost about $100,000, and while it will be erected and owned by private capital, the city is to reserve the right to buy, and will operate it as a part of the municipal street system from the first.

TRADE NEWS.

The American Electrical Novelty and Manufacturing company of New York has been incorporated for $25,000, with a capital in Illinois of $2,500.

The Stein and Langlos Electric Manufacturing company of New York city has been incorporated, with a capital stock of $10,000, by George Stein, W. V. Langlos and C. F. Kabisch.

The American Electric Appliance company of Philadelphia has leased the plant of the Marcus Hook Iron Works in that city, and will manufacture engines and dynamos as soon as the necessary repairs and alterations have been made.

Consul Marshal Halstead of Birmingham, England, writes that he will be glad to furnish information concerning an English electric-supply company which wishes to open correspondence with American manufacturers of electrical accessories.

The International Correspondence Schools of Scranton, Pa., carries on a students' aid department, the object of which is to assist in securing employment for the students at the schools. This service is rendered without charge to either employer or employed.

The McKenna Bros. Brass company of Pittsburg has completed plans for an eight-story factory plant, to be erected at the corner of First avenue and Ross street in Pittsburg. The building will be of brick and steel, 160 by 84 feet in size, and will cost $100,000. The first four floors will be occupied by the McKenna company in the manufacture of its line of fine brasswork, while the upper floors will be rented.

The Southern Conduit company is building works at Pine Bluff, N. C., to manufacture wooden electrical conduits in 10 to 12-foot lengths of long-leaf Southern pine. When completed the conduit is immersed in a hot bath and thoroughly saturated with a compound that is said to make it waterproof, resistant to electricity and practically indestructible. The company has been experimenting for 18 months to perfect the process, and will begin business as soon as the machinery is installed.

The International Brass and Electric company of New York has been incorporated. It manufactures induction coils, fine-wire winding, binding posts, general electrical devices, small machinery, screw-machine products and scientific instruments, and has enlarged its facilities. The new company has a paid-in capital stock of $25,000 and the following-named officers: President, Edwin Huerstel; vice-president, Robert A. Scott; secretary and treasurer, Gustave Huerstel. Its address in New York city is 76 Beekman street.

Work is now progressing on a new addition, 90 by 220 feet in size, to the plant of James Leffel & Co., Springfield, Ohio. The addition will be built of brick and steel and equipped with electric cranes and a number of new machines, to enable the firm to supply the increased demand for its Samson waterwheels. These works will now give work for 300 men. Leffel & Co. have just received an order for a large pair of horizontal wheels from Minneapolis to develop 3,000 horsepower, and another contract for 10 68-inch Samson wheels from Michigan for driving electrical machinery.

The officers of the American Steel and Wire company elected recently in New York are as follows: Chairman of the board of directors, J. W. Gates; president, William P. Palmer; first vice-president, William Edenborn; second vice-president, J. S. Keefe; third vice-president, P. W. Moen; fourth vice-president, S. H. Chisholm; treasurer, F. L. Watson; assistant treasurers, T. P. Alder of New York and A. F. Allen of Chicago; secretary, C. S. Roberts; assistant secretaries, F. E. Patterson of New York and A. F. Allen of Chicago; auditor, C. A. Honecker; assistant auditor, C. A. Vogt; general counsel, Max Pam; executive committee, J. W. Gates, William Edenborn, P. A. B. Widener, Thomas F. Ryan, John Lambert, H. Clay Pierce and William P. Palmer.

Apropos of the unfortunate tariff misunderstanding between Russia and the United States, the following translation from an article appearing in the Deutsche Export Zeitung is of interest: "The increase in the trade of the United States with Russia is noticeable. This is due to the cordial relations which exist between these two countries and to the less friendly attitude of Russian merchants toward the manufacturers of other countries. The greater part of the orders for the Siberian railway has been placed in the United States. Another large order, amounting to $595,000 in value, has just been placed in America for machinery to cut a tunnel of about 1½ miles in length, not far from Charbin, in Manchuria. The tunnel is to be finished in one year's time. Direct connections will then be completed between Europe and Vladivostock. The United States has outdistanced Germany in the markets of Russia."

BUSINESS.

The Western Electric company, Chicago, is carrying a large stock of lead-covered and braided rubber-covered cable, also weatherproof cable and wire from the largest to the smallest commercial sizes. This company is offering these goods at very attractive prices with prompt delivery.

The Ball Engine company, Erie, Pa., is installing five 300-horsepower, self-oiling engines in the new electric-light plant of the Lacombe Electric Light company at Denver, Colo., and a 175-horsepower, self-oiling engine in the electric power plant of the P. R. Mitchell company at Cincinnati, Ohio.

John E. Blake & Co., 169 Broadway, New York, manufacturers of cross-arms, pins and brackets, report a greatly increased business during the month of February. The company states that it handles only the best in its line and has a large quantity of cross-arms and pins always in stock for quick shipment.

The Gregory Electric company, Chicago, announces that it has on hand 200,000 lights' capacity in transformers, which it has just received. The company states that every transformer listed in its bargain sheet is actually in stock at its works and can be shipped at once. All transformers are guaranteed as good as new and the company states that it will replace defective ones free of cost.

The Chicago House Wrecking company, West Thirty-fifth and Iron streets, Chicago, which makes a specialty of handling second-hand machinery, says it has at present in stock a fine line of moderate-speed dynamos and motors which can be used for lighting, charging storage batteries, electroplating, etc. The company guarantees these machines to give thorough satisfaction, to be noiseless, and not to spark or heat. The company states that it is in a postion to quote attractive prices on these machines, and will be glad to hear from prospective purchasers.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued February 19, 1901.

668,151. Trolley Switch. Max D. Baron, New York, N. Y. Application filed May 15, 1899.

The two crossing trolley conductors each contain a gap, and a junction piece connects the parts at their respective gaps. A switch pivoted on the junction piece moves in a horizontal plane and mechanically opens and closes the gaps of both trolley conductors to afford an even way over which the trolley may travel across the gaps. Striking pieces carried by the junction piece and connected with the switch near each trolley conductor are struck by an approaching trolley to operate the switch. (See cut.)

668,170. Electric-railway System. Ed W. Farnham, Chicago, Ill. Application filed October 17, 1900.

The contact rail is made in a number of independent sections, each of which is supported by an antifriction device. An arm for each of the sections has a pivotal connection with the section at one of its ends and with a fixed support at its other end. The movement of each section upon its pivoted arm places the section in electrical connection with the feeder and a contact shoe supported by the car moves the sections for this purpose.

668,174. Trolley Wheel and Harp. Joseph D. Forrer, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed June 8, 1900.

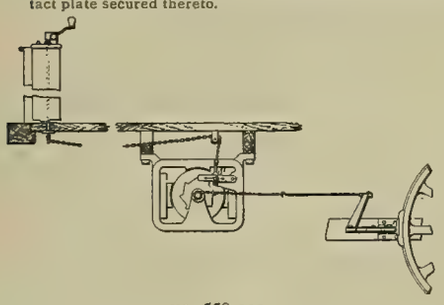
The harp is provided with seats for the bearing members. A wheel is connected to a spindle to rotate therewith, and removable bearing members fit the seats and receive the end portions of the spindle. Contact springs secured to the harp and impinging the ends of the spindle engage the bearing members and secure them against rotation and displacement.

668,194. Rotary Field Magnet for Electrical Machines. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed July 14, 1900.

The body portion is built up of several sections, the meeting faces of which are transverse to the axis and have pole-piece end blocks or plates each of which extends from end to end of the body portion and is bolted to the several body sections.

668,213. Attachment Plug. William T. Pringle, Lansdowne, Pa. Application filed December 18, 1899.

The insulating block has upon its opposite sides channels of limited extension. Keying nuts in the channels are limited as to their movement in one direction by the limit of the channel and in the other direction by the contact plate secured thereto.



NO. 668,233.

668,215. Galvanic-battery Electrode. Charles J. Reed, Philadelphia, Pa. Application filed September 14, 1897.

A layer of granular carbon is in electrical contact with a thin metal plate, and a non-conducting cement serves to render the layer of carbon waterproof and to attach it to the metal plate.

668,233. Brake for Electric-railway Cars. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed December 12, 1899.

A controlling switch is arranged to connect the motor or motors to run as generators in a local circuit. An auxiliary motor has its armature connected to the mechanical brake rigging of the car, with a locking device for preventing a backward or brake-releasing movement of the armature, and a mechanical connection between the locking device and a movable member of the switch, whereby the operation and release of the switch effects the operation of the lock. (See cut.)

668,235. Rheostat. Nathan H. Suren, Needham, Mass. Application filed June 29, 1899.

Part of the contacts are single and part double. A movable two-armed switch is used, one arm of which is insulated from the other arm and co-operates with one series of contacts while the other arm co-operates with the other series.

668,246. Electric-lighting Apparatus. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed August 19, 1899.

Glowers formed from one or more rare earths are the incandescing bodies. A plate of heat-resisting material carries glowers mounted on its two sides, the glowers being arranged in groups in series, different members of the same groups being on opposite sides of the plate.

668,248. Automatic Copying Telegraph. Ignatius Zabinski, Milwaukee, Wis. Application filed December 18, 1899.

The receiving mechanism comprises the tube or spurter of a siphon recorder having an actuating connection with the bobbin of the recorder. A motor actuates a longitudinally movable rotary cylinder, and an intercepting device catches the ink from the tube or spurter when it occupies its neutral position.

668,257. Electromagnet. George L. Foote, Brooklyn, N. Y. Application filed October 19, 1900.

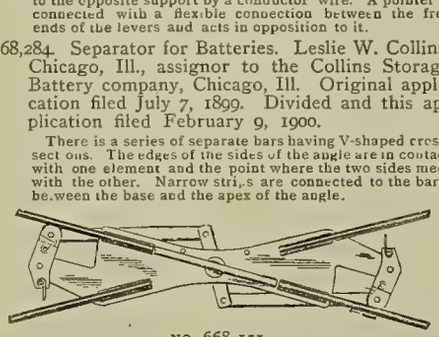
A vibrating bar is provided with a retracting spring and limiting stops. A supplementary bar is pivotally supported upon the vibrating bar, with an armature fixed thereto and means for varying the position of the armature with respect to the vibratory bar and the magnet poles.

668,260. Electrical Measuring Instrument. Karl Lehner, Frankfort-on-the-Main, Germany. Application filed February 16, 1899.

The subject of this patent is a hot-wire instrument comprising two fixed supports and two levers, each lever pivotally connected to the adjacent support by a link and to the opposite support by a conductor wire. A pointer is connected with a flexible connection between the free ends of the levers and acts in opposition to it.

668,284. Separator for Batteries. Leslie W. Collins, Chicago, Ill., assignor to the Collins Storage Battery company, Chicago, Ill. Original application filed July 7, 1899. Divided and this application filed February 9, 1900.

There is a series of separate bars having V-shaped crosssections. The edges of the sides of the angle are in contact with one element and the point where the two sides meet with the other. Narrow strips are connected to the bars, between the base and the apex of the angle.



NO. 668,151.

668,293. Fuse Box. John F. Lyons, Bridgeport, Conn. Application filed April 17, 1900.

A pivoted bar carries at its extremity a circuit-closer which is in connection with the line wire. A spring normally forces the closer in contact with the circuit wire. A spreader has one of its ends resting against the fuse wire while the other end sustains the pivoted bar in an elevated position against the action of the spring, whereby when the fuse wire melts the bar will be thrown downward, thus closing the circuit.

668,295. Storage-battery Plate. Harry M. N. Muhle, Dayton, Ohio. Application filed October 22, 1900.

Two or more plates or grids are integrally joined by connecting bars, and a lug or terminal is joined to the connecting bars and projects into the space between two of the grids. The plates or grids are adapted to be bent by means of their connecting bars into parallel positions, and the lug or terminal is bent in a perpendicular position.

668,315. Receiver for Electrical Oscillations. Guglielmo Marconi, London, England, assignor to Marconi's Wireless Telegraph company, Limited, London, England. Application filed July 17, 1900.

An induction coil has its secondary wound in two parts. The aerial conductor is connected to one end of the primary, and a capacity to the other end. The coherer is connected to the outer ends of the secondary with a condenser across the inner ends and a local circuit connected to the condenser. (See cut.)

668,345. Electric Arc Lamp. Thomas F. Barrett, Chicago, Ill., assignor of two-thirds to James P. Barrett and Fred C. Jones, Chicago, Ill. Application filed October 15, 1900.

A cup has a central perforation containing marginal notches. A socket block has means for supporting the lower carbons and the chimney at the top, and is provided below with a screw-threaded portion and a reduced screw threaded portion. A nut is threaded to the first-named screw, and an elongated nut to the reduced portion, and the latter is adapted to pass through the notches in the cup.

668,356. Electrical Accumulator Battery. Paul E. Placet, Paris, France. Application filed November 14, 1899.

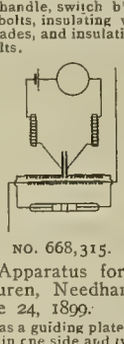
The plate is composed of a support of fibrous material coated with a substance that will prevent its being injured by an electrolyte and surrounded by coils of a material conductive of electricity. It is encased in a composition consisting of glycerine, oxide of lead and a powder susceptible of being eliminated after the hardening of the composition.

668,359. Electric-battery Contact. Arthur L. Stevens, New York, N. Y. Application filed July 26, 1900.

The battery terminals of an electric vehicle are arranged at the lower part of the battery box, with wires coupling the cell electrodes to each other and to the terminals. Universally movable lead contact plates are sustained in opposition to the terminals. All of the terminal and lead contacts are accessible from outside the vehicle body.

668,389. Electric Switch. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, New York, N. Y. Application filed November 23, 1899.

The base is provided with an insulating pivot with contacts arranged around it. A switch lever mounted thereon is composed of a handle, switch blades arranged side by side, connecting bolts, insulating washers separating the handle and the blades, and insulating sleeves surrounding the connecting bolts.



NO. 668,315.

668,426. Testing Apparatus for Electric Circuits. Nathan H. Suren, Needham, Mass. Application filed June 24, 1899.

A spring-jack has a guiding plate and one of its contact plates connected in one side and two contact plates in the other side of the line normally held in engagement with each other. A jack plug has three contact plates adapted to engage the aforesaid contact plates and to separate the two contact plates which are normally held in engagement. A voltmeter and an amperemeter are connected with the contact plates on the jack plug.

668,429. Synchronizing System for Alternating-current Generators. Herbert W. York, New York, N. Y. Application filed June 16, 1899.

A motor and a lever of variable length are interposed in the valve mechanism of the engine, the length of the lever determining the throw of the steam valve. The engine is thereby controlled by the motor controller.

668,430. Synchronizing Apparatus for Alternating-current Generators. Herbert W. York, New York, N. Y. Application filed May 11, 1900.

The cut-off for the engines is controlled by a sliding block within the rocker arm upon the rock shaft. Circuit-controllers are placed at different points along the path of the sliding block, the circuit-controllers being operatively connected with indicating devices. The sliding block is operated by a motor carried upon the rock shaft, which is controlled from the switchboard. (See cut.)

668,431. Method of Synchronizing Alternating-current Generators. Herbert W. York, New York, N. Y. Application filed May 11, 1900.

The generators are brought to synchronism by means of the apparatus described in the previous patent, the time of admission of the steam being controlled to vary the speed.

668,438. Elevator-signal System. Martin H. Collom, Denver, Colo. Application filed April 9, 1900.

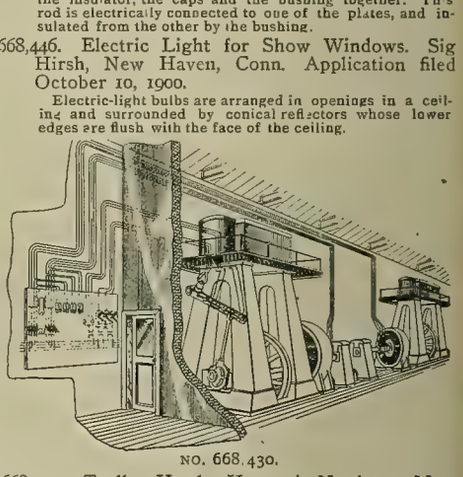
In an elevator-signal system with an elevator door and door jambs on each floor of the system, push-pin switches are secured to the door jamb in line with push-rods in the doors, and arranged to stand normally in open circuit. Wires connect the current supply with the terminals of these switches, and lights of some one predetermined color are in circuit with one of the switches, and lights of two colors in circuit with the other switch, one of the signals to indicate when the door is open.

668,442. Resistance Coil. Arthur C. Eastwood, Cleveland, Ohio. Application filed December 13, 1900.

A resistance coil is wound on a tubular insulator with metallic caps at each end, and electrically connects the caps. There is an insulating bushing in the tubular insulator and also a metallic rod, having on it means for clamping the insulator, the caps and the bushing together. This rod is electrically connected to one of the plates, and insulated from the other by the bushing.

668,446. Electric Light for Show Windows. Sig Hirsh, New Haven, Conn. Application filed October 10, 1900.

Electric-light bulbs are arranged in openings in a ceiling and surrounded by conical reflectors whose lower edges are flush with the face of the ceiling.



NO. 668,430.

668,453. Trolley Head. Henry A. Nettleton, Manchester, Conn. Application filed December 20, 1900.

Forked side pieces have slots for the reception of the trolley-wheel axle. The trolley-wheel axle is supported in the slots and bears a trolley wheel. A swinging latch is pivoted to the side pieces of the trolley head, arranged to project across the slots to hold the axle in position.

668,517. Storage-battery Plate. John Hewitt, Chicago, Ill., assignor to the Hewitt-Lindstrom Motor company, Chicago, Ill. Application filed June 12, 1900.

A frame and a series of zigzag stays extend from the top to the bottom of the plate, the stays being grooved on their inner edges. Transverse bars are formed integral with the plate and extend across the frame transversely of and uniting the stays. Alternate bars are arranged on opposite faces of the plate and are of less thickness than the stays.

668,538. Trolley Wheel. Chauncey R. McAdoo, Indiana, Pa. Application filed December 1, 1900.

The trolley arm has its upper end bifurcated to form two parallel members, between which the trolley wheel is mounted. One of the members extends above the periphery of the wheel and carries a shoulder. The second member extends above the wheel opposite to the first member and extends rearwardly beyond the periphery of the wheel. A spring-pressed shaft in a vertical perforation in the second member has its upper end bent laterally to lie against the shoulder of the first member. A cord passed through an eye in the rearwardly extending portion of the second member engages with the laterally bent end of the shaft to move it from the shoulder.

668,554. Electrical Relay and Circuit. Albert M. Bullard, Somerville, and Louis A. Falk, Boston, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed December 3, 1900.

The relay comprises an iron core with an exciting coil therefor consisting of front and rear sections in series. An armature of slight inertia in the field of the front coil section is responsive to currents passing through the front coil section regardless of the condition of the other, and a second armature of greater inertia in the field of both coil sections is held in its normal position when currents are passing through both coil sections, but is responsive by attraction into its working position, on the passage of current through the front coil section only.

668,555. Resistance Coil. Frank Comminge, Pittsburg, Pa. Application filed December 11, 1900.

The coil consists of several cylindrical layers of insulating material, with a conducting wire wound around each layer successively, alternately from one side to the other, whereby the successive wrappings of the wire are insulated from each other. The windings terminate in attaching terminals. The terminals extend through a surrounding covering of impervious substance, and an outer coating of impervious substance is laid over this covering.

668,581. Trolley Wheel and Bearing. Orien P. Martin, Akron, Ohio. Application filed July 30, 1900.

A divided harp is provided with spherical bearings. Individual flanges are provided with spherical recesses on their outer sides and conical recesses on their inner sides. A removable pulley disk has conical projections.

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Independent Telephone Service in Erie, Pa., and Vicinity.

When, about three years ago, Mr. P. H. Adams, then a telephone contractor, undertook the building of a 600-subscriber telephone exchange in Erie, Pa., for the Mutual Telephone company, it is safe to say that the most sanguine stockholder of this new organization would not have been willing to venture the prophecy that within three years the modest enterprise would prove to be the center of a telephone system controlling absolutely 21 exchanges and making connection with hundreds of Independent exchanges outside of its own jurisdiction.

Starting with this 600-drop equipment in the city of Erie, the Mutual Telephone company within a year increased this capacity to 800 drops, and within another year the 900 mark was reached. When the Mutual Telephone company had brought its subscriber list up to about 500 names, owing to the rapidly increasing demand for Independent service in Ohio, Pennsylvania and New York, with Erie as a center, Mr. Adams realized the necessity of forming a telephone-construction company which could build lines and exchanges to connect with the Erie exchange. In other words, the telephone situation became such in this particular territory that the formation of the Union Telephone and Telegraph company for the construction and the operation of exchanges was a natural and timely outcome. Accordingly, in 1898, this latter company was organized, with Mr. P. H. Adams at president.

These two companies, the Mutual Telephone company of Erie, the local organization, and the Union Telephone and Telegraph company, the telephone-construction company, to-day operate in harmony in all matters pertaining to the introduction of their system into New York, Pennsylvania and Ohio; in fact, the officers and stockholders of these two organizations are practically the same body of Erie business men, and the total amount of capital involved in these two companies amounts to about $525,000.

The Mutual Telephone company's exchange is located in Erie, Pa., on East Ninth street, in the brick building shown in Fig. 2, page 160, which, singularly enough, stands just opposite its local rival, the Bell company. The Mutual company had the forethought, in planning this building exclusively for its telephone business, to secure property in such location that the building when erected would be entirely isolated from its neighbors, thus insuring not only the maximum light and ventilating facilities, but a lessened fire risk as well.

The exchange proper (Fig. 1) is on the second floor of the building, occupying a room 30 feet square, and in which the entire apparatus is contained, viz.: The multiple switchboard, the distributing board, indicator racks, cable terminals, auxiliary switchboard, long-distance switchboard, chief operator's desk, testing operator's table and intermediate connection board. Referring to Fig. 3, the arrangement of the apparatus in the room is shown in section. Detail views are given in Figs. 4, 5 and 6. The first of these shows the cable terminals with a back view of the distributing board and indicator racks. Next comes (Fig. 5) the view of the front portion of the distributing board, indicator racks and testing operator's table, and back view of the multiple switchboard. A detail view of the auxiliary switchboard is shown in Fig. 6.

Inspection of Fig. 1 reveals to the left, in the far corner of the room, a small door. This door opens into what might properly be called the power room of the exchange. In this little apartment, compactly arranged, as shown in Fig. 8, are the battery of Chloride storage cells, 360 ampere-hour capacity, and the motor-dynamo for charging the batteries from the local lighting circuits, and two motor-generators for signaling purposes, and also the fine marble switchboard shown to the left in the picture (Fig. 7). In addition to this equipment extra armatures in cases are hung directly over the power apparatus, as an extraordinary precaution against the cessation of service for even a minute. The batteries are provided, very properly, with a complete system of ventilation for carrying off the gas during charging.

In order that the reader may understand the various novel features of the Mutual Telephone company's system it will be well to study its operation by the effect of a subscriber's call into the exchange, leaving out, however, unnecessary reference to circuits and other apparatus, details of which are already familiar to the practical telephone man.

The first thing that attracts the attention of the visitor as he enters the exchange is the absence of signals from the switchboard. The operators are seated before solid banks of jacks, with the usual plugs, cords, keys and clearing-out drops, but with no line signals immediately in front of them, and for a moment one is puzzled to know how the calls are received.

Following the glance of the operator at work, the visitor notices a large board at the opposite side of the room, within plain view of all the 17 operators, studded with red and white numbers; and he sees that the white numbers show for just a second, then suddenly turn to red, and that red numbers frequently "go out." Following a subscriber's call as it comes into the exchange, it is seen that all this automatic appearing, changing and disappearing of numbers on the board is not a stock-quotation device, but in reality pertains to the drop-frame of the exchange, which extends upward to the ceiling, and on which is shown, not only "in calls," but a novel "busy" signal as well. The switchboard (multiple) proper, before which the operators are seated, and the drop-rack or frame referred to above are, however, separate pieces of apparatus. The Varley duplex magnet coils are used in the exchange of the Mutual Telephone company and, in

FIG. 1. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA., AND VICINITY.—GENERAL VIEW OF EXCHANGE OF MUTUAL TELEPHONE COMPANY.

fact, generally throughout the system of the Union Telephone and Telegraph company.

The modus operandi is this: A call is indicated on the drop-frame by the showing of a white number. The operator on whose section the call comes in, but who is seated before the multiple board, is immediately notified of the fact by the lighting of a pilot lamp on the multiple board before her. She sees the number on the rack, and plugs in on the corresponding jack on the multiple board to answer. This act not only extinguishes the pilot lamp on the multiple board, but changes the color of the drop on the rack to red; likewise the act of plugging in on the multiple board, on the line called for, causes that number to show red on the rack.

In the showing of the red numbers lies the "busy" signal, which is visual. All numbers showing red indicate "line in use," and the first care of the operator when a number is called for is to notice if that number shows red. Thus a quick glance of the eye is the only motion required on the part of the operator to make the "busy test" in place of the usual and more laborious motion of the hand required by the "click" busy signal now in general use on multiple boards. When a connection is taken down, the numbers disappear entirely, and the drops are ready for another call.

In other multiple switchboards it is possible to answer calls only from the operator's section on which they come in, so that a sudden heavy demand on any operator from a number of her subscribers at one time must necessarily cause delay, until she can serve them all. Any such contingency is provided against in this exchange by the altogether novel feature of an auxiliary switchboard (Fig. 6), at which are seated two monitors, whose duty it is to help operators who cannot give immediate attention to all their calls, as well as to keep a supervision over the operators at the board. This auxiliary board contains multiples of all the lines in the exchange, and it is only by means of this valuable adjunct that it is possible to give immediate service. This auxiliary board is also used at night, when one operator can, without changing position, take care of all the business of the exchange. The Mutual Telephone company is using the magneto call, but its switchboard system is equally adapted to common battery for signaling.

A map of the lines of the Union Telephone and Telegraph company is given above. Several of the exchanges of this company are shown in the group illustration (Fig. 9).

In view of the fact that the exchange of the Mutual Telephone company in Erie, and all the 21 exchanges of the Union Telephone and Telegraph company, with switchboards, auxiliary switchboards and drop racks, to say nothing of the 900 miles of overhead and three miles of underground work in Erie, subscriber's apparatus and other details—in fact, practically all the details of this large system—were designed, constructed and worked into their present efficient condition without the assistance of any telephone manufacturer, it is proper to say something of the man, Mr. William S. Paca, superintendent of construction of the Union Telephone and Telegraph company, who brought the entire system into its present state of high efficiency. The auxiliary-board feature of the system is Mr. Paca's invention, and patents on it are now pending.

Mr. Paca's experience in the telephone field dates from early boyhood and extends over a period of 20 years. His association as superintendent for Mr. P. H. Adams dates from 1897, when he began work upon the system of the Union Telephone and Telegraph company. Mr. Paca is a native of Baltimore, Md., and is a great-great-grandson of William Paca, one of the signers of the Declaration of Independence. Mr. Paca was educated and married in his native city, and soon after leaving school engaged in the telephone business as an electrician, serving the Bell Telephone company in that capacity for 12 years. He has made a thorough practical study of the business in all its phases.

Proper credit should also be given to Manager John Z. Miller for his valuable invention of the multiple-switchboard system in use by the Mutual Telephone company. This exchange system, as will be seen from above description, is a valuable adjunct in the Mutual Telephone company's system. Mr. Miller has likewise made a name for himself in Erie through his diplomatic handling of the Mutual Telephone company's local business, and the rapid advance of the Mutual company's service to a point where the books show as many as 1,400 Erie subscribers speaks well for his executive ability in a trying position.

The officers of the Mutual Telephone company are: President, W. B. Trask; secretary and treasurer, George Burton; manager and superintendent, John Z. Miller. The officers of the Union Telephone and Telegraph company are: President, W. B. Trask; general manager, P. H. Adams; superintendent of construction, W. S. Paca; secretary and treasurer, James Russell. The gentlemen named are also interested in the Union Switchboard company, organized to build the apparatus described.

MAP OF THE LINES OF THE UNION TELEPHONE AND TELEGRAPH COMPANY.

FIG 4. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA., AND VICINITY.—DISTRIBUTING BOARD AND CABLE HEADS IN MUTUAL EXCHANGE.

FIG. 2. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA., AND VICINITY.—MUTUAL COMPANY'S BUILDING IN ERIE.

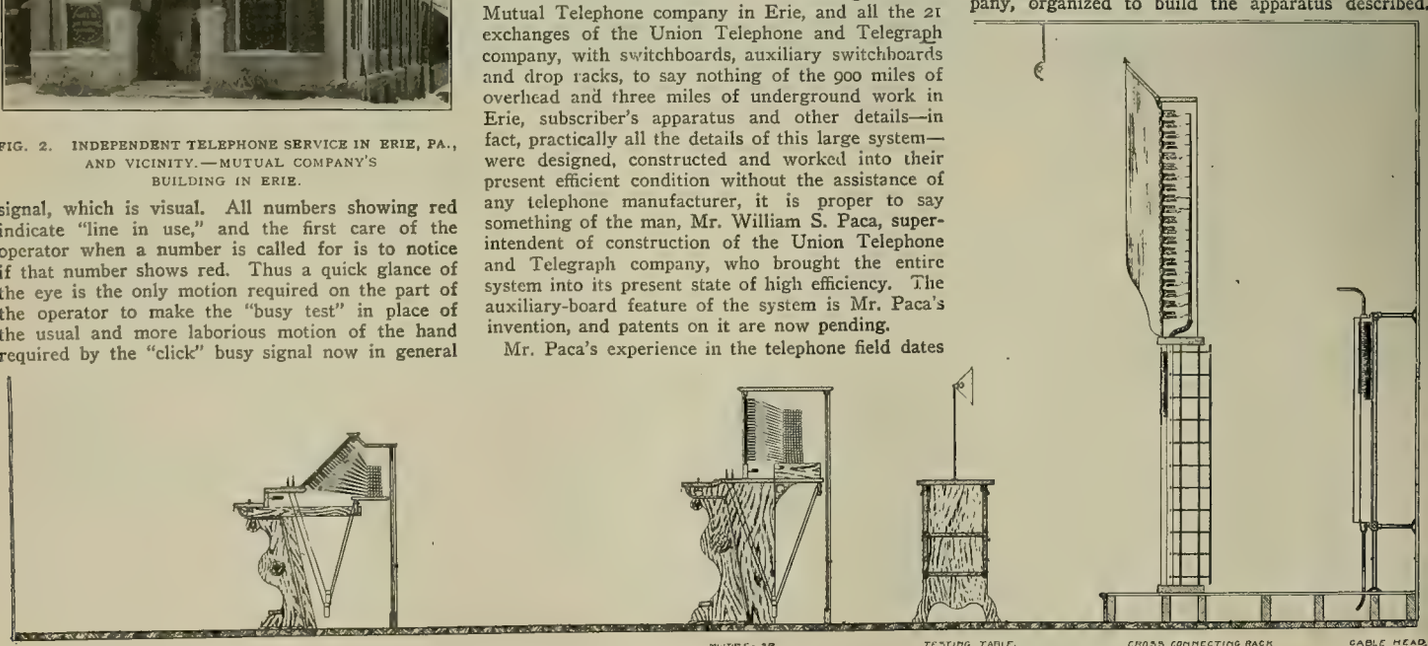


FIG. 3. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA., AND VICINITY.—CROSS-SECTION OF MUTUAL COMPANY'S EXCHANGE.

Illinois Electric Vehicle Transportation Company to Be Dissolved.

At a meeting of the board of directors of the Illinois Electric Vehicle Transportation company, operating in Chicago, held on February 23d, it was deemed advisable and for the benefit of the corporation that it should be promptly dissolved. A special meeting of the stockholders of the company will be held in Jersey City, N. J., on April 4th, to take action on the resolutions passed by the board

FIG. 5. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA, AND VICINITY.—TESTING TABLE IN MUTUAL EXCHANGE.

of directors. In a notice to the stockholders the following facts are mentioned:

The Illinois Electric Vehicle Transportation company was organized on May 5, 1899, under the laws of New Jersey, with an authorized capital stock of $25,000,000, to be represented by 250,000 shares of $100 each. On April 5, 1900, this stock was reduced to $2,500,000, divided into 250,000 shares of the par value of $10 each. A total of $793,700 has been paid in on the stock. The company began actual business about September 13,

FIG. 6. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA, AND VICINITY.—AUXILIARY SWITCHBOARD IN MUTUAL COMPANY'S EXCHANGE.

1899. There had been expended up to February 1st for vehicles, machinery, apparatus, materials, supplies, utensils, fixtures, labor, etc., approximately $643,588.42. The gross income of the business to February 1st was $137,106.90; the total expenses of operating and conducting the business were $265,885.37, thus showing a loss of $128,778.47, with additional loss in depreciation of vehicles and station equipments. There was cash on hand, on February 1st, $205.458.13, and the company now owns 109 vehicles. The company is the lessee of its main station at 171 Michigan avenue and of two substations.

The concluding sentences of the notice, which is signed by President Samuel Insull and Secretary Clement B. Rockhill, are as follows: "Your board is of the opinion that owing to the local conditions and the consequent high cost of maintenance the vehicles now owned by the company cannot be operated in the city of Chicago on a profitable basis. Your board is therefore of opinion that it would be advantageous to this company and its stockholders if this company, in manner provided by law, be dissolved as soon as possible and its assets converted promptly into cash, the same to be distributed ratably among its stockholders. Your board has procured the consent of the Electric Vehicle company to a cancellation of the contract between that company and this company, together with the settlement of all existing claims as between the two companies, and an exchange of mutual releases, such cancellation of contract to be subject to approval of the stockholders of this company."

In referring to the plans for liquidation of the company the New York Times says: "The directors have already approved the plan, and it remains only to have it ratified by the stockholders, a majority of whom have already expressed their assent. It is positively stated that the quick assets of the company will be sufficient to pay $2 a share, and in addition a further dividend in liquidation may be paid. In all the amount may be brought up to $3 or $4 a share." On the New York market, on March 2d, $1 a share was asked for the stock of the company and 87½ cents was bid.

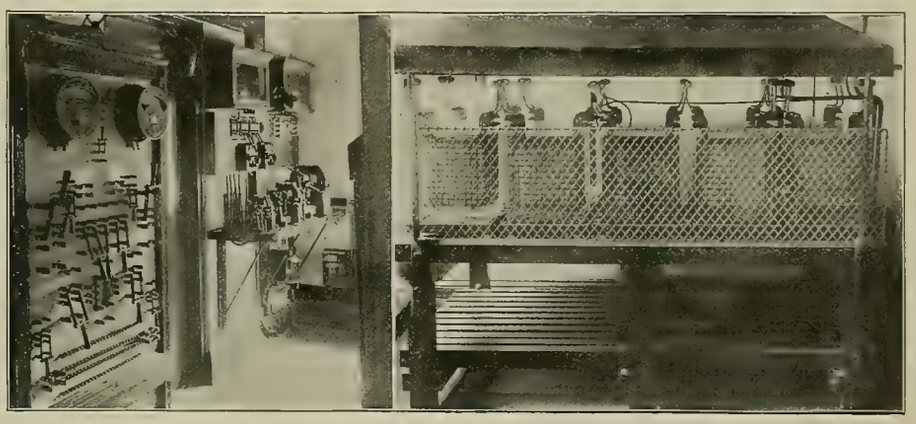


Fig. 7. Power Generators and Switchboard.

Fig. 8. Storage Battery.

INDEPENDENT TELEPHONE SERVICE IN ERIE, PA., AND VICINITY.—MUTUAL COMPANY'S EXCHANGE.

American Street Railway Association.

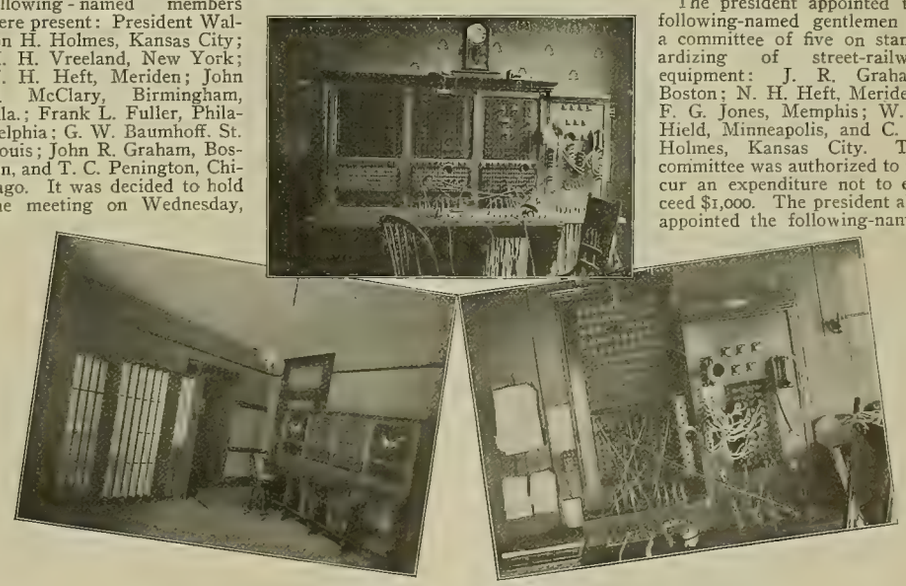
The executive committee of the American Street Railway association met at the Murray Hill Hotel, New York city, on February 28th, to make arrangements for the twentieth annual meeting of the association, which will be held in New York city. The following-named members were present: President Walton H. Holmes, Kansas City; H. H. Vreeland, New York; N. H. Heft, Meriden; John B. McClary, Birmingham, Ala.; Frank L. Fuller, Philadelphia; G. W. Baumhoff, St. Louis; John R. Graham, Boston, and T. C. Penington, Chicago. It was decided to hold the meeting on Wednesday, Thursday and Friday, October 9th, 10th and 11th. There will be two sessions of the convention on each of the first two days, and the last day will be set aside for the inspection of exhibits. The banquet will be held in the evening of the last day, when the newly elected officers will be installed.

The Madison Square Garden has been leased from October 6th to 13th, and it is expected that the exhibit of street-railway appliances will be on a very large scale. The meetings of the association will be held in the same building. Provision has also been made for the meetings at the same time of the Street Railway Accountants' association of America. The usual charge of 10 cents a square foot for space in the exhibit hall will be made.

A new departure has been determined upon in the matter of papers presented to the meeting. They are to be printed and advance copies sent to the members. They will be read at the meeting by title only. The president was authorized to select a speaker to open the discussion on each paper, and 30 minutes will be given to the consideration of each paper. The following topics were selected, upon which papers are to be presented: "Street Railways; A Review of the Past and a Forecast of the Future;" "The adoption of Electric Signals on Suburban and Interurban Railways, Single or Double-track, and Their Economy of Operation;" "The Value of Storage Batteries as Auxiliaries to Power Plants;" "The Public, the Operator and the Company;" "The Best Manner and Mode of Conducting the Return Circuit to the Power House;" "The American Street Railway Association—The Purposes of Its Organization and the Benefits Accruing to Investors in, and Operators of, Street-railway Properties by Membership Therein;" "The Economies Resulting from the Use of Four Motors Instead of Two on Double-motor Equipments;" "The Best Form of Car for City Service—A Consideration of the Various Types of Cars as to Size of Car and Arrangement of Seats, Including the Best Types of Brakes and Wheels;" "Practical Results Obtained from Three-phase Transmission and Rotary Transformers or Motor-generators in Transmitting Power on Railway Lines;" "Relations of Interurban and City Railways;" "The Modern Power House, Including the Use of Cooling Towers for Condensing Purposes."

The admission fee will be waived in the case of any company becoming a member of the association prior to October 1st next, provided the annual dues to October next be paid at the time the application for membership is made.

The president appointed the following-named gentlemen as a committee of five on standardizing of street-railway equipment: J. R. Graham, Boston; N. H. Heft, Meriden; F. G. Jones, Memphis; W. J. Hield, Minneapolis, and C. F. Holmes, Kansas City. The committee was authorized to incur an expenditure not to exceed $1,000. The president also appointed the following-named gentlemen as a committee of three to report at the next convention on the subject of transporting the mails and mail carriers on street-railway cars: C. S. Sergeant, Boston; C. L. Rossiter, Brooklyn; J. B. Parsons, Philadelphia. It is confidently expected that the forthcoming meeting will be largely attended and of greater value from a practical standpoint than any that has been held. The executive committee was most pleasantly entertained by President Vreeland of the Metropolitan Street Railway company during the stay of its members in the city.



Exchange at Olean, N. Y. Exchange at Sharon, Pa. Exchange at Middlesex, Pa.

FIG. 9. INDEPENDENT TELEPHONE SERVICE IN ERIE, PA., AND VICINITY.

The city of Rockwood, Tenn., has voted $20,000 bonds for a waterworks and lighting plant.

The Construction and Use of Graphical Tables.

By M. J. Eichhorn.

The subject of graphical tables, or, more generally speaking, the representation of numbers by means of lines or figures, is one that has occupied mathematicians, as well as practical men in other branches, for centuries. It is not, however, until the end of the seventeenth century that we find the first example of a graphical table, in the modern sense of the word, the so-called Gunther's logarithmic scale. The fundamental importance of this great step in advance has hardly yet been realized, notwithstanding the lapse of time and the many forms under which nowadays such scales, commonly called slide rules, can be obtained. The most important forms are the Fuller and Thacher calculators and Sexton's omnimeter, besides the ordinary short rules. Dumesnil, in Paris, issued in 1894 a magnified edition of Gunther's scale, and this is a striking instance of the superiority of graphical representation for certain purposes. Dumesnil's scale is 20 meters, or about 65 feet long,

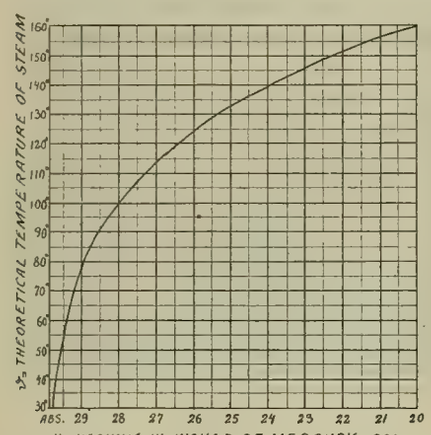


FIG. 1. THE CONSTRUCTION AND USE OF GRAPHICAL TABLES.

divided in 80 pieces, which are placed side by side, and occupying only four pages. It is equivalent to an ordinary five-place logarithm table occupying 30 pages. One of the earliest attempts to convert Gunther's scale into a graphical table of multiplication was made by Lalanne, with his abacus, issued in this country by Captain Bixby, United States Engineers, and consisting of three systems of straight lines arranged logarithmically. This is now commonly called logarithmic cross-section paper, and has been found very useful in calculations involving fractional powers of quantities, especially in thermo-dynamical problems. Hermann issued, 1867, in his "Graphisches Einmaleins," a modification of this table.

One disadvantage of these devices, and all similar graphical tables with closely ruled straight and curved lines, is the difficulty of visual interpolation between lines and the further difficulty of following one particular line among a number of others to the edge of the table, where the numerical result is read off.

In defining the terms graphical table and graphical calculation, we must exclude the graphostatical method. This latter very useful tool of the engineer has for its object the solution of a single problem under particular given conditions. If these conditions undergo any important change, the whole diagram must be drawn over again. Not so with the graphical table. The aim of this method is to offer at once all possible solutions of a whole class of problems. Take, for instance, the Lalanne-Bixby abacus, which not only gives all products, but also third and fifth powers and roots, areas of circles, volumes of spheres, etc., with an approximation limited only by the length of the scales.

This limitation of the degree of approximation is perhaps the most serious objection to this

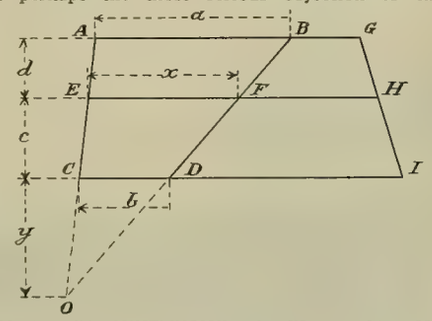


FIG. 2. THE CONSTRUCTION AND USE OF GRAPHICAL TABLES.

type of graphical tables, which we may call the Cartesian type, as the starting point can be considered as the geometrical representation of a function $y = f(x)$ in Cartesian co-ordinates. For a function of two variables $z = f(x, y)$ this strict geometric representation would lead to solving problems by the help of a surface in three dimensions, but this is, of course, avoided by taking successive sections at different points of the z axis. The prominent feature, however, of these Cartesian abaci, which lately have become very frequently employed in technical literature, is that the solution

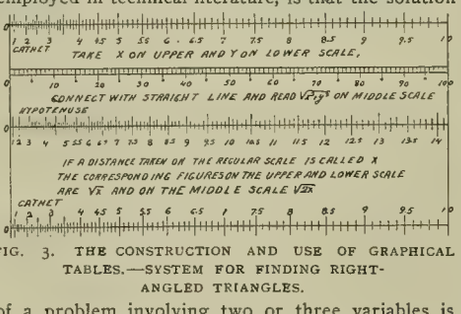


FIG. 3. THE CONSTRUCTION AND USE OF GRAPHICAL TABLES.—SYSTEM FOR FINDING RIGHT-ANGLED TRIANGLES.

of a problem involving two or three variables is represented by a point in a plane of Cartesian co-ordinates. The relative position of this point to a third system of straight lines or curves determines the numerical value of a particular solution. Consequently, this type is limited to a certain area, generally a rectangle, and the length of the sides of this rectangle absolutely limits the approximation. For instance, the Bixby abacus, as published, is 11¼ inches square, and gives an average approximation of only one in 500. For comparison, we may mention that the ordinary 10-inch slide rule gives an approximation of one in 620, Sexton's four-place omnimeter, one in 10,000, and Thacher's, one in 60,000.

The difficulties above mentioned have been overcome in the most ingenious manner by Maurice D'Ocagne, who is, in fact, the creator of the new science of nomography. He has given this name to the science of constructing graphical tables for every purpose, and has done some very remarkable work in developing the underlying principles.

The fundamental improvement made by D'Ocagne is his system of alined points, and the central idea is the exchange of systems of numbered lines, as in the Lalanne abacus, for systems of numbered points, which may be arranged in straight or curved lines in a plane in various ways. The solution of a particular problem is represented by a straight line, instead of a point, and the intersection of this moveable line with the once-and-for-all graduated straight or curved lines gives the particular solution, by visual interpolation between points.

The simplest case is when the equation to be

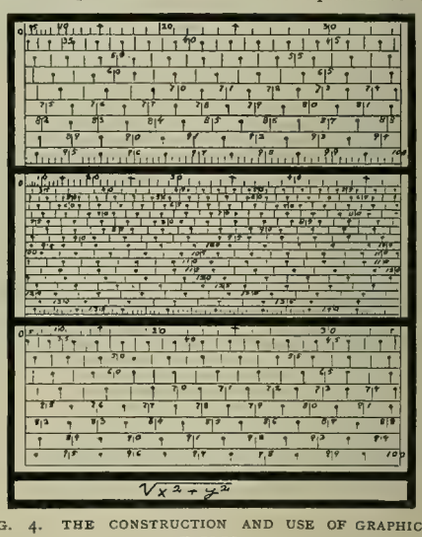


FIG. 4. THE CONSTRUCTION AND USE OF GRAPHICAL TABLES

graphically represented contains only two variables. A familiar instance is a thermometer with double graduations in Centigrade and Fahrenheit degrees Such a graduation can be considered as the abacus for the equation

$$C = \frac{5}{9}(F - 32)$$

where C is degrees Centigrade and F degrees Fahrenheit.

The approximation obtained is limited only by the length of the scales and can always be made as close as required. The equations of the form $y = ax + b$ require the juxtaposition of two regular scales, where the distance between the zero point is equal to b. Any formula $y = f(x)$ can be solved by a graphical table of this form, and either the x or the y scale can be made regular. In the case $y = ax^n$, it is, of course, more convenient to make them both logarithmic scales, one n times as long as the other. Taking logarithms on both sides:

$$\log. y = \log. a + n \log. x.$$

This shows that the distance between the points marked 1 is equal to log. a.

It is very interesting to compare the Cartesian abacus with the corresponding one composed of two

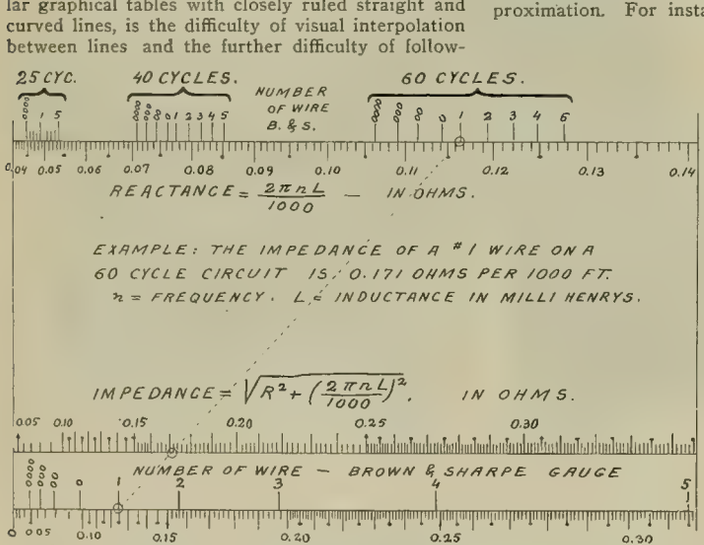


Fig. 5. Impedence of Alternating Circuits.

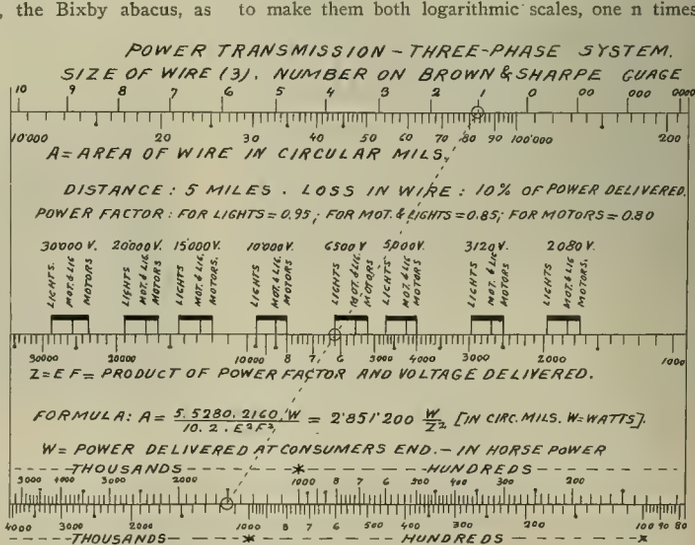


Fig. 6. Three-phase Transmission System.

THE CONSTRUCTION AND USE OF GRAPHICAL TABLES.

scales. In Fig. 1 is shown a curve which represents the relation between the vacuum in an exhaust pipe from a steam engine and the theoretical temperature of steam. This curve is, of course, entirely empirical and obtained from steam tables. The middle scale in Fig. 7 shows the same empirical function plotted so that the vacuum scale becomes regular. In order to find the temperature corresponding to a certain vacuum on the first diagram, it is necessary to follow the vertical line from the vacuum to the point where it intersects the curve, and the horizontal line going through the same point determines on the left-hand scale the desired temperature. On the middle scale of Fig. 7 the result can be read off far more accurately and directly. Any empirical table can, to great advantage, be plotted in this form, as, for instance, a steam table or a series of test results. The advantage depends largely on the superiority of visual interpolation over arithmetical.

When we come to the question of three variables, the advantage of the graphical table becomes still more pronounced, and in problems involving four variables, any system of numerical tables is almost out of the question.

The most common case of three variables is $z = xy$, or, in other words, the common multiplication table. This is of importance, particularly in such cases where the variables are comprised within very narrow limits for special cases in practical work. Any problem of this nature can be solved by the system of alined points, on parallel scales.

Referring to Fig. 2, we see that in this type we can, from the triangles (C D O), (E F O) and (A B O), establish the following proportions:

$$\frac{x}{c \div y} = \frac{b}{y}\ ;\ \frac{a}{c - d \div y} = \frac{x}{c \div y}\ ;$$

$$\left.\begin{matrix} xy = bc \div by \\ ac \div ay = cx \div dx \div xy \end{matrix}\right\}\ ;\ y(x - b) = bc\ ;$$

$$y = \frac{bc}{x - b}$$

Substituting this value in the second equation, we get, after reduction,

$$x = \frac{ac \div bd}{c - d} \qquad \text{If } c = d,\ x = \frac{a \div b}{2}$$

The graduated scales are represented by (AG), (EH) and (CI). The line (BD) is movable, and preferably drawn on a sheet of transparent celluloid. Those variables which are most often given are placed on the outer scales, and the result read at (F).

If the original equation is $z = f(x, y)$, the necessary condition for representation under this form is

$$F(x) \div F(y) = F[f(x, y)] = F(z).$$

This can be seen from the geometrical formula $a \div b = 2x$. If $a = F(x)$, $b = F(y)$ and $x = \frac{1}{2} F(z)$.

In Fig. 3 is shown a graphical table of this kind, which gives immediately all possible combinations of the three sides in a right-angled triangle. The identity on which it is based is the following:

$$(x)^2 + (y)^2 = (\sqrt{x^2 + y^2})^2.$$

The function F corresponds to the second power, and the equation solved is $z = \sqrt{x^2 + y^2}$.

Fig. 4 shows an elaboration of this abacus, whereby the scales can be made of considerable length and a close approximation obtained within a small area. The method consists in dividing the total length of the upper and lower scales into nine equal parts, which are then superposed. In order to combine any of the upper with any of the lower scales, it is necessary to duplicate the middle scale, as shown, so that the result is always read on a scale which is exactly in the center between the sections of the upper and lower scales on which the given values of the sides are located.

A modification of this abacus, shown in Fig. 5, is of considerable interest, as it expresses the well-known relation of reactance, impedance and resistance. The reactance or inductive resistance is in quadrature to the energy resistance and the resulting impedance forms the hypotenuse. The upper scale is graduated for reactance, but has a secondary graduation, giving directly the values corresponding to different numbers on the Brown & Sharpe gauge for different commercial frequencies as given by the General Electric company. The lower scale has also a secondary graduation giving the number on the Brown & Sharpe gauge corresponding to the resistance. The use of such a table is enhanced by the fact that any of these three quantities can be taken as the unknown.

In Fig. 6 is represented the conversion of a graphical table given in Maurice A. Oudin's book on "Standard Polyphase Apparatus." It gives the size of wire required for a three-phase power transmission, five miles long and with a line loss of 10 per cent. of the power delivered. The graduation on the upper scale is proportional to log. A according to the formula

$$\log. A + 2 \log. Z = K + \log. W$$

where K represents a constant. The geometrical purpose of this constant is to displace the central scale longitudinally with reference to the others. The upper scale also has a secondary graduation showing the number on Brown & Sharpe gauge. This latter is, of course, the one which will be used principally. The middle scale gives the different voltages and power factors and the lower the power delivered, expressed both in kilowatts and horsepower. The formula used for constructing this abacus is

$$A = \frac{2160\ D\ W}{2\ P\ E^2\ F^2}$$

in which A is the area of wire expressed in circular mils, D is the distance of transmission in feet, W is the power delivered at consumer's end in watts, P is the percentage of power delivered, which is lost in the line, E is the voltage and F is the power factor. In this shape the formula involves six variables and would require a somewhat complicated abacus, but by making D and P constant and putting $Z = EF$, it is reduced to the simpler form, $A = 2{,}851{,}200 \frac{W}{Z^2}$. This results in a practical table, because neither E nor F varies continuously.

In Fig. 7 is shown a graphical table involving five variables, in which the result is found by the method of step-by-step solution. On account of the fact that several of the functions involved are empirical and have to be plotted from steam tables, this method appears to be the most practical and easily understood. The problem is to determine the amount of condensing water necessary for a steam engine, and the table is calculated from the following formula:

$$X = \frac{Q\left[r \div s(\vartheta - T)\right]}{s(T - t)}$$

X = weight of condensing water in pounds per hour.
Q = weight of steam in pounds per hour.
r = heat of vaporization in British thermal units per pound.
s = specific heat of water at temperature $\frac{T + t}{2}$.
ϑ = theoretical temperature of steam.
T = temperature of discharge or hot-well water.
t = temperature of injection water.
V = vacuum in inches of mercury column.

This formula applies, of course, only to jet condensers. The number of variables is really only five, as mentioned, V, X, Q, T, t, because r and ϑ can be considered as empirical functions of V, and s as a function of $\frac{T + t}{2}$

To use the scale, the first step is to find ϑ on the middle scale opposite the desired vacuum; then, forming $\vartheta - T$, $T - t$, and $\frac{T + t}{2}$, and using the first and last on the second and first scale, the heat from the condensed steam is read on the third scale. This has a logarithmic graduation on one side and a regular graduation on the other, both of the same range, and the result just found is transferred to the regular scale and connected by a straight line to the vacuum on the fifth scale. The total heat to be dissipated is then read on the fourth scale and noted down. The dotted lines across the figure indicate the course in solving a particular example. $\frac{T + t}{2}$ on scale No. 6 is then connected with T—t on scale No. 7, and the total heat absorbed by water is read on scale No. 9. This result, together with the result previously found, taken this time on scale No. 7, determines on scale No. 10 the desired factor, or the number of pounds of water required to condense one pound of steam under the given conditions. The last two scales are added simply for completeness, as they only perform a simple multiplication and are too short to give the approximation required. The other scales, however, give a greater approximation than that which can be obtained on the thermometers and other observing instruments used in practice.

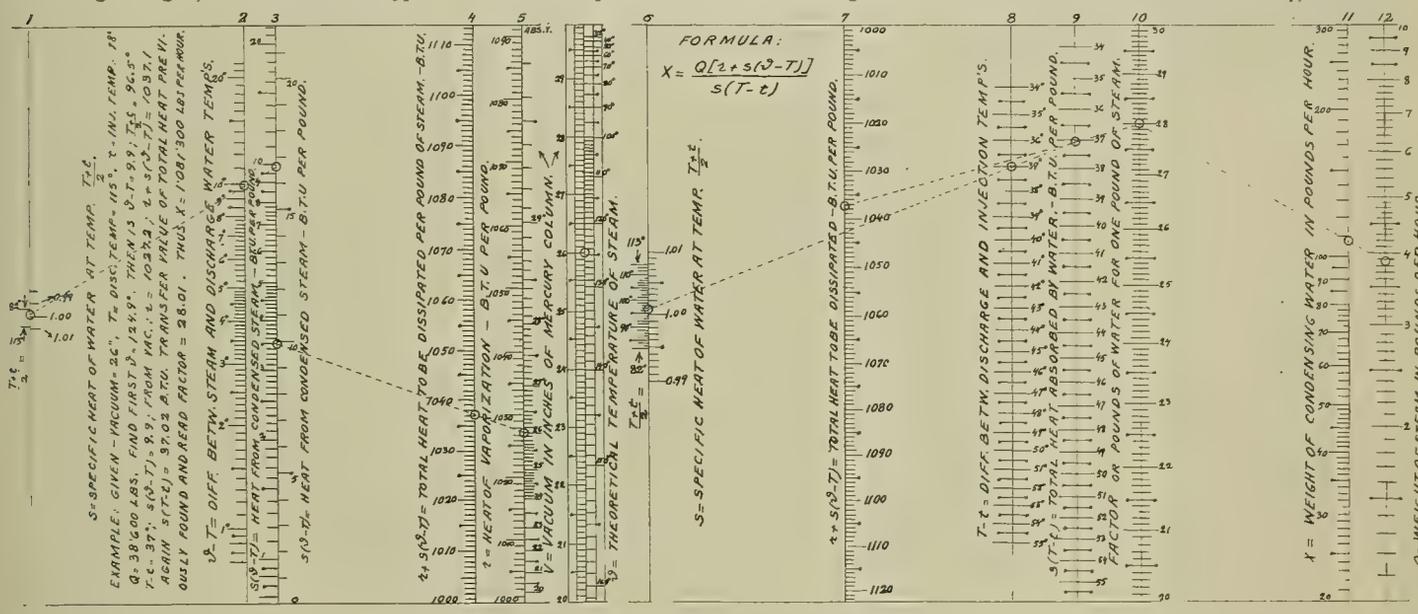


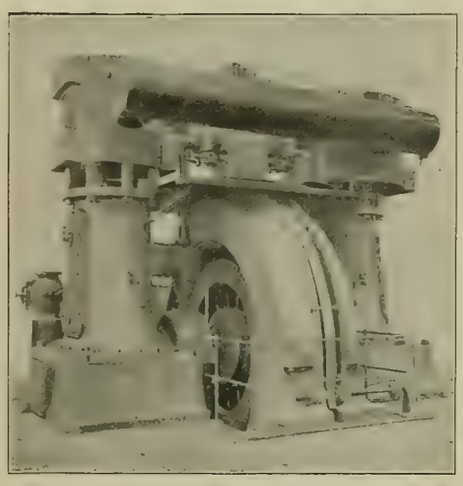
FIG. 7. THE CONSTRUCTION AND USE OF GRAPHICAL TABLES.—AMOUNT OF CONDENSING WATER FOR STEAM ENGINES.

Chicago Electrical Association.

At the business meeting of the Chicago Electrical association on March 1st, after the reading and discussion of Mr. Miller's paper on "Modern Telephone Engineering," the question of providing a suitable commemoration for the tenth anniversary of the association in April was considered. The report of the committee recommending an elaborate banquet with a prominent electrical engineer from the East as a guest of honor was adopted, and the committee was continued with power to make complete arrangements for the banquet. The next meeting of the association on March 15th will be addressed by Mr. A. V. Abbott, chief engineer of the Chicago Telephone company, his subject being "The Electrical Conditions of Chicago."

Ferranti Steam Alternator at South London Electric Supply Works.

The South London Electric Supply corporation's works are located at Loughborough Junction, London, and it may be of interest to note some of the details of construction of the high-power engines and alternators. The Ferranti alternator shown in the accompanying view and drawings is a 1,000-kilowatt generator and is operated directly, being placed between the cylinders of the engine. The armature acts as a flywheel and is mounted directly on the crankshaft. The speed of the unit is 167 revolutions per minute. The field of the



FERRANTI STEAM ALTERNATOR.

alternator is excited by a small direct-current machine, operated from the crankshaft.

The air gap of the alternator may be changed as desired, the position being maintained by distance bolts. Screw shafts are provided with right and left-handed sections working in nuts in the magnet frames, so the frames may be opened transversely, to render cleaning and repairs easy. This operation is effected by a chain gear from a controlling hand wheel, the power required being reduced to a minimum by the use of rollers under the frame feet. Two cast-iron rings carry the field-magnet coils, each of the rings being built up of four quadrants, firmly bolted together. Two of these quadrants are cast with feet, which support the weight of the mounted field magnets on heavy girder bed-plates.

The field winding is wound on mandrels from copper strip, and when the coil is completed it is placed over the magnet core and carefully insulated from the magnet and frame casting.

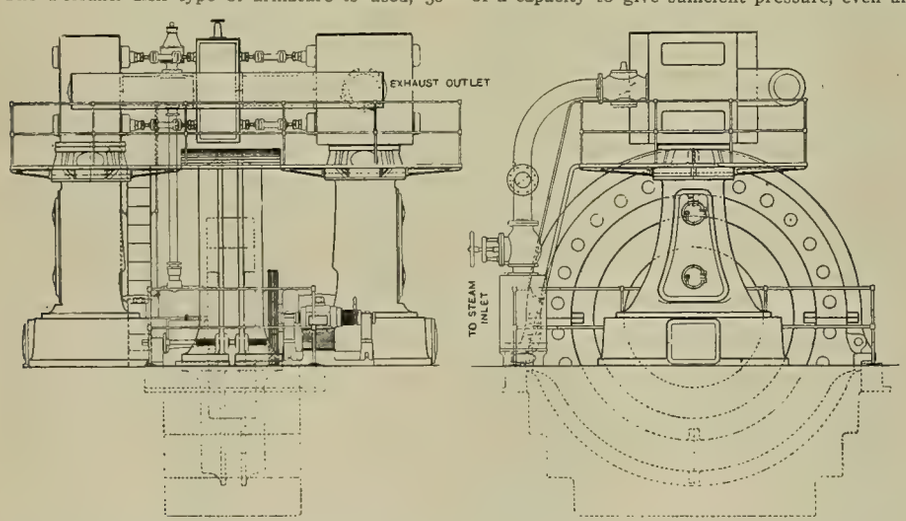
The Ferranti disk type of armature is used, 36 coils being placed on the rim of the flywheel. These bobbins of copper ribbon are wound around a brass laminated core and carefully insulated. Two brass carriers receive these coils in pairs and are fastened by bolts projecting from depressions in the flywheel rim. Special connections were required to connect these bobbins together, and the high-potential terminal of the alternator is joined up to a brass ring of small diameter, and therefore of small surface speed. This ring is mounted on insulated studs, let in holes in the wheel boss. The flywheel comprises two cast-iron halves, each consisting of a heavy rim joined by three arms to a segmental hub. Heavy steel rings fasten the two halves together by shrinking them over prepared bosses on the hub and rim, causing the wheel to grip the shaft at the same time. A very strong steel tie-bolt is placed between each of the six radial cast-iron arms; the head of the bolt fitting in a recess in the rim and the end of the bolt screwing into a steel hoop. This steel hoop is shrunk on to the shaft and lies inside a cored recess in the cast-iron hub. On account of the high surface speed of this wheel, it is necessary to have it well stiffened to bear the necessarily great stresses. These bolts are therefore heated before being screwed into place and on cooling put a compression stress in the rim.

The engine is of the vertical, compound type, of comparatively high speed, and was built by the Ferranti establishment at Hollinwood, near Manchester. The advantage of high speed is to reduce the floor space occupied, to give more even turning moment, and to reduce the cost of the dynamo and engine. To obtain the economy of Corliss engines, the system of four valves to each cylinder has been adopted, and these valves are placed in the covers, so as to minimize clearance surfaces and spaces. The valves are of the grid type and have a very short movement, and as the valve gear is only worked at half the speed of the engine, the surface speed of the valve faces is very low. The valves are actuated directly from cams, the cams being so designed as to give a constant distance between the cam rollers, thus making it possible to work with fixed rollers and making the motion quite independent of springs, and therefore quite positive. The cams are arranged on vertical shafts, working in a completely enclosed box, which in the view and drawings will be seen to stand midway between the cylinders. This box is filled with oil. The connection between the cam and the valve is a direct one; thus there need be no joints to wear, and, as will be seen from the view, the external valve gear is extremely simple. The cam shafts are driven by means of cut gearing from the crankshaft, and each wheel is arranged to run in an enclosed casing containing oil, thus eliminating any question of lubrication.

The governor can be arranged either to vary the cut-off automatically or to act on a throttle valve, in which latter case the cut-off can be made either adjustable by hand or fixed.

Turning to the main parts of the engine, these are, on the whole, of ordinary construction, similar to those usually adopted in marine practice, except that the crank-pin bearing is of the spherical type, so as to insure equality of pressure along the pin; also, the main bearing steps rest in spherical seats with the same object.

The reciprocating parts are enclosed, so as to prevent the splashing or leakage of oil. The lubrication is effected entirely by the use of pumps of a capacity to give sufficient pressure, even after the engine has been running a considerable time and, in consequence, with the bearings somewhat worn. The oil is forced from the pump through a filter arranged in the bed-plate. From the filter the oil goes to the various bearings, from which it passes through a strainer at the bottom of the bed-plate into a tank below, from which it is again pumped through the filter to the bearings. To prevent the oil creeping along the crankshaft, the oil throwers are arranged in series, with the idea that to prevent creeping of the oil the last thrower has only to deal with such small quantities of oil as may have escaped past the preceding thrower.



FERRANTI STEAM ALTERNATOR.—FRONT AND SIDE ELEVATIONS.

Patentability of Methods or Processes.

A decision has been rendered by the Court of Appeals of the District of Columbia, in connection with an application for a patent made by Edward Weston, which is of general interest to inventors, not only on account of the subject of the patent, but mainly because it defines more clearly than has heretofore been done the difference between a method or process which is patentable and one for which a patent should not be granted. The claims of the patent in question describe in each case a method of constructing the moving system of an eletcrical measuring instrument; the patentability of the article itself is not considered, as it was understood that patents for both the instrument and the mechanism connected with the process of manufacture had already been granted to the applicant. The court reviewed a number of cases in which the patentability of processes had been one of the points at issue, and some of the conclusions drawn are as follows:

"It seems to us from all these authorities the deductions to be drawn are these: First, that processes involving a chemical or other elemental action, if new and useful, are patentable; second, that a process which amounts to no more than the mere function of a machine is not patentable; third, that a process or method of a mechanical nature, not absolutely dependent upon a machine, although perhaps best illustrated by mechanism, may, if new and useful, be the proper subject of a patent, even though it involves no chemical or other elemental action. In this last class of cases, possibly a very large class, and thus far certainly a very indefinite class, the criterion of patentability, so far as it seems possible yet to state any definite criterion, would seem to be that the process may be performed by hand or by other mechanism than that exhibited, although perhaps not with equal efficiency. That we must at all events recognize the existence of such a class would seem to be beyond doubt."

Later, in justification of the decision, and to lay emphasis upon the importance of the questions under consideration, the court says: "There are three things involved in many, perhaps in most, of what are known as pioneer inventions—the thing produced, the mechanism by which it is produced and the process of production, and the last is very often the most important part of the invention or discovery, for the reason that the first mechanism used is very often crude, the thing produced equally so, and the process only is that which effects the great change in the art of science to which it appertains. In such cases the inventor or discoverer might lose the benefit of his real invention or discovery if he were not entitled to a patent for the process invented or discovered. And so, there is, of course, no question that, in a proper case, an inventor may have a patent for his process, irrespective of the mechanism used and of the result of the process. The process, however, is an intangible thing, while the mechanism and the thing produced are tangible. But, after all, it is the idea, the intangible thing, that is of permanent importance and most valuable."

Motor Connection on Linotype Machines.

Charles B. Davey, the electrician of the Chicago Daily News and Chicago Record, has devised a method of attaching electric motors to linotype machines by which, he thinks, small high-speed motors of standard design can be used. He employs an ordinary one-fourth-horsepower, 110 or 220-volt, direct-current motor supported on a bracket on the frame of the linotype machine and capable of being very quickly removed and replaced by another motor in case of necessity. The power of the motor is first applied to the shaft which serves for the operation of the keyboard. This shaft, in turn, is belted back to a driving pulley from which all the slower moving parts are operated. Spur gearing, with its noise, is dispensed with. The advantages of the plan are said to be lower initial cost, by using a high-speed motor, and greater facility for effecting repairs. A specially designed motor bracket may also be used as a belt-tightener.

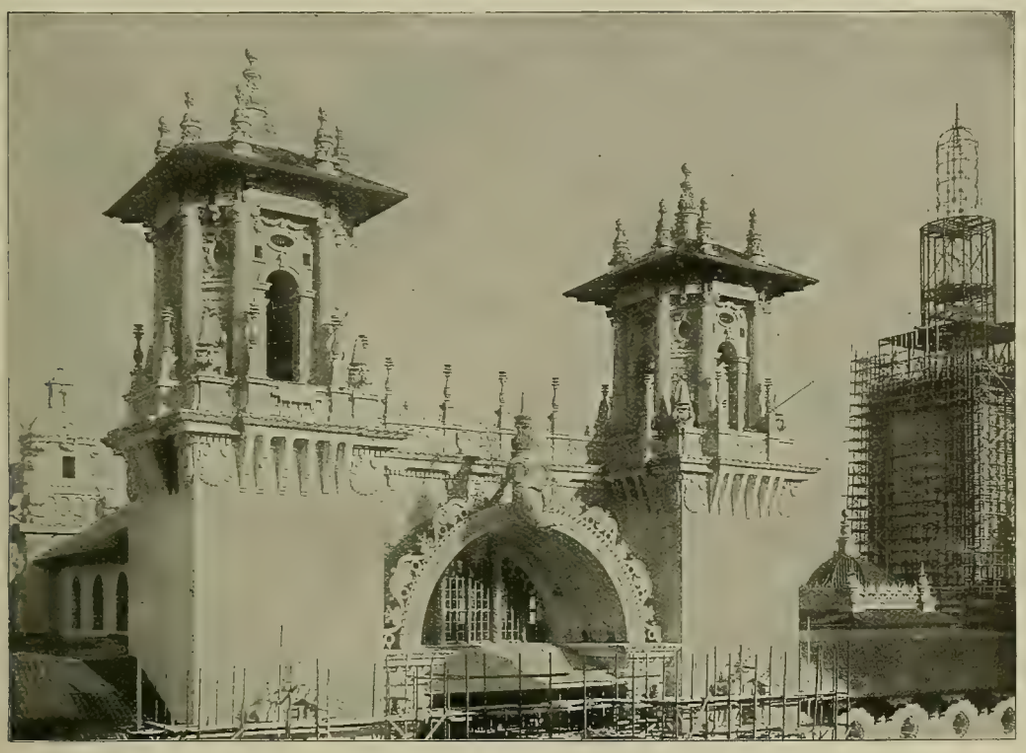
Electrical Recorder for Dexterity and Muscular Activity.

Prof. Fred W. Smedley of the department of child study in the Chicago public schools has in use an electrical recorder for tests of ambidexterity and nervous control in children. The recorder consists of a ratchet-and-pawl mechanism, controlled by an electromagnet, and operating a pointer over a dial. The magnet circuit is completed by touching a metallic stylus to a platinum plate. The stylus is held in the hand like a pen, and the number of separate contacts made in a specified time by the subject furnishes an indication of his quickness of muscular action. Tests are made to determine the relative speed attained by the right and left hands. Professor Smedley maintains that unidexterity is a normal condition and that training in ambidexterity is training contrary to a law of the child's life.

Electricity Building at the Pan-American Exposition.

The progress in the development and application of the various branches of electrical science and industry of recent years will be shown in the fine Electricity building of the Pan-American Exposition. Like the other large exhibit buildings of the exposition, this one is of modernized Spanish Renaissance architecture, covered with staff, artistically colored and adorned with sculpture. In dimensions it is 500 by 150 feet. The towers of the buildings rise to considerable heights, two over the south entrance being 158 feet high, and two over the north entrance, 128 feet high. They are elaborate in design and among the most beautiful features of the exposition architecture. The accompanying illustration, taken from the roof of the Machinery building, shows the south towers of the Electricity building and the framework of the 391-foot electric tower in the distance.

In all the different fields of electrical progress the Pan-American Exposition will have exhibits. There will be a collection of historical matter relating to the subject which will show the gradual development of the apparatus used. An especially interesting exhibit will be that illustrating the application of electricity to the propulsion of cars and vehicles. Most persons are more familiar with the successful operation of such vehicles by electricity than with the means to this end. On this account it is hoped to illustrate them at the exposition in such a manner that the inter-relation of the various elements will be quite apparent. The utilization of electricity in various forms of manufacturing industries will also be illustrated.



SOUTH TOWERS OF THE ELECTRICITY BUILDING AT THE PAN-AMERICAN EXPOSITION.

The aim will be to make the electrical exhibit in the Electricity building a collective one, rather than one composed exclusively of individual commercial exhibits. The exhibit will be divided into two groups:

First—The collective exhibit, which will consist of retrospective exhibits of historical interest, illustrating models, or practical contrasts showing the advances in the art.

Second—The commercial exhibit, composed of those exhibits possessing distinctive merit, whether this consists in workmanship, novelties or useful applications.

As a whole, it is said that the exhibits in this building will be both attractive and educational in a degree not before realized at any exposition held upon the American continent.

$100 Limit for "Mental Anguish."

The Indiana Appellate Court, in a case brought against the Western Union Telegraph company, holds that when the basis of an action is mental anguish alone, unaccompanied by any bodily injury, as in case of a negligent failure of the defendant company to deliver a telegram announcing the death of the plaintiff's grandmother and the time of her funeral, there can be no recovery of damages, but the recovery must be limited to such a penalty as is given by statute, which in Indiana is $100. The Indiana Supreme Court has decided the question otherwise (Telegraph company vs. Reese, 123 Ind., 294), and the Appellate Court has certified its ruling to the Supreme Court with a recommendation that it overrule its former decision.

Change of Ownership of Chicago Railways.

The transfer of the holdings of Charles T. Yerkes in Chicago traction properties to Chicago and eastern capitalists probably marks the beginning of a series of changes likely to take place in the affairs of the various companies now operating in Chicago. The purchasers were represented in the deal by Blair & Co. of New York and Marshall Field, Norman B. Ream and John J. Mitchell of Chicago. Blair & Co. financed the Northwestern Elevated road, and the interest which they secured at that time, together with what has lately been transferred, gives them control of that road, as well as of the Lake Street and Union Loop properties. Under the new arrangement Clarence A. Knight is made general counsel for the three roads, and the other officers and directors are as follows:

Northwestern elevated—President Clarence Buckingham; secretary and treasurer, W. V. Griffin; directors, Charles Counselman, W. W. Miller, Clarence A. Knight, Clarence Buckingham, W. V. Griffin, Charles F. Ayer, John B. Dennis. C. A. Knight and W. V. Griffin succeed C. T. Yerkes and L. S. Owsley.

Union Elevated—President, John B. Dennis; secretary and treasurer, W. V. Griffin; directors, John B. Dennis, Clarence Buckingham, H. M. Brinckerhoff, J. J. Mitchell, Dickinson MacAllister. J. B. Dennis, Clarence Buckingham and J. J. Mitchell, succeed C. T. Yerkes, C. E. Yerkes and L. S. Owsley.

Lake Street Elevated—President, Clarence A. Knight; secretary and treasurer, W. V. Griffin; directors, William G. Adams, W. V. Griffin, Clarence Buckingham, Harvey T. Weeks, Clarence A. Knight, W. W. Shaw, W. W. Miller, Frank Hedley, J. C. Hutchins. W. G. Adams, W. V. Griffin, Clarence Buckingham and W. W. Miller succeed C. E. Yerkes, L. S. Owsley, E. C. Veasey and A. S. Littlefield.

The change in management is regarded as indicating a consolidation of the lines directly affected within a short time, and it is probable that efforts will be made to include the Metropolitan and South Side elevated systems in the combine, although reports of negotiations toward that end at present are positively denied. As Mr. Yerkes was not represented in the directory of the Chicago Union Traction company, no changes were made in the officers of that road. While the rumors of a consolidation of all the surface and elevated lines were not long-lived, it seems probable that some arrangement will be made by which the change of ownership may be of benefit to the Union Traction company, as well as to the elevated roads, as it is known that the traffic of the North Side surface lines has been cut into by the operation of the Northwestern Elevated.

Mr. Yerkes announces that his disposal of his interest in street-railway affairs in Chicago does not mean his permanent removal from the city. He will be in London for some time in connection with his underground-railway projects there, but says he intends to make Chicago his home.

Electrical Undertakings in Great Britain.

The capital involved in electrical undertakings in the United Kingdom has increased in one year from £106,000,000 to £123,636,602, exclusive of the government telegraphs and telephones, the greatest increases having been in connection with supply, traction and manufacturing works. In five years the total capital has been doubled, while the money involved in electrical manufacturing concerns has increased from £6,500,000 to £21,708,180, and of this increase £5,000,000 is credited to this year—a large development, for which some justification is to be found in the greatly increased use of electricity for lighting, power and traction.

Five years ago less than £14,000,000 were thus involved; now the total is £55,000,000, and schemes projected will swell this total enormously in the next few years. Thus, in Parliament, in 1900, 98 provisional orders were granted for the construction of supply works, bringing the total orders still in force to 527, while many also of the 89 stations authorized in 1899 are not included in the capital sum named above. In operation, or under construction, there are 169 municipal and 108 company-owned stations, the sum involved in the former being £13,776,372, and in the latter, £12,434,827.

Under the former head there has been a very much greater advance than in the case of companies. Thus, five years ago, the capital of company supply stations was three times that of municipal loans; now the latter excels. In other words, the company capital has only doubled in five years; the municipal loans have increased sevenfold. In traction schemes, there has been an increase in the five years from £6,000,000 to £28,890,000; but here private enterprise still holds the field, for of the total only £2,748,873 is held by the 18 municipalities, while over £26,000,000 has been found by 75 companies. It would be easy to prove, also, that there has been great progress toward the reduction of costs of production.

The average cost of generation has been decreased in five years from 2.45d. to 1.70d., with the corresponding reduction in other items, and the total cost is now 2.67d. against 4.07d. per Board of Trade unit. In five years the number of eight-candlepower lamps connected has increased from 2,000,000 to 7,660,000, and the units sold in even greater proportion from 30,000,000 to over 125,000,000. The price obtained for current has, in the case of companies, decreased from 6.08d. to 5.26d., and in municipal undertakings, 5.32d. to 4.06d. per unit. The percentage of profit on capital expenditure has not increased, being, for municipalities, 4.90, and for companies, 5.45 per cent.—Engineering.

"Bob" Burdette in Trouble.

In his characteristic staccato fashion Robert J. Burdette, the humorist, discourses of electric-lighting in hotels. The following extract from a recent article in the Chicago Times-Herald is funny; but there is so much truth in it that all who lay out the wiring plans of future hotel plants should read and profit thereby.

"Well, anyhow, 'hotel newly refurnished and refitted throughout, and brilliantly lighted with electricity,' puts electric light of three-quarter candlepower in guest's room. Puts it away up in ceiling like distant planet. Man wants to read, hauls washstand under planet, puts chair on top, and sits there, as though he was reading to invisible audience. Was reading thrilling novel in such position one night; just as got to where he was going to kill the duke, chair slipped; fell off in several directions and jammed foot in water pitcher so tightly couldn't get it out. Landlord and clerk came up. Wanted them to get hammer and smash pitcher. Landlord refused; said it would break set, and he couldn't get it duplicated, and suggested that instead of hammer they get ax and amputate foot. Scared me so that got cold feet; foot shrunk, pitcher dropped off, and landlord put item in bill of '$2 for medical attendance,' and $1 for 'misuse of furniture.' Electric light way up in ceiling no improvement on candle on table. Another favorite way of placing electric light in hotel guest-room is to hang it on string, just about three inches higher than man can reach. Guest comes into room in dark. Remembers to have seen electric pendant in room. Gropes around room with outspread fingers and uplifted hands and promiscuous language; steps in open valise. Knocks everything off bureau feeling for matches. Feels all over the grimy wallpaper for bell button, which is cleverly concealed behind head of bed, and finally goes downstairs for matches. Clerk gives him just one. Man lights it, sees where lamp is, reaches for it, falls short; goes across room for chair. On his way back match burns down to thumb and finger. Swears at it, and loses bearings, can't find lamp again; climbs on chair and delivers impressive and impassioned address in pantomime, feeling round for bulb, gets down and gropes to bed in dark. Candles may be semi-obsolete, but they don't belong to dark ages, like swinging bulb."

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

Iowa Telephone association, Savery Hotel, Des Moines, Iowa, March 12th and 13th.

Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Boston, Mass., June 19th.

Northwestern Electrical association, Sheboygan, Wis., June.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

We trust that the application of the Crerar library trustees for permission to erect a fine, large building on the Lake Front of Chicago will be given careful and unbiased attention by the city and state authorities. The library is already of great value to the scientific and technical interests of Chicago, and with a building offering shelter to the various engineering and kindred societies of the city, as is proposed, its usefulness will be greatly increased. No other site so central and well suited to the purpose as the Lake Front Park can be secured. The objects of the library are purely benevolent, and its application should not be lightly disregarded.

An interesting collection of interviews with telephone men relating to the effect of the Berliner decision is given on another page. To a man the Independents say that the decision will have a beneficial effect on the industry; the gentlemen connected with Bell companies state that the situation is unchanged, so far as they are concerned. Representatives of the Independent companies point out that the securities of the important anti-monopoly companies will now have a much better standing with financiers. Some of them declare, in addition, that even if the patent had been upheld non-infringing transmitters equal to that described as the alleged invention of Berliner would have been forthcoming. From a careful review of the situation it is quite evident that the decision will have a stimulating and healthful effect on the industry as a whole. The great army of telephone subscribers should be especially thankful that the result will make for better, cheaper and more extended service.

Boreas has no chilling frost that can nip that sure winter crop—freak legislation. The assembling of the law-making bodies in the various states is the signal, year after year, for the introduction of many bills that merely amuse the thoughtless and grieve those of more sober mind. In this class, surely, belongs a bill which is to be, or has been, presented to the Illinois Legislature, compelling "all corporations using electric currents of 300 volts or over to place underground all wires or cables conducting such currents." A period of two years is allowed for compliance with the terms of the bill, which applies only to Chicago. Such a bill appears to be especially directed against the street-railway companies. It is entirely unnecessary and has no chance of becoming a law, even in the Illinois Legislature. The objects of its introduction must be merely the annoyance of the companies affected by it and the personal aggrandizement of its author. These motives are unworthy of anyone qualified to sit in the Legislature of a great state.

The daily newspaper reader of the last two months must have been impressed with the numerous and varied announcements of electrical experiments and developments of electrical phenomena credited to Nikola Tesla. It will be interesting to consider these announcements en bloc.

Mr. Tesla began the new year with his twentieth-century greeting to the National Red Cross society, in which he asserted that his delicate instruments at his mountain laboratory in Colorado had been unquestionably affected by electrical influences of planetary origin. Mr. Tesla believes that communication may possibly be carried on between the earth and Venus or Mars by using an enormous delivery of electrical energy, but lasting each time only a fraction of a second. He has been led to this conclusion, he says, by his ability to confine electrical currents of a pressure of 50,000,000 volts and to produce electrical movements up to 110,000 horsepower, and by other experimental results and investigations.

Together with the development of machinery for the production of powerful effects, Mr. Tesla has also perfected novel methods for detecting feeble electrical actions, which, he feels confident, will be important in a number of lines of scientific research.

Of special scientific interest is the announcement that the inventor has found electrical capacity, heretofore generally regarded as a constant, to be variable. He reached this conclusion after a series of experiments at different altitudes in Colorado, from which he was led to conclude that capacity varies with the height above sea level, with the relative height of the capacity with respect to the bodies surrounding it, with the distance of the earth from the sun, and with the relative change of the circuit with respect to the sun, caused by the diurnal rotation of the earth.

Next came the announcement by Mr. Tesla of great improvements in his system of tube lighting, which is said to give the nearest approach to daylight of any artificial illumination yet invented. The lamp is composed of a rectangular spiral of glass tubing containing rarefied gases which emit the radiations when submitted to an extremely high-frequency current.

While waiting for "a number of improvements that must be made before the new light can be generally introduced," scarcely a fortnight had passed before still another startling announcement was made. This time it was to the effect that "the plans for the machinery of wireless telegraphy to signal across the ocean have been completed and a site for a plant selected by Nikola Tesla, and that the project will at once be actively begun." Eight months is said to be the time required to perfect the apparatus, and pertinent to the announcement came a later report from London, stating that an agent of Mr. Tesla was en route to Lisbon to establish a receiving station on the Portuguese coast, which is to be placed in communication with a transmitter located on the New Jersey coast. Accounts differ as to the system to be used for this long-distance, wireless telegraphy. According to one, Mr. Tesla proposes to utilize electrical waves in the earth, by the use of which, with proper apparatus, he believes a wireless transmission of signals to any point on the globe is practicable. This system has been said by some to be the one that will be used in communicating under the ocean. Other accounts refer to a patent granted to Nikola Tesla about a year ago for a system of transmitting electrical energy through the higher strata of air without the use of wires.

An interesting factor that figures in all the Tesla experiments and investigations is the use of an "oscillator." This instrument, which has been evolved after considerable study and years of experiment is at the basis of all the recent developments of Mr. Tesla, and will, so the inventor asserts, accomplish many more wonders in the production of light, in telegraphy and telephony, and in the transmission of power.

Mr. Tesla has been criticized by more prosaic electrical men for raising expectations in the mind of the public which cannot be realized—for talking much and accomplishing little, in other words. His projects are certainly bold in conception and vast in extent. If any of the schemes originating in his fertile brain, and which have been "sprung" with such bewildering rapidity in the last few weeks, should actually, in practice, measure up to the claims made for it, it will be an achievement that will equal or surpass, perhaps, Mr. Tesla's work in the electrical power-transmission field a dozen years ago. In the meantime the electrical journals and all other observers must simply await developments with fair and unbiased minds.

News of a wonderful invention comes from Hamilton, Ohio. Electric heating, with its admitted losses, would seem to be about the very last transformation of energy considered in a perpetual-motion scheme, but it appears that Dr. C. E. Griffing of the city mentioned has done the trick. The inventor is credited with the building of an electrically heated steam boiler, in which steam is generated to run an engine to drive a dynamo to heat the boiler to make more steam—and so on to the last syllable of recorded time. "The plan is to empty the boiler of water," writes a correspondent, "and then attach an electrical dynamo to the flues, which in a short space of time become hot. Then by turning the water on the flues in spray Dr. Griffing secures the necessary amount of steam in short order. A small, two-horsepower, gasoline engine is used to operate the dynamo until the steam reaches the desired point, when a belt is attached to the engine and the steam then operates the dynamo itself." Apparently all that is needed is a start and a supply of feed water and the combination continues to operate indefinitely. But the Hamilton correspondent of the Cincinnati Enquirer supplies still more extraordinary details: "It is claimed that with this electric steam boiler 21 pounds of steam a minute can be secured with a voltage of 800 ohms per hour." This fairly passes belief and throws discredit on the whole scheme. Since the deplorable failure to make a commercial success of the ohm-sifter, so widely heralded a few years ago, no living man has attempted to employ a current of electricity having a voltage of 800 ohms an hour. Of course, if the ohm-sifter, with its promise of eradicating the more dangerous ohms, had been perfected, the thing might have been done. But in the present state of the art the use of this esoteric electricity is manifestly impossible.

WHAT THE BERLINER DECISION MEANS.

The decision of Judge Brown of the United States Circuit Court in Boston invalidating the much-vaunted Berliner telephone-transmitter patent of the American Telephone and Telegraph company still continues to be the absorbing topic of discussion in telephone circles. A comprehensive abstract of the long opinion of the court, together with a history of the case and a report of the prompt action of the Indiana Mutual Telephone association, was given in the last issue of the Western Electrician. This week a number of interviews with representative telephone men show the manner in which the decision is regarded by men of prominence in the industry.

L. G. Bowman, general manager of the Western Telephone Construction company of Chicago: "All persons engaged directly or indirectly in the Independent telephone business have every reason to congratulate themselves and feel pleased over the recent decision. The Bell company has held this patent over the heads of the Independent people ever since the first exchange was started, and has succeeded, to a certain extent, in hurting the financing of large deals by going to possible investors and representing that they held the Berliner patent. This has limited the market for bonds and stocks of Independent telephone companies, and to this extent limited the growth. The effect of this decision, removing as it does the only fear that investors could have, will be greatly to stimulate the business, especially in the large cities. A decision in favor of the Bell company would have had the opposite effect, and would have further frightened intending investors. In my opinion, the Bell people have no hope of an appeal being favorable to them, although they will undoubtedly make some effort in this direction. The Independent telephone business was never so prosperous as now, and the prospects, especially with the Berliner patent out of the way, are very flattering, not only to the telephone-exchange owner, but to the manufacturer."

James S. Cuming, president of the Central Telephone and Electric company of St. Louis: "We believe that the Berliner decision has been discounted by the Independent telephone companies to a very great extent; still, the subject has been used for bluffing purposes by the Bell Telephone company for quite a while, and in many instances has prevented capital from being invested in the Independent telephone business. We do not look for any great immediate increase from the effects of this decision, but believe that it will certainly add to the already large demand for Independent telephone goods."

W. E. Doolittle, general manager of the Sterling Electric company, Lafayette, Ind.: "The Berliner decision removes the doubt as to the perpetuity of the Independent telephone movement. The club—the menace—held over manufacturers, operatives and prospective investors has been removed. The decision will give Independent telephone properties a stable, permanent value, and will make their stocks and bonds a class of securities that will be sought for by capital. I predict, with the new capital that will flock into this field since this decision, that 1901 will see an Independent telephone growth and enlargement exceeding the expectations of the most sanguine."

F. W. Dunbar, Kellogg Switchboard and Supply company, Chicago: "The decision given by Judge Brown of the United States Circuit Court in the famous Berliner case was a broad and sweeping decision in favor of the defendants, the National Telephone company et al. The effect of this decision will be to remove the cloud under which investors in the Independent telephone companies have had to labor. The decision covered practically all of the points urged by the defendants to show the invalidity of the patent in question. These points may be briefly stated as follows: The patent as filed did not contain the subject-matter of the patent as issued. Berliner did not invent the constant-contact transmitter. The constant-contact feature was introduced into his application subsequent to its purchase by the American Bell Telephone company and after a prior use for more than two years. The patent, as issued, was anticipated by the early Edison transmitter patent and by Bell's liquid-transmitter patent. The Berliner transmitter patent is invalid on account of the prior patenting by Berliner, in 1880, of the identical mechanical structure used as a receiver. If the claims of the Berliner patent be so limited as to cover whatever invention Berliner may have disclosed, then the defendants' transmitters and all other modern commercial forms of carbon transmitters do not infringe. Edison was the inventor of the carbon transmitter, not Berliner. 'The defendants owe nothing to Berliner.' Shortly after the Berliner patent was issued, after a delay of 14 years in the Patent Office, in November, 1891, Mr. Milo G. Kellogg of Chicago, realizing the injustice of the issue of such a patent at that late date and realizing that were this patent allowed to exist without questioning its validity, great injustice would be done to the public by effectually stopping competition and thus deferring for many years the improved service and lower charges which such competition would bring about, brought the matter before President Harrison and succeeded in convincing him that the patent should be canceled on the grounds above pointed out, and for substantially the same reasons which Judge Brown in his recent decision found were good and sufficient for invalidating the patent. President Harrison then authorized the suit of the government against the American Bell Telephone company for the cancellation of the Berliner patent. In this suit the Supreme Court decided that the government had not shown that the American Bell Telephone company was guilty of fraud in the prosecution of the patent in the Patent Office, and refused to pass upon the validity of the patent on any other grounds. The present suit was a suit for infringement of the Berliner patent, brought by the American Bell Telephone company against the National Telephone company and the Century Telephone company. Had the decision been adverse to the interests of the Independent telephone companies—that is, had the decision upheld the validity of the Berliner patent according to the broad interpretation placed upon this patent by the American Bell Telephone company—it would have given a severe set-back to the Independent telephone business, yet it may be stated, and should be stated in justice to those who have invested in the Independent telephone movement, that there were other telephone transmitters actually constructed which would give substantially as good results as those telephone transmitters upon which the Bell company brought suit, and which are distinctly different in principle and mode of operation from the principle and mode of operation of the Berliner transmitter as interpreted and construed by the experts who have testified for the American Bell Telephone company. The effect of the decision upon the American Bell Telephone company, now known as the American Telephone and Telegraph company, and upon its many licensee companies operating throughout the United States, will not be marked, except in so far as these companies will be subject to competition of even greater activity than heretofore. The Bell Telephone companies have anticipated the adverse decision by placing themselves in a position, during the last few years, to meet competition by rendering a telephone service far superior to the service which they had rendered prior to competition."

Angus S. Hibbard, general manager Chicago Telephone company, Chicago: "The decision will have no effect on our company and we will continue our business the same as heretofore."

J. G. Ihmsen, manager American Electric Telephone company, Chicago: "I was not greatly surprised at the decision being adverse to the Bell company, as the effort of that company to perpetuate a monopoly by endeavoring to force an invalid patent upon the people of the United States was a grievous injustice and well deserving of the severe rebuke administered by this decision. I did not, however, anticipate the complete, broad, annihilating opinion rendered by Judge Brown. In the rescript there is every evidence of careful consideration by the able jurist who heard the case. There is shown an intimate knowledge of every detail, an intelligent interpretation of the several patents offered by the defence as anticipating Berliner, an exhaustive compilation of facts so beautifully presented to show plainly the invalidity of the patent involved, that there is not the least prospect of a reversal of judgment in the event of an appeal. I do not look for any immediate boom in the Independent telephone business as a result of this decision, for the reason that the larger investors have been buying apparatus as rapidly as they are able to install it, and few of the smaller buyers ever knew that there was such a thing as the Berliner patent, and those who are familiar with it took it for granted that we would win the case, and went right on with the good work. There must, however, prevail a better feeling in regard to the employment of capital in Independent enterprises, since the stamp of legitimacy has been so forcibly impressed upon the industry by Judge Arthur L. Brown. Large quantities of investment funds that have heretofore been withheld will be attracted to this line of securities. Opening up the markets to these securities will create a gradually increased demand for telephone apparatus and construction material and eventually benefit many lines of business. Judge Brown has certainly administered a judicial chastisement to the Bell Telephone company."

William A. Jackson, president Central Union Telephone company, Chicago: "There is nothing to be said about the matter. The decision does not affect our company in the slightest. We will go on just the same as before."

Kokomo Telephone and Electric Manufacturing company, Kokomo, Ind.: "The Berliner decision is very satisfactory to us. While we expected it, yet we feel somewhat relieved, and think now, with others, that as this cloud is removed there will be a new impulse to the business. New capital, new people and more of them will take hold; wires will be stretched from one end of this country to the other, and in every direction. This means more telephone apparatus, and we, as manufacturers, expect the largest output this year within our history."

I. J. Kusel, president of the Eureka Electric company of Chicago: "The Berliner decision is, and always has been, claimed in the past, by all the knowing Independent telephone men, simply great in notoriety only. The Bell people in the past took every opportunity of claiming all they could under the Berliner claims. Now that Judge Brown has so clearly and emphatically, in plain language, given the monopoly the 'black eye,' the Independents certainly have just cause to feel good and, at the same time, glad that the Bell company has in the past given the Berliner claims the great notoriety that it did. This final great bluff has been called by the decision just handed down. As to any appeal they may take, it amounts to nothing, unless the Bell company feels like continuing to squeeze its sublicensee companies. This can be the only object of an appeal. The results in the upper courts can certainly be no different than the decision handed down by Judge Brown. As showing the confidence that this patent contained all the weaknesses that have been shown by the decision, may be cited the fact that the Independent manufacturers have extended their factories and gone into the business to a greater extent than any reasonable business men would have done had they not felt as confident of the ultimate outcome of this decision. Now that the sky is clear from the bluffing tactics employed by the monopoly, there should be no trouble in the Independents floating bonds and finding a very reasonable sale for them, which, in the past, has been almost, if not quite, an impossibility. The prospect in the Independent field in the future is certainly flattering. The business has grown beyond all expectations in the past, and we can only believe that it simply remains for the manufacturers to produce superior apparatus, and from now on the success of the Independents will not be questioned for an instant."

J. J. Nate, general superintendent Standard Telephone and Electric company, Madison, Wis.: "In 1894, when the Standard Telephone and Electric company was organized, able counsel was employed and the patent situation thoroughly canvassed. By far the most important patent then in question was that of Berliner, and the letter files of the Standard company show how thoroughly and earnestly the question of validity of the Berliner patent was gone into. On the advice of our attorneys, as a result of their investigation and our personal knowledge and faith in the ultimate outcome of any future suit under this patent, we proceeded with our work, using exclusively from the first a transmitter manufactured in France and patented both abroad and in this country. From the foregoing it is not difficult to understand why we have expected a favorable verdict to Independent telephone interests in the suit pending. A reverse decision coming at this late date would, in our opinion, have delayed the growth of Independent interests but slightly. We are furthermore of the opinion that a considerable number of men who have capital and awaited the result of the Berliner suit will now come into the field, lending new interest to the work in the construction of larger and stronger exchange plants. It has been our theory from the first that the Berliner patent was really valuable to the Bell company from a royalty point of view rather than from its effect in the Independent field. Under the decision of Justice Brown these royalties should in justice be cut off, and it would seem to us that an appeal at this time on the part of the Bell company would have nothing stronger for its object than a final verdict which would mean a continuation of royalties from its licensees."

E. B. Overshiner, president of the Swedish-American Telephone company of Chicago: "Once more have right and justice predominated, and the decision rendered reveals the absurdity of the Berliner claims. The honor of the victory belongs to the many Independent exchange owners, as Judge Brown no doubt took into consideration that if the Berliner claims were valid so many good business men would not have invested their money. This decision simply explodes another bugaboo claim held over the Independents and the threats implied thereby. The decision rendered was a surprise to no one except those not posted. The Bell company knew that it was fighting against a lost cause and was simply fighting for time, realizing that as long as the desision hung fire, it had a certain amount of capital intimidated. Capital will now come forward and set a pace for the would-be monopoly that will compel it to adopt the Independent method of doing business—'live and let live.'"

Stromberg-Carlson Telephone Manufacturing company of Chicago: "There is no question that the decision of Judge Brown declaring the Berliner patent invalid will have a stimulating effect upon the Independent telephone interests, and we will probably see the greatest activity in the way of new work, rebuilding and additions to old plants seen in the history of the telephone business. While it is to be expected that the Bell company will adopt new tactics in the way of harassing manufacturers and users of apparatus other than its own manufacture, yet the effect of its threats will have comparatively little effect upon the situation. A number of very important enterprises have been in a sort of statu quo condition for the last year awaiting the outcome of this decision. Now that the atmosphere is cleared of any possible patent interferences, these deals will be consummated and telephone plants will be established in all of the large

cities of the United States as well as the smaller ones. While the business has been unusually brisk and the volume large, and so much so that it has been almost out of the question for some manufacturers to keep pace with the rapid growth and demands of the business, there will be no handicap in the ability of Independent companies to secure apparatus of the latest design, as preliminary arrangements for enlargements have generally been made, and are in such shape that the increased demand for apparatus will be fully met."

President Tyler of the Southern New England Telephone company, one of the licensee companies of the American Telephone and Telegraph company, was quoted in a New Haven dispatch as saying that the use of the Berliner patent had got beyond the point where it could be controlled by any company. He also said, it was added, that he had not considered the question of patents in telephone instruments as of any importance.

J. A. Williams, president of the Williams Electric company, Cleveland: "I do not consider that the decision in the Berliner case, recently handed down, will make much difference in the status of the Independent telephone business, as the vast majority of all the persons interested in exchange promotion, construction or operation have been practically certain for the last two or three years that the decision would be rendered just as it is. The only thing which it has done will be to remove the doubt which may have existed in the minds of a few who contemplated engaging in the telephone-exchange business, and to this extent only will it affect the future prosperity of the industry. Had this decision occurred three or four years sooner, the Independent telephone business would, no doubt, be much greater in extent to-day than it now is. It, however, places Independent telephone interests beyond the peradventure of a doubt, upon an absolutely safe commercial footing, and we may look for, within the next four or five years, unparalleled advancement and prosperity to the Independent telephone interests. To the early investors in Independent telephone exchanges, a great deal of credit is due. They really were the pioneers in the field and performed their work and risked their means under what certainly must have seemed to them risky conditions."

Electrical Development in the Island of Trinidad.

The British colonial government of the Island of Trinidad has consented to the granting of a charter to the Trinidad Electric company for the construction of an electric tramway line and an electric-lighting plant in the city of Port of Spain, the capital of the island. Some months ago the Trinidad Electric company obtained control of the existing tramway lines and lighting plant in Port of Spain, and made application for a charter to convert the tramway lines into electric trolley roads, covering the entire city. The charter also asked for power to extend the lighting service to all parts of the city and its adjacent suburbs. This application was granted, and the company now has a charter under which it purposes to expend some $940,000 in acquiring existing tramway and lighting plants and converting them into a system covering the whole of the city of Port of Spain and three adjacent suburbs. The new company will be capitalized at over $1,000,000, and the work of construction will be commenced in the course of a few months. Bruce & McConnell, engineers, employed by the new company, have gone over the ground and prepared plans and specifications for the work the company purposes to undertake. The existing properties which the company will take over include a good electric plant, a mile and a half of poor tram line and a small lighting system. There are also about eight miles of good mule-car line in and outside the city. The island of Trinidad is the most prosperous of all the British West Indies.

The lighting plant at Escanaba, Mich., is running at its full capacity, and arrangements are being made to duplicate the present equipment.

Westinghouse O. D. Transformers.

The Manhattan Elevated Railroad company has recently ordered a large number of Westinghouse O. D. transformers, which are to be used for lighting the elevated-railway passenger stations throughout the city of New York. These transformers are to be of 3.2 kilowatts and 6.4 kilowatts in size.

Although the O. D. transformers are of relatively new design, they partake of all the distinctive characteristics which have marked the Westinghouse transformers for many years. In this respect, as in others, the Westinghouse designs have necessitated extremely little modification from year to year, the earlier designs having embodied the essential features of an efficient type of apparatus. In the new transformers, however, are incorporated a number of new and valuable details.

In working out the design of the Westinghouse transformers, the attempt has been made to obtain a general excellence without placing undue weight upon any feature of the design. Efficiency at various loads, regulation in all classes of service, insulation and mechanical simplicity and strength have all been made elements in the design. A feature of the transformers is the use of a surrounding body of oil, enclosed in a metal outer case. This oil is valuable, both as a cooling medium and because it increases the life of the insulation and the lightning-resisting power of the transformer. The coils are individually insulated and are spread apart at the ends in such a way as to secure the greatest possible heat-radiating surface without in any way lowering the efficiency of the apparatus.

The O. D. transformer has been given a considerable range of electromotive force by winding it for two primary and three secondary voltages. Individual sections of the windings are supplied with terminal contacts, which, by a simple change of connections, give a range of voltage covering all practical requirements. The secondary coils for all transformers are wound with copper of square cross-section, which gives about 30 per cent. more available cross-section than similar coils wound with round copper, thus reducing the loss due to the resistance of the windings.

Before the O. D. transformer was placed upon the market it was subjected to a series of the most thorough tests, in order to remedy any possible defects in design or construction. A complete line of transformers was operated for nearly a year at twice their normal electromotive force. The insulation was subjected to tests in which the electromotive force was raised to eight times the normal figure, and careful measurements were made of the iron losses, which showed that throughout this long period of experimental overloading the iron had undergone no deterioration, the Westinghouse method of treating the iron being thus proven to be entirely satisfactory.

Every individual transformer before leaving the factory is run at overload with the normal potential and also at three times the normal voltage without load, and insulation tests are made at voltages ranging from 4,000 to 8,000. Subsequently the coils are immersed in oil, which greatly increases their insulation resistance. These transformers may be wound for any electromotive force up to 6,600; they may be arranged for the Scott system of three-phase, two-phase transmission, and may be adapted to almost any special class of work. For capacities greater than 50 kilowatts, the Westinghouse company manufactures a line of transformers known as the oil-insulated, self-cooling type. These self-cooling transformers are now being made in sizes up to 500 kilowatts. The oil-insulated, water-cooled transformers are being made in sizes up to 2,250 kilowatts, and the air-blast transformers in sizes up to 2,750 kilowatts. Of the accompanying pictures Fig. 4 shows the standard transformer of the small size without case, and Fig. 3 the primary and secondary coils of the same transformer. In Fig. 5 is shown a 50-kilowatt transformer, while in Figs. 1 and 2 are given two views of the small-size transformer.

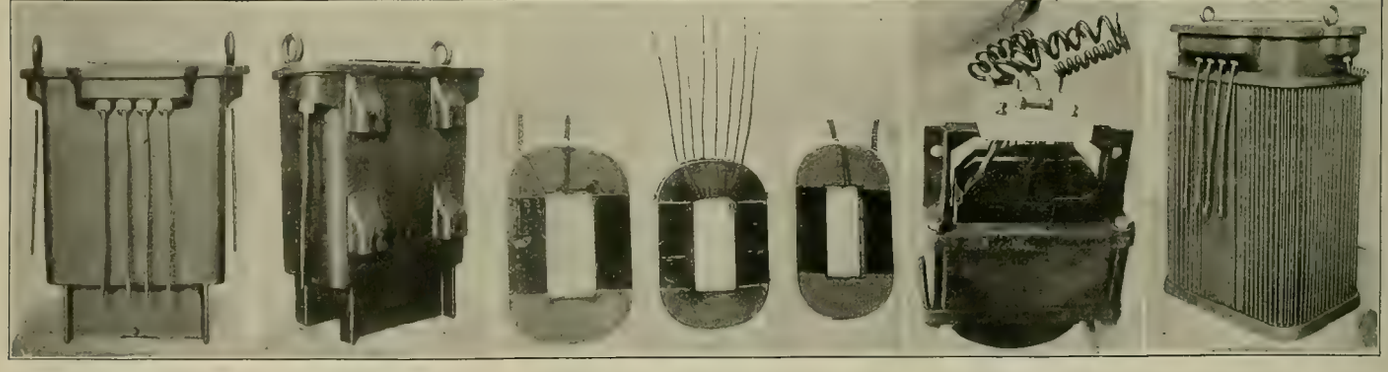


Fig. 1. Small Size. Fig. 2. Small Size (Rear View). Fig. 3. Primary and Secondary Coils. Fig. 4. Coils of Small-size Transformer. Fig. 5. 50-kilowatt Transformer.

WESTINGHOUSE O. D. TRANSFORMERS.

A franchise has been granted for the installation of a power and lighting plant at Marion, Ala.

Wave Transmission over Non-uniform Cables and Long-distance Air Lines.

By M. I. Pupin, Ph. D.

Part III.

d. Determination of the Attenuation Constant.—First Method.—It was shown above that the equation of the curve of the mean value of current is

$$y = \frac{y_0}{2}\left(\epsilon^{\beta\xi} + e^{-\beta\xi}\right)\cos\frac{2\pi}{\lambda}\xi$$

where (y) is the mean value of the current at the distance ξ from the middle point of the cable and y_0 is the mean value at the middle point when the brush (h) of the contact-maker is set to give a maximum deflection at this point. In Figs. 12 and 13 two such curves are given. In these curves the abscissæ represent the number of the coil at which the reading was taken, and the ordinate represents the galvanometer reading at the corresponding coil.

An attempt was first made to determine β from these curves.

Let $y_{\frac{\lambda}{2}}$ be the value of y at $\xi = \frac{\lambda}{2}$, then

$$y_{\frac{\lambda}{2}} = -\frac{y_0}{2}\left(e^{\frac{\beta\lambda}{2}} + e^{-\frac{\beta\lambda}{2}}\right)$$

Since $\frac{\beta\lambda}{2}$ is small, we can also write

$$y_{\frac{\lambda}{2}} = -\frac{y_0}{2}\left(2 + \frac{1}{4}\beta^2\lambda^2\right)$$

Therefore, considering the numerical values, only, of y_0 and $y_{\frac{\lambda}{2}}$, we shall have

$$\beta = \frac{2}{\lambda}\sqrt{\frac{2\left(y_{\frac{\lambda}{2}} - y_0\right)}{y_0}}$$

Referring now to curve Fig. 12

$$\lambda = 17$$
$$y_0 = 33.5$$
$$y_{\frac{\lambda}{2}} = 34$$

$$\frac{2}{\lambda}\sqrt{\frac{2\left(y_{\frac{\lambda}{2}} - y_0\right)}{y_0}} = \frac{2}{17}\sqrt{\frac{1}{33.5}} = .02 = \beta$$

The value of β calculated from the formula

$$\beta = \frac{R}{\sqrt{2}\,10^3}\sqrt{\frac{C}{L}}$$

gives $\beta = .0141$

if we assume for L, C and R the following average values: $L = .058$, $C = .074 \times 10^{-6}$, $R = 17.5$.

The question now arises: What degree of accuracy can be claimed for this experimental determination of β? The expression for β contains the difference of quantities which are nearly equal. Now this difference is very near the limit of the errors of observation, the limit being quite considerable, on account of several reasons. The chief reason is this: The condenser sections of the cable are far from uniform. This lack of uniformity is due, first, to the varying thickness of the tinfoil which makes the resistance vary from section to section. Secondly, the sections are heated before compression is applied to them. This heating is, of course, not quite uniform; the amount of paraffin driven out by the applied pressure is, therefore, different in different sections. Hence the variation of capacity. The result is that the speed of propagation is different in different sections. The difference may amount to as much as 20 per cent. Hence the wave length will change considerably from point to point of the cable. This will be observed in the curves of Figs. 12 and 13. Thus in Fig. 12 the first quarter wave length is four miles long, the second quarter wave length is 4.5 miles and the average is 4.25. The same variation will be observed in curve of Fig. 13. It is evident, therefore, that the method described above for taking readings at the various points of the cable will not give readings which will follow very strictly the mathematical law of the formula. Taking all these things into consideration, it is evident that this

method just pointed out for determining experimantally the attenuation constant is not strictly applicable to our cable.

Another method will be described now which determines the attenuation constant not from the one-half wave lengths, only, near the middle of the line, but takes all the waves corresponding to a long length of the line into consideration. The wave-length determination given above agreed so much better with the theory for the very reason that the method employed gave the average wave length, and not the wave length at any particular point of the cable.

Although the curves of Figs. 12, 13 and 14 do not enable us to calculate β accurately, they are still of considerable importance. First, they show that the cable, though it has a large resistance, possesses, nevertheless, a small attenuation constant. This is particularly well shown in the curve of Fig. 14. This curve represents the mean square of current at the various coils. The readings were obtained in this case by dispensing with the sliding contact arrangement and putting in place of (E) an electro-dynamometer. This mean-square curve represents a very near approach to the stationary wave form, which shows that the attenuation is extremely small. Secondly, the smoothness of the curves 12, 13 and 14 shows that the non-uniform cable acts, even at the frequency of 625 periods per second, just like a uniform cable. This, in fact, was the principal aim of this experimental research.

Second Method of Determining β.—The value β was determined from

$$y = \frac{y_0}{2}\left(e^{\beta\xi} + e^{-\beta\xi}\right)\cos\frac{2\pi}{\lambda}\xi$$

as follows: Suppose that at a considerable distance from the point $\xi = 0$, we find a point the distance of which is some multiple of $\lambda/2$. Then

$$y_1 = \frac{y_0}{2}\left(e^{\beta\xi_1} + e^{-\beta\xi_1}\right)$$

This was done experimentally by shifting the brush (h), Fig. 8, until the maximum reading was obtained at the middle point of the line. It was

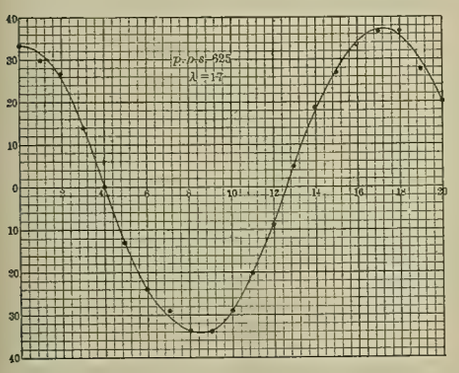


FIG. 12. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

152 scale divisions—that is, $y_0 = 152$. Then the spring-jack was carried to the beginning of the cable and passed along from coil to coil, until the galvanometer reading passed through a maximum. The distance ξ_1 of this point from $\xi = 0$ was 145. The reading actually obtained was 60, but this reading was obtained from a shunt wire, and the reading as calculated from the shunt was 630. Now, when ξ_1 is so large that the omission of $e^{-\beta\xi_1}$ in comparison to $e^{+\beta\xi_1}$ involves an error of the same order of magnitude as the errors of observation, we have the simplified formula

$$y_1 = \frac{y_0}{2}e^{\beta\xi_1}$$

Therefore,

$$\beta = \frac{1}{\xi_1}\log\frac{2\,y_1}{y_0}$$

In the case before us

$$\beta = \frac{1}{145}\log\frac{1260}{152} = .0145$$

The calculated value of β, as given above, is .0141. Experiment and theory agree quite satisfactorily. The equivalence between the non-uniform cable and its corresponding uniform conductor up to 625 periods per second has therefore been established experimentally.

Internal Reflection of Electrical Waves in a Non-uniform Cable.

It remains to be shown now that when the distribution of the inductance coils over the cable does not render the cable approximately equivalent to its corresponding uniform conductor, then there will be serious internal reflections which will diminish the efficiency of wave transmission.

For this purpose the inductance coils were connected in groups of 10; one of these groups was inserted into the cable every 10 miles, so that the total inductance of the cable was now the same as before. A simple harmonic electromotive force of 260 periods per second was impressed upon the cable. The wave length of a wave of this frequency on the corresponding uniform conductor was found (see Fig. 13) to be 41.4 miles, so that the inserted inductance coils were apart at a distance which is equal to about one-quarter of the wave length on the corresponding uniform conductor. The degree of equivalence between this non-uniform cable and its corresponding uniform conductor is the same as the degree of equivalence between $\sin \pi/4$ and $\pi/4$; that is to say, the resemblance between the two is very small.

Theory of the Experiments on Internal Wave Reflections.—The current at any point between two consecutive groups of coils can be written as follows:

$$y = A\,e^{\beta\xi}\sin(pt - \alpha\xi) + B\,e^{-\beta\xi}\sin(pt + \alpha\xi)$$

that is, there are two waves, one a direct one and the

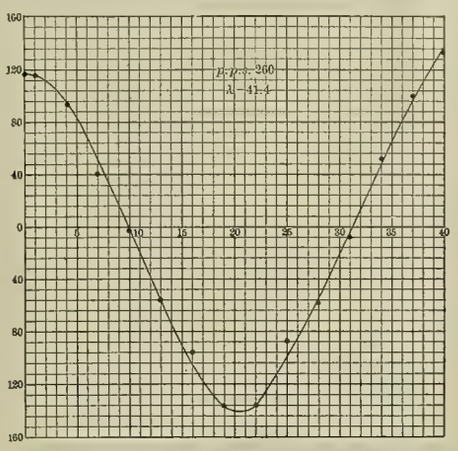


FIG. 13. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

other a reflected one. This equation can also be written:

$$y = \sqrt{A^2 e^{2\beta\xi} + B^2 e^{-2\beta\xi} + 2\,A\,B\cos 2\alpha\xi}\,\sin(pt - \epsilon)$$

where

$$\tan\epsilon = \frac{A\,e^{\beta\xi} - B\,e^{-\beta\xi}}{A\,e^{\beta\xi} + B\,e^{-\beta\xi}}\tan\alpha\xi$$

Let M (y) stand for the mean value of the current, then

$$M(y) = \frac{1}{\pi}\sqrt{A^2 e^{2\beta\xi} + B^2 e^{-2\beta\xi} + 2\,A\,B\cos 2\alpha\xi}\cos(pt_1 - \epsilon)$$

This is a maximum when t_1 is given such a value that $pt_1 - \epsilon = 0$. In that case M (y) is proportional to the square root of the mean square of the current.

Experiment.—The curve of M (y) was obtained in the same manner as the curves of Figs. 12 and 13, except in this case the movable brush (h), Fig. 8, was shifted until the galvanometer showed the maximum deflection at every reading. These readings were plotted as ordinates of curve, Fig. 15. Points (a b c d) on the axis of abscissæ mark the positions of the groups of inductance coils. The effect of reflections is shown in a very marked manner by the sharp corners and strong depressions. The sharp corners coincide, of course, with the positions of the coils. The rapid rise of the minima points show strong attenuation. To compare the attenuation in this case with the attenuation which exists where the coils are distributed one per mile it is only necessary to obtain from curve 15 the curve of mean square of current and compare it to curve of Fig. 14. Draw then a straight line through two consecutive minima and compare the slope of this line in curve 14 to that of curve 15. It will be found that the slope in this latter case is very much more rapid, and therefore the attenuation is very much more powerful; and it should be remembered that in curve of Fig. 15 we have the attenuation which is accompanying a frequency of 260 periods per second. With a frequency of 625 periods per second (the frequency

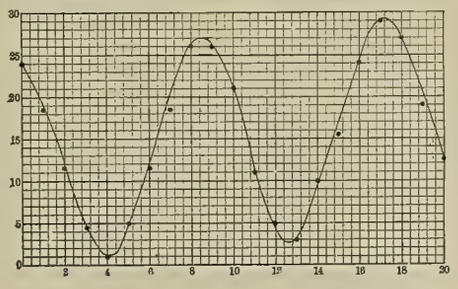


FIG. 14 WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

of Fig. 14) the attenuation would be even much more powerful. I intend to continue this particular part of the research in the very near future.

Telephony over the Non-uniform Cable.—These experimental results leave no doubt as to the correctness of the prediction which the mathematical theory makes with regard to telephony over non-uniform cables. Actual experimental tests with transmitters and receivers which were kindly put at my disposal by the New York Telephone company, for which I feel very grateful to it, verified these predictions completely. Telephonic communication over the whole of the cable was carried on with perfect ease. Both the volume and the articulation of the transmitted sound were all that could be desired. If, however, the inductance coils were cut out and the cable used as a uniform cable, then the transmission was good up to 50 miles, fair up to 75 miles, impracticable at 100 miles, impossible at distances over 112 miles. Increased distance interferes with the transmission over the uniform cable, not only on account of the diminished volume of the sound transmitted, but also on account of the rapid loss of articulation. This manifests itself at first as an apparent lowering of the pitch of the voice, just the theory demands it. My assistant's voice is of an ordinary pitch, if anything, a little above the pitch of the average man's voice. When it was transmitted over 75 miles of the uniform cable (that is, the coils being disconnected from it) it sounded like a strong baritone. Over a distance of 100 miles it became so drummy (this is an expression borrowed from telephone engineers) that it was difficult to understand it, unless nothing but ordinary conversation was carried on, and then very slowly, and the speaker had to put his mouth as close to the transmitter as possible, and speak out as if he were addressing a big audience. At distances over 112 miles nothing but the lowest notes of the voice could be heard; the articulation was entirely gone. When the coils were all in, then no drumminess in the voice was noticed, and the conversation could be carried on as rapidly as one chose to do. I understand that in long-distance work three galvanic cells of the same type of which I had two only were formerly employed by the American Telegraph and Telephone company when it employed the old system of transmission.

Effect of Internal Reflections upon Telephonic Transmission.—The effect of internal reflection is illustrated even more strikingly by telephonic transmission than it is by the exploration of the simple harmonic wave, as represented in Fig. 15. The same distribution of coils was used for telephonic transmission as described above in connection with

FIG. 15. WAVE TRANSMISSION OVER NON-UNIFORM CABLES.

the internal-reflection experiments. A distance of 100 miles of the cable was employed. Telephonic transmission over this distance was absolutely impossible, although the lowest note in the voice was transmitted quite vigorously and sounded like the muffled beating of a big drum. Another distribution of the coils was now tried. The coils were divided into groups of five, and these groups were put into the cable at points five miles apart. Transmission over a distance of 100 miles became intelligible, though with much difficulty; but it was not as good as over the cable without the coils. The drumminess was even more excessive in the former case than in the latter. One had to put his mouth very close to the transmitter, speak very slowly, very loud, and about very ordinary things, otherwise the meaning of the transmitted intelligence would not be caught at all. But if the same distance of cable was employed with the inductance coils placed one mile apart, as the mathematical theory suggests, then the voice of the sender sounded just as if he stood right before the receiving operator. It was not necessary to stand near the transmitter at all, in order to be heard at the other end. There was no difficulty in making the receiving operator understand, even if the transmitting operator stood anywhere in the room at a distance of 20 feet or more from the transmitting instrument. The effect of the inductance coils, properly distributed over the cable, upon the efficiency of transmission astonishes even one like myself, who has now worked for years upon, and made himself perfectly familiar with, this fascinating problem of electromechanics.

The inductance coils which I have so far described contain no iron. Coils with iron cores to be used for this purpose will have, of course, to be constructed in a perfectly definite way to work satisfactorily. I expect to bring this matter before the Institute at some future time. Suffice it to state now that such coils would be required in the construction of non-uniform submarine and underground-telephone cables on account of the much smaller volume per unit of inductance. For long-distance air lines inductance coils without iron cores would be in many respects preferable.

In conclusion, I wish to thank my assistant, Mr. Cushman, and my students, Mr. Frank and Mr. Koscherak, for the very faithful and persevering way in which they have assisted me.

[*The end.*]

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

A reorganization of the Mississippi Valley Telephone company of St. Paul and Minneapolis is soon to be effected and its affairs placed upon a business basis. The receiver is now preparing his report for the court, and it will be submitted shortly. With it will be a proposition for reorganization from local capitalists. It is thought it will be acceptable and that the new concern will take charge early in April.

The local telephone company at Waseca, Minn., contemplates extending lines into the country.

The Alsen, Beresford and Emmet Telephone company of Alsen, S. D., has been formed to build a line connecting Alsen, Beresford and Emmet.

Robert Caniff has sold his interest in the Centerville (S. D.) Telephone company to his partner, W. E. Ege.

The Black Hills Telegraph and Telephone company and the Harrison Telephone company, both operating in Deadwood, S. D., and the Black Hills, are preparing to extend their lines the coming season.

The Broken Bow Telephone company of Broken Bow, Neb., will extend wires to Burwell from Taylor and from Comstock to Ord, Neb.

The Independent telephone exchange at David City, Neb., has been sold to the Nebraska Telephone company, which will put in long-distance instruments and a new switchboard.

A local exchange is projected for Staples, Minn.

Farmers northwest of Walker, Iowa, are working to establish telephone connection with that point.

The local telephone company at Galva, Iowa, is working to induce farmers between Galva and Coulson to put in telephones.

The Pacific States Telephone company has had a dispute with the local operator at Hillyard, Wash., and has taken out its instrument there. The town is without telephone connection. Citizens talk of inducing the Spokane and British Columbia Telephone company to put in an office and establish an exchange.

A local exchange for Battle Creek, Iowa, is nearing completion.

N. S. and M. H. Harter have been granted franchises for exchanges at Kingsley and Correctionville, Iowa.

The Iowa Telephone company proposes improvements to its local exchange at Muscatine, Iowa, in the spring. Considerable new cable is to be put in.

Telephone connection is promised from Rolla, N. D., with Dunseith, Bottineau, Willow City and Towner.

Ed. Code has concluded to install a local exchange at Park River, N. D.

The telephone company at Missoula, Mont., is examining all the instruments in the city and remedying all defects.

A telephone line will be constructed from Ainsworth, Neb., to Springview and Norden.

The Central Union Telephone company of Illinois has made a proposition to absorb the farmers' mutual telephone lines in Scott County, Iowa, and vicinity, and give them the Bell service.

The Mutual Telephone company of Des Moines, Iowa, has opened a sub-exchange at East Des Moines with 300 connections. Another section of 100 connections will be added to the switchboard, and it will be gradually increased to 700 connections.

The Iowa Telephone company will establish a local exchange for Columbus Junction, Iowa.

A farmers' system will be constructed from Tilton, Iowa, to farmers in the vicinity.

The Chicago Independent Telephone Construction company has asked for a local franchise at Billings, Mont.

The Olds Telephone company of Olds, Iowa, has filed articles of incorporation, with $1,800 capital stock.

Farmers of Wheeler Township, Sac County, Iowa, have formed a mutual telephone association.

A rural telephone system will be built from Victor, Iowa, to Hickory Grove and beyond.

The Rocky Mountain Bell Telephone Company contemplates establishing a local system in Twin Bridges, Mont.

The Nez Perce Telephone company of Nez Perce, Idaho, will build a line from Peck to Mohler.

A bill has passed the House and is before the Senate of Minnesota which provides that persons or companies may use the public highways of the state for telephone and telegraph wires without securing permission from the City Council or governing board of any city or village. A vigorous fight is being made on the measure. R.

Indiana Telephone Items.

The United Telephone company of Wabash has closed a contract for the erection of a telephone toll line from Indianapolis to Huntington, 50 miles, to compete with the Bell company, and for a line from Wabash to Rochester.

The telephone and other companies in South Bend using overhead wires have agreed with the city to place all their wires underground early in the spring.

A bitter war is raging between the Indiana Telephone company of Hartford City, Marion and Montpelier and the Central Union company. Ten years ago the latter put in a local exchange at Hartford City and established the rate of $5 and $4.50 for business houses and dwellings, respectively. A year later the service was taken out and a toll service and station established. The local company was organized and an Independent exchange put in cutting the rate to $2 and $1.50, respectively. It has since grown to include the local Independent systems of Montpelier, Marion and Upland, with connecting lines from each place. The Marion system was recently acquired, and the company for the first time came into direct competition with the Central Union. In the way of retaliation the latter company has begun to solicit patronage at Hartford City for a new exchange, and the solicitor claims to have nearly 100 subscribers. To counteract the progress of the invading company, the Independent concern secured 80 business men to sign an agreement not to use the telephones of the Central Union. The latter, however, is going ahead, and will attempt to secure 200 or 300 patrons in the residence part of the city, and practically compel the business men to accept their telephones. To do this the rate has already been cut to $1 for residences, and may be much less. Capitalists of Muncie, Hartford City, Bluffton and Marion are attempting to form an Independent company to fight the Central Union at Muncie.

A telephone war has been started at Crawfordsville by the Central Union company, by cutting the rates of the Home company, which operates the Independent system, and is soliciting subscribers on the proposition that it will soon have as large a list as the Home company. Three years ago the Bell company was the only one operating in Crawfordsville, and its patronage had dwindled down to 30 subscribers. The service was so poor that a company of home capitalists secured a franchise from the city and the Bell franchise was declared forfeited. The Bell company regained its franchise, and for two years has been furnishing free service to subscribers, and has secured a number of them. In spite of this the Home company has increased its list until it is now serving 1,000 patrons. On the first of the year the Bell company began charging patrons the same rates as were asked by the Home company, and as a result many of the latter's subscribers left, and in an effort to stem the tide it has announced a reduction to one-half of its present rates.

The Indiana Legislature is considering a bill which has stirred up great opposition. It provides that telephone companies may locate their poles in streets and public highways and in any places they may choose, so long as the poles do not obstruct public traffic. The bill has been reported on favorably and the report concurred in. The enemies of the bill declare that it is innocent enough in appearance, but practically gives the roadways of Indiana to the telegraph and telephone companies. It is claimed that the New Telephone company is back of the measure. The bill has been amended so as to provide that the poles can be located only by consent of the abutting property holders, and if passed at all will probably be in this form. F.

Telephone Connection between Ohio and the South.

As the result of a conference between officials of the Cumberland Telegraph and Telephone company and the City and Suburban Telegraph association of Cincinnati, it is said that telephone lines will be built connecting Cincinnati with all of the important cities and towns of the Central South. The Cincinnati company will build about 300 miles of new lines in order to connect the various termini of this company already in existence with the northern termini of the Cumberland company. The Cumberland company owns the systems in Nashville, New Orleans, Chattanooga, Knoxville, Frankfort, Lexington and Louisville. The Cincinnati company controls the territory north of the Ohio. Their conjunction means that the territory from the Ohio to the Gulf and including all of those southern states west of Georgia will be controlled by the joint organization.

Independent Telephone Consolidation in Pennsylvania and Vicinity.

An Associated Press dispatch from York, Pa., dated March 1st, states that representatives of the Independent telephone companies of Pennsylvania, Maryland, Virginia and West Virginia have effected an agreement whereby a consolidation of all the companies will be made, with a capitalization of $2,000,000, with headquarters in York. It is said that arrangements have been made whereby a long-distance service to Philadelphia and New York will be obtained through the Keystone Telephone company of Philadelphia. The officers of the companies, says the dispatch, hope ultimately to unite with the Independent telephone companies of the western states and thus become the great rival of the Bell Telephone company.

Telephone Practice Discussed.

The regular meeting of the Chicago Electrical association, held on March 1st, was addressed by Mr. Kempster B. Miller, engineer of the Kellogg Switchboard and Supply company of Chicago, who read a paper entitled "Modern Telephone Engineering." Mr. Miller treated his subject quite exhaustively and with a thorough knowledge of all the elements entering into the operation of a complete and modern telephone exchange. He stated that he believed in a city a single exchange with multiple switchboard was best, all points considered. Mr. Miller said that whereas the largest switchboard in operation at present (that of the Cuyahoga company at Cleveland) provided for 9,600 lines with an ultimate capacity of 20,000, he believed a single exchange furnishing service to over 90,000 subscribers could be built. This would be accomplished by reducing the size of jacks on the multiple board to quarter-inch centers and by making use of the divided-multiple system. By the aid of a number of diagrams the speaker explained the operation and construction of a modern multiple switchboard and then showed several views of large exchanges. A number of detail views of apparatus were also given, illustrating plugs, jacks, lamp signals, relays, cords, etc. One of the most interesting views was a chart giving curves of the number of calls during the 24 hours of a day of both the Bell and Independent systems in a large city. The humps and depressions in the curves were taken to represent the "pulse" of the city, the telephone exchange being regarded as the heart of the community. Mr. Miller closed by stating that in the future the large cities would be the main offices, the smaller towns the branch offices and the connecting toll lines the trunk lines of a vast telephone system, reaching all over the country.

There were about 100 members and visitors in attendance at the meeting, and several persons took part in the discussion following the paper. W. Clyde Jones made a few interesting remarks on the phonograph "busy" signaling system brought out in the West by Mr. Sabin a few years ago. He also dwelt upon the development of Independent telephony and the attitude of the Bell company and predicted that undoubtedly the present competition would eventually resolve itself into two large competing companies—one the Bell and the other a consolidation of all the Independent companies—similar to the present telegraph situation. In answer to questions by the members Mr. Miller believed that it was advisable to use the common-battery system in any ordinary exchange of 100 subscribers or over. He thought that automatic systems of over 1,000 subscribers were not praticable, particularly for the reason that intelligence in the central office was eliminated.

NEW COMPANIES.

The Gaffney Telephone company, Gaffney, S. C., is in the market for a complete plant of 150 instruments.

A company is being organized for the establishment of an Independent telephone system at New Decatur, Ala.

The Houston Telephone company of Golden, Ill., has been incorporated, with a capital stock of $2,500, by T. J. Downing, E. J. Hedrick and L. W. Miller.

The Farmers and Merchants' Union Telephone company of Griggsville, Ill., has been incorporated for $2,500, by Angus N. Orr, Adam Zimmermann and J. W. Orr.

The Dakota Telephone and Electric company of Geddes, S. D., has been incorporated by G. E. Wickes, Edward C. Wood and Frank Exline, with a capital stock of $150,000.

Edmund Walton, general manager of the Howard Telephone and Electric Lighting company, recently incorporated for $25,000 at Ellicott City, Md., is in the market for cross-arms, insulator pins and brackets, No. 9 and No. 14 wire, telephones and switchboards.

The Queen City Telephone company has been incorporated at Albany, N. Y., with a capital stock of $500,000. It is the purpose of the company to operate a telephone system in the city of Buffalo, connecting with the following-named other cities: Easterly to Rochester, Syracuse, Utica, Albany, Poughkeepsie and New York city; northeasterly to Tonawanda, Niagara Falls, Lockport, Oswego, Watertown and Ogdensburg; westerly to Dunkirk, Erie, Cleveland, Detroit, Toledo and Chicago, and southerly to Jamestown, Hornellsville, Binghamton, Corning, Elmira, Scranton, Wilkesbarre, Philadelphia, Jersey City and Washington. The directors of the company are Hardin H. Littell, Robert R. Hefford, Frank H. Goodyear, Charles W. Goodyear, Robert F. Schelling and Eugene A. Georges of Buffalo, and Samuel E. Wayland of Scranton, Pa.

The Present Telephone Situation in Michigan.[1]

By J. B. Ware.

It is with more than ordinary pleasure that I greet you to-day in this our third annual meeting of the association.

This pleasure is the greater owing to the very satisfactory conditions surrounding each of the companies here represented, the gratifying outcome of the year's business and the growth of the Independents in Michigan and elsewhere, during said period.

When we assembled in Battle Creek one year ago a cloud of uncertainty hung over us, owing to the recent sale, by Detroit and Kalamazoo individuals, of the telephone properties of the

Detroit Telephone Exchange with	5,200 telephones
New State Exchange and lines	4,457 telephones
Central Telephone company	413 telephones
Kalamazoo Exchange	819 telephones
Total telephones sold	10,889

We cannot too strongly express appreciation of the offer made at our last annual meeting, by the United States Telephone company of Cleveland, Ohio, to build a 30-foot pole, long-distance toll line, with sufficient copper circuits to handle adequately the toll business from Michigan to Ohio and other states.

Under authority given by you to your executive committee at that meeting, proper 25-year contracts were secured with a majority of the companies of the state for an interchange of business, etc., and the United States company began the construction of the line mentioned, from the Saginaw end. The line is completed from Saginaw to Owosso and Lansing, and to Jackson and Manchester, except that the lines in Jackson are not yet built, owing to delay in the securing of the franchise, which was not granted until January 21st. The line will be completed, however, via Adrian, to Toledo, before May 1st, in all probability.

The United States Telephone company, besides owning numerous exchanges, including one of some 6,000 telephones in Cleveland, and one of 4,000 in Columbus, owns more miles of toll line and connects with more telephones in Ohio (outside of Cincinnati) than do the Bell licensee companies. These connections will be secured to our Michigan companies over the United States company's lines before mentioned.

The United States company has recently secured long-term contracts for Pennsylvania toll connections, via Pittsburg. The toll lines to Pittsburg are nearly completed, and by the time the Michigan lines are finished to Toledo, connections will have been made with the Pennsylvania city named.

Strong Independent companies are rapidly developing in Western and Central New York and Pennsylvania, and the Baltimore exchange is approaching completion. The year 1901 will undoubtedly see established a magnificent system of exchanges and toll lines east of the Alleghany Mountains, thus furnishing to the Michigan Independents an eastern long-distance service sooner than we had believed possible or probable.

In view of the character of toll-line construction in other states, there is every reason for us to build with even greater care than we have in the past, and while a very large amount of copper circuits have been put up, we should endeavor to cover the Lower Peninsula with sufficient copper circuits to handle adequately the toll business, which has not heretofore been done by anyone.

Whatever may have been the expectations regarding the action of our Independent companies one year ago, as a matter of fact, they became more active and aggressive than ever before.

The Citizens' Telephone company of Grand Rapids in February, 1900, purchased a majority of the stock of the Muskegon company, and a few days later formed a consolidation with the Lansing company. In August it purchased the interest of the Northern Telephone company, including the Traverse City exchange and the Leelanaw County lines. It later built copper-circuit lines from Cadillac to Manton and Traverse City, thus opening for the first time a very large territory that heretofore had not had any telephone toll service, including Frankfort, Thompsonville, Copemish, Wexford and Sherman.

Like other Independent companies, the Citizens' has connections with many towns not reached by the Michigan-Erie company. Within a circle around Grand Rapids having a 50-mile radius, the Citizens' company reaches 231 exchanges and toll stations, while the Erie reaches but 91, an excess of 140 in favor of the Citizens'.

With Ionia as a center, within a circle having a 40-mile radius, including all lines west of Lansing owned by the New State company and sold, as before referred to, at the present time the following shows all places:

Reached by both	77
Reached by Bell only	9
Reached by Independent only	88
The total points	174

Of the above, the following comparison shows present strength:

	Independents.	Bell.
Exchanges	37	13
Toll stations	128	73
Total	165	86

1. Presidential address at the annual meeting of the Independent Telephone association of Michigan in Lansing, February 6, 1901. Mr. Ware is secretary of the Citizens' Telephone company of Grand Rapids.

If all New State company lines and points reached were cut out the result in said Ionia circle would be:

	Independents.	Bell.	Independents' Excess Strength.
Exchanges	33	16	17
Toll stations	105	82	23
Points reached	138	98	40

Similar conditions exist throughout the Lower Peninsula, outside the Kalamazoo districts. The Citizens' company has paid regular two per cent. quarterly dividends for past 3½ years.

The Union Telephone company of Alma, in February, 1900, formed a coalition with the Montcalm County Telephone company. It immediately began the development of the Central Michigan territory.

In the territory covered by the Union Telephone company, its relative strength compared with the Michigan company (Erie-Bell) is as follows:

Points reached by both	46
Points reached by Bell only	1
Points reached by Union only	37
	84

	Exchanges.	Toll.	Telephone.
Union	19	42	954
Bell	3	20	176
Excess Union company	16	22	778

The Kalamazoo and Detroit companies had no telephone property in Union territory and Bell interests have made no purchases therein.

The Union Telephone company is out of debt and pays eight per cent. cash dividends.

During the year the Union Telephone company built exchanges in Mount Pleasant, Shepherd, Harrison, Merrill, Breckinridge, Carson City and Lakeview; it connected Saginaw, its eastern terminus, by heavy copper circuits, via Alma, with Howard City on the Citizens' system; also ran copper from Alma to Mount Pleasant, Clare, Harrison and Farwell.

The Citizens' Telephone company of Evart, in turn, built copper lines from Marion to Evart, and then to Farwell, thus connecting with the Union company on the east, and the Citizens' of Grand Rapids at Evart on the west.

The Moore company at Caro has put up considerable metallic toll lines and several exchanges in the Thumb territory.

The Valley company, covering the commercial center of Eastern Michigan, while not extending its borders, has had an increase of over 300 telephones in its Bay City, Saginaw and Flint exchanges. It has more business telephones in each exchange than has the Erie-Bell, and is giving extra fine service to its patrons, which is far more than its Bell competitor can or does claim.

The Owosso, St. Johns and Benton Harbor companies have each been prospered financially and increased numerically, and each is furnishing A1 service, and each is greatly superior numerically to the Erie-Bell competitor in its territory.

Adrian has put in a fine new switchboard, built an exchange at Palmyra and has done, as we would have expected, its full share. It has paid four per cent. semi-annual cash dividends from date of organization.

The Oceana County company (Hart) has extended its lines to Ludington and is building an exchange there. It reaches 39 places in its territory, while the Michigan Bell reaches but 10 places.

The West Michigan company at Allegan has not been contented to have 165 telephones in Allegan with the Bell 12, but has secured a franchise at Otsego, and is now building an exchange to replace the one the Kalamazoo company sold to the Erie one year ago. It is a private corporation, and its profits are entirely satisfactory to its owners.

In the old Detroit territory trouble has begun for the Erie company. Mr. J. W. Martin promoted a company at Pontiac, and not only has built and has in operation there an exchange of some 370 telephones (about equal to both New State and Michigan Bell exchanges), but has built an exchange at Holly and also toll lines between said exchanges and to the Independent exchanges of Oxford on the northeast, Northville and Plymouth on the south, and to Rochester on the east. Mr. Martin has recently secured a franchise for an exchange in Detroit and in 10 days signed subscribers for 3,800 telephones, proving conclusively that even if the Detroit people were betrayed once, they stand ready to support another Independent exchange. It not only promises reasonable rates, but with common honesty and the same care as shown by the Independents of the state, a new exchange at Detroit can furnish first-class service, and that is something Detroit has not yet had.

Other companies in various parts of the state should be mentioned if time permitted. As explaining why these selections are made, I will state that no formal reports have been received from all the various companies, and I have given only the information which has come to me from reliable sources.

The Erie Telephone company's policy is "the stifling of competition by expansion." Probably no greater effort has ever been made under this policy than by the Erie company in Michigan during the past year. It has been worked without regard to cost of rebuilding, cost of construction, cost of operation, or rental charges for exchange service. The policy has failed in Michigan, and I understand has proven a failure in other states.

The only places where competition has been prevented, as far as I now recall, are in Albion, Marshall and Portland, in each of which places residence rates were fixed at $6, and are maintained to this day. At Portland and Lowell, in addition to the $6 residence rate, a $12 business rate was made and still continues.

At Lowell, in spite of the Erie having 154 telephones, the Citizens' company had the temerity to attempt to establish an exchange at higher rates. Starting with 32 telephones, the exchange has constantly grown, until it numbers 90 telephones, with every indication of permanency and supremacy.

At Hastings, with the Bell exchange of 54, a $6 residence rate was made to keep out the Citizens' company, and two professional solicitors canvassed the town for nearly three weeks, increasing the Bell subscribers to 74. In 10 days, one individual, assisted by the local manager, secured 75 contracts at $4 higher residence rates, and the Citizens' exchange was built. To-day the Citizens' company has 294 telephones in service there, and the Erie-Bell has about a dozen free telephones.

The business people of Michigan do not want or expect less-than-cost telephone service. They have every reason to believe that an era of exorbitant rates would follow the driving out of the Independents and would also restore the poor service of the Bell licensee company. And yet, less-than-cost service has greatly increased the number of Bell telephones in Michigan, as shown by the following figures:

January 1, 1897	15,025 telephones
January 1, 1898	16,270 telephones
January 1, 1899	19,539 telephones
January 1, 1900	32,231 telephones
July 1, 1900	42,500 telephones

This increase is largely residence telephones at less than average cost of operation and maintenance.

What is the ultimate effect of the Erie policy? As frequently pointed out, it means bankruptcy. In many places in Michigan the exchanges of the Erie company receive less income than the actual operating expenses, even when not including interest on bonds, dividends, royalties, general office and Lowell expenses, etc.

In Grand Rapids, the Erie's exchange has not paid expenses of operation alone for over 4½ years. Its rates are $12 for residences and $24 for business telephones anywhere within the city limits. For the year 1900 the operating expenses in Grand Rapids of the Bell exchange exceeded the rental income by more than $20,000, in my judgment, and the statement is not contradicted, though frequently made.

The absolute loss in operating Michigan Bell exchanges in Muskegon, Benton Harbor, Battle Creek, Portland, Lowell, Saginaw, Bay City, Owosso, Charlotte and numerous other places, is known to those present and explains in part, at least, the recent financial troubles of the Erie company.

I will not worry you with a review of the Erie company's financial troubles of the last 20 days, which are known to us all, except to recall to your attention that one year ago Erie stock was selling at 122 and Michigan stock at about 90. Now Erie stock finds little or no sale and is quoted at from 55 to 67, while Michigan stock finds no sale at quotations of 69. Quotations are made only in Boston. It seems that, like the old wildcat money of Michigan, the farther away from the state one goes, the more valuable the property. The contrast with the conditions of one year ago, however, presents a picture to our minds not soon to be forgotten. The present thus finds in this state and other states two vast telephone interests, heretofore antagonistic. In view of the past exclusive policy dictated by the American Bell company to its licensees, an interchange of business between the Bell companies and the Independents was impossible.

If the lesson of past experience has been properly understood, it is my judgment that new policies should be adopted. One policy is outlined in an article appearing in the Michigan Tradesman (Grand Rapids) of January 23d, entitled "Rational Solution of the Telephone Situation." Unless a solution is found resulting in a reasonable interchange of business, I predict the final ruin of the Bell company's interests in this state, and that at no distant day.

The Bell movement wanes; the Independent grows naturally. Everywhere are proofs of prosperity among the Michigan Independents. Not one has failed during the last 4½ years, and a number not already mentioned are paying quarterly and semi-annual cash dividends. Nothing but good to the people has come out of the Independent movement, and without question, they will continue to support it as in the past.

From the report of the tax commission to the state, it appears that there are 22,000 Independent telephones in the state.

The New York and New Jersey Telephone company, for the year ended December 31st, reports gross earnings of $2,827,481, an increase of $446,-112, and net earnings of $808,877, an increase of $45,700. The total surplus is $2,076,609, increase $143,497.

Union Switchboard Company.

In another part of this issue of the Western Electrician is given a description of the plant of the Mutual Telephone company of Erie, Pa., which has some novel features. The gentlemen interested in that company and also in the Union Telephone and Telegraph company, which operates exchanges in the country surrounding Erie, have decided still further to extend their business and branch out into the field of telephone manufacture; in a word, it is now the purpose of the coterie of Erie capitalists controlling the companies named aggressively to push the business of manufacturing and installing exchanges throughout the United States to any number of drops. This new branch of the business will be operated under the name of the Union Switchboard company, which will have an operating capital of $100,000. The factory of the new company is in Erie, Pa., in the Mutual Telephone company's exchange building.

The apparatus, as now offered on the market, is the same as that which has been in service so successfully for the Mutual Telephone company for over two years, and which has done such excellent work on the lines of the Union Telephone and Telegraph company for a still longer period.

The new switchboard apparatus insures, it is asserted, practical immunity from switchboard trouble, a minimum amount of attention and freedom from interference to business; and for these reasons is said to be less expensive to construct and operate than any other multiple board on the market. The remarkable swiftness with which it can be operated, the positiveness and quickness of its busy signal and the general flexibility of the system are pointed to as other advantages.

The new manufacturing organization starts business, not only with a remarkably well-developed switchboard and telephone system, but one also that has the merit of having been thoroughly tried under all sorts of adverse conditions, such as short and long-distance, underground and overhead lines, etc. Mr. P. H. Adams is largely interested in the new company, and Mr. W. S. Paca has been placed in charge of all the telephone-engineering work of the Union Switchboard company. Mr. Paca will, however, retain his position as superintendent of the Union Telephone and Telegraph company and also continue as chief consulting engineer for the Mutual Telephone company. The improvements of Mr. J. Z. Miller, as developed in the Mutual exchange at Erie, will be made use of by the new manufacturing company.

GENERAL TELEPHONE NEWS.

The new system recently installed in Birmingham, Ala., by the People's Telephone company will soon be ready for business.

The Keystone Telephone company of Philadelphia has secured properties for two new exchanges, purchased the ducts formerly owned by the Standard Telephone company and will install switchboards and construct a subway system.

The East Tennessee Telephone company, operating 40 exchanges under the Bell franchises, has passed into the hands of the Cumberland Telephone company. The capital stock of the former company is $300,000; bonds, $200,000.

It is stated that the city of Newport News, Va., will proceed against the Southern Bell Telephone company in the courts to compel the company to desist from doing business without a franchise in Newport News, save that which it is entitled to do under the original charter.

MANUFACTURERS AND DEALERS

The Globe Automatic Telephone company of Chicago has been incorporated, to do a manufacturing and telephone business. The incorporators are John E. Norling, Frank A. Lundquist and Ward B. Sawyer, and company is capitalized at $25,000.

The Stromberg-Carlson Telephone Manufacturing company has just secured one of the largest contracts of the season, it being the full equipment for the Independent telephone exchange at Wheeling, W. Va. The system is to be of full central-energy type, with lamp-signal, multiple switchboard of 5,040 ultimate capacity, and, besides complete installation of the plant, the contract includes the instruments, board, protectors, distributing board, storage batteries and power board. The plant is to be in operation by May 15th. It is said that this will give Wheeling one of the best and most modern Independent exchanges in the country.

At the annual meeting of the Sterling Electric company of Lafayette, Ind., the secretary's report showed that the business of the company was in a very gratifying condition and constantly growing. The company has something over $100,000 in unfilled orders on hand. It was decided to increase the capital stock of the company from $100,000 to $150,000, in order to improve the facilities of the plant by adding such machinery as will enable it to manufacture all telephone parts. The company now employs 200 hands and hopes to increase this number to 300 within a year. Directors F. B. Cook, H. A. Taylor, Charles Murdock, Mortimer Levering and W. E. Doolittle were re-elected, and a vote of thanks was unanimously tendered to President Cook, Secretary Doolittle and the board of directors for their efficient management of the affairs of the company.

CORRESPONDENCE.

New York Notes.

New York, March 4.—The contract for the Post-office section of the underground railway has been awarded to the contractors who recently secured the Forty-second street section. The plans for the down-town loop have been slightly changed, and a considerable saving is expected in consequence. Chief Engineer Parsons of the Rapid Transit Commission expresses confidence that trains will be running throughout the system on Manhattan Island by the end of 1903. The Brooklyn extension, however, will probably be delayed a little longer, on account of the difficulties presented in the portion between the City Hall and the Battery. No trouble has been experienced up to the present time in securing prompt delivery of the structural steel, and the supply is said to be somewhat in advance of the immediate requirements.

At the annual meeting of the stockholders of the Rapid Transit Subway Construction company, held on February 28th, the following-named directors were elected to serve for a term of three years: W. H. Baldwin, Jr., August Belmont, James Jourdan, W. G. Oakman and Cornelius Vanderbilt.

The State Board of Railroad Commissioners has rendered a decision on the last of the complaints made by residents of the Twenty-third ward of Brooklyn relative to the service of the Brooklyn Heights Railroad company. The commissioners point out that while it is true that the public suffers great inconvenience at certain times of the day, this condition is due to the unavoidable congestion of traffic on a few main routes, and that no relief can be given until the opening of the new bridges to Manhattan. The board states that the company operates all the cars that can be moved on the existing lines in safety, and that to put additional cars into service in those hours would render the movement of all slower and more dangerous. The board has never assumed that it had jurisdiction over the operation of trains on the Brooklyn Bridge, and therefore makes no recommendation on the subject.

A bill is before the Internal Affairs Committee of the lower house of the state Legislature giving to county boards of supervisors the authority to regulate the speed at which automobiles may be driven on the highways under their control. A. R. Shattuck, president of the Automobile Club of America, and S. T. Davis, Jr., president of the National Association of Automobile Manufacturers, have argued against the bill, maintaining that such a law would result in a lack of uniformity in regulations of different counties that would cause great confusion. It is probable that the bill will be amended to make eight miles an hour the limiting speed within towns, and 15 miles an hour the maximum for country highways.

Henry G. Stott, for nine years engineer of the Buffalo General Electric company, has been appointed superintendent of motive power of the Manhattan Railway company, and will have control of the large power plant of that company. He is a member of the American Institute of Electrical Engineers, and has written a number of valuable papers.

A school of instruction for new motormen is shortly to be established by the Brooklyn Rapid Transit company. There will be in the school the skeleton framework of an electric car, consisting of a standard truck, with motors, controllers, etc., the car body being replaced by the two end platforms. The floor of the car will be removed so as to show the motors. The fuse boxes will be in their proper places, and the car will be equipped with two ground switches, an automatic blow-out and a circuit-breaker. All the working machinery will be exposed. It is intended that the course of instruction shall take from 10 days to two weeks, and after a man has demonstrated his ability and the chief of instruction has certified to his fitness he will be detailed to a suburban line until he acquires proficiency. The new school is to be established in the Fifty-eighth street depot.

It has been stated recently that the management of the New York Central Railroad company had decided upon the third-rail system for the moving of suburban trains. Experiments have been conducted for some time with a view to obtaining a satisfactory motive power to replace steam in the tunnel, and both electric and compressed-air motors have been tried. President Callaway of the New York Central states that no such decision has been made as yet, although the electric system is still one of those considered.

On account of the recall of the passes issued to employes of the Brooklyn Rapid Transit company a general strike was threatened, but it is believed now that the men will not go out. M. L. G.

Canadian Intelligence.

Ottawa, Ont., March 2.—At a recent meeting of the Town Council of Coburg, Ont., a by-law was passed granting a franchise for pole rights to the Central Ontario Power company of Peterboro, Ont., for the purpose of transmitting electric current from Burleigh Falls for lighting and power purposes. The Port Hope (Ont.) Town Council has passed a similar by-law for the same purpose, as have all the intervening townships that lie between Port Hope and Burleigh Falls. The Crossen Car Manufacturing company and the Dick Ridout Woolen mills will be supplied with 500 horsepower, and the town of Port Hope has arranged with two new manufacturing corporations to establish works in the town, the town furnishing the buildings. Mr. J. Alexander Culverwell of Peterboro is the managing director of the power company.

The Canadian House of Commons has passed the following resolution providing for Canada's share of the increased cost of the new Pacific cable: "That whereas by the Pacific cable act of 1899 his excellency in council is authorized to guarantee payment of five-eighteenths of the principal sum of £1,700,000 sterling to be applied in establishing direct submarine telegraphic communication between Canada and Australia; and whereas in lieu of the said sum of £1,700,000 it is estimated that for the purpose aforesaid there will be required a sum not exceeding £2,000,000, which sum the government of the United Kingdom is willing to advance, the governor-in-council is hereby authorized to guarantee payment of five-eighteenths of the principal and interest of and upon the securities to be issued by the government of the United Kingdom for raising the said sum, namely, £2,000,000, to be advanced."

The annual meeting of the Lachine Rapids Hydraulic and Land company of Montreal shows a gross revenue for the last year of $269,401. The general operating expenses amounted to $79,607, and for betterment and repairs, $11,604, leaving a profit of $130,977 for the year. Two dividends, equal to 10 per cent. for the year, were paid, $10,587 added to the contingent account and a balance of $4,015 carried forward to profit and loss. It came out, during the discussion on the annual report, that the machinery now in use was working at nearly full load, and that the directors would shortly consider the advisability of installing the rest of the plant, for which room had been provided in the power house. The plant now in use constitutes about two-thirds of the capacity of the power house. G. B. Burland is president of the company.

A. V. W.

From the Buckeye State.

Columbus, Ohio, March 2.—The Canton Light, Heat and Power company, Canton, has increased its capital stock from $150,000 to $225,000. A. J. Underhill is the secretary of the company.

The Toledo Automobile company, Toledo, capital stock, $25,000, has been incorporated for the purpose of doing an auto-cab business, conducting a transfer line and manufacturing, buying and selling automobiles. The incorporators are Edward A. Kirk, Edward P. Hubbell, Charles M. Hall, E. G. Eager and Frank Southard.

H. E. Putney of Toledo has invented a new brake for traction cars that is said to be superior to those now in use, from the fact that it is very easily and quickly applied and is very durable. Experiments have been made with it on the lines of the Toledo Traction company, and the management seems to be satisfied that it will do what is claimed for it.

Preparations are being made to extend the lines of the Zanesville Street Railway company to South Zanesville. W. A. Gibbs is the manager of the road.

J. H. Horan and E. H. Eschert of Toledo are interested in a new line that has been proposed from East Liverpool to Lisbon. These gentlemen say they will form a company of Toledo capitalists to build the line.

The Portage Lake Traction company is opposing the application of a franchise made to the commissioners of Portage County by the Northern Ohio Traction company to extend its line from Kent to Ravenna. The lines would parallel each other for some distance.

The woman street-car conductors at Chillicothe went on a strike last week because they were required to get off the cars and go ahead at railroad crossings, as required by law. The motormen have been doing this, but the management made a change in the matter, and the conductors concluded to take it into their own hands.

The town councils of Winchester and Groveport have granted franchises to the Columbus, Winchester and Lancaster Traction company, and the promoters are working on the right-of-way. They hope to have the road in operation by midsummer.

There is some talk that the proposed line of the Columbus, Buckeye Lake and Newark Railroad company will be extended on to Zanesville this summer. A great part of the grading between Columbus and Newark has been completed, and it should not take the company long to have a portion of it in operation.

The Columbus, London and Springfield Railroad company has leased property on West Gay street, Columbus, and will remodel a house already on it into a first-class depot. It will serve all the roads that use the loop built by this company. The offices of the company will be in the depot, where the ticket office will also be located.

The Northern Ohio Traction company has secured the right-of-way in Summit County for the Akron-Massillon line. The engineers are at work, and it is probable that construction will commence soon. The company will secure a private right-of-way, which will be much shorter than the public highway.

The Thresher Electric company of Dayton suffered heavy damage from fire a few nights ago. Several completed dynamos and motors were damaged and the machinery was also injured. The loss

is placed at $20,000, with insurance enough to cover it.

The Dayton and Northwestern Traction company has been granted a franchise by the commissioners of Preble County.

The Tiffin Southwestern Railroad company is securing the right-of-way in Hardin County and has many consents, but the promoters are being opposed by others who wish to build a line from Ada to Kenton.

The Cincinnati and Dayton Traction company is preparing to commence work on the line from Norwood to Dayton. Many of the people along the line are employed in Cincinnati, and for this reason it is believed that the line will be a paying one.

The commissioners of Butler County have granted a franchise to the Millcreek Valley Traction company to build a line over the Springdale pike. The company is to pay the county $25 a mile for the first five years and $35 a mile for the remaining 20 of the life of the franchise.

The Dayton and Northern Traction company has made arrangements to issue $450,000 in bonds for the purpose of building the road to Union City.

Charles L. Henry has resigned as manager of the Union Traction company of Marion, and George F. McCulloch of Muncie, Ind., was chosen to take his place.

The promoters of the Akron-Canton electric railway are preparing to ask for franchises in Akron and for a right-of-way for the line. John C. Welty and others are interested in the line, and it seems that it will be built, notwithstanding the fact that the Northern Ohio Traction company will connect the two towns.

A report has been current that an electric road will be built from Warren to Burton, to connect with one now under construction from the latter place to Cleveland, thus giving Warren connection with the Forest City.

The power house of the Toledo and Western Railroad company has been completed, and the company has received several new cars that are to be used on the line.

Representatives of the Lakeside, Napoleon and Western railroad are at work getting the right-of-way. The company proposes to connect Lakeside, Port Clinton, Fremont, Bowling Green and Napoleon.

The commissioners of Defiance County have granted a 25-year franchise to the Toledo, Napoleon and Defiance Railroad company. Work must be commenced by May 1st of this year and completed by July 1, 1902.

The Toledo and Northwestern Ohio Railroad company has been organized, with the following-named officers: President, F. V. H. Collins; secretary, William P. Heston; treasurer, John Q. Adams; general manager, Ellis Bartholomew. The company proposes to build several lines out from Toledo, and has already done some work. Right-of-way has been secured for others upon which the company will go to work this summer.

The Dayton, Springfield and Urbana road has put on a newspaper car which will run regularly, carrying papers out of Springfield to several smaller towns.

It is reported that the lighting interests of the Kentucky suburbs of Cincinnati will all be purchased by the North American company. The street-railway companies may be taken in also.

Clyde Mulford of Columbus is experimenting with an electric bolt-heating machine which will, in all probability, prove a success. He is assisted by Professor Caldwell of the State University, who is a well-versed student of electrical matters. By means of an endless-chain carriage the bolts are carried along so that the ends are immersed in a brine bath, to the ends of which are attached electrodes. The carriage being charged, the introduction of the bolt into the bath short-circuits the electrodes, and the bolt is heated to a red heat. As it passes a bolt-heading machine it is dropped by the automatic carriage into place, where the work proceeds. It is considered an important invention, and is already patented. O. M. C.

Information from Indiana.

Indianapolis, March 2.—A bill has been passed by the Indiana Legislature which places interurban electric lines in the hands of the State Tax Board for assessment and taxation; and also a bill to authorize street and electric railroad companies to make contracts with similar companies.

William Dages, recently killed in Chicago, was connected with the electric-light works at Huntington for many years.

Twenty or more of the leading merchants of Kokomo have organized an Independent electric-light company and will at once put in a competing plant.

Steps have been taken to secure a new electric-light plant at Hagerstown.

Judge Palus, of the Grant County Court, has given a decision in the suit of Gilbert La Rue against the town of Fairmount. La Rue contracted with the town to equip an electric-lighting plant and was to receive $160 a month for 10 years, the rental to apply on the purchase. The town became six months in arrears on payments. The court held the contract was a sale, rather than a lease, and was void, because the town exceeded its constitutional limit of indebtedness.

The Wabash-Peru interurban road is receiving pine and cedar ties for its track. The company expects to have cars running by July 1st.

The Union Traction company is completing plans for the erection of a $15,000 passenger station at Elwood, and will also build a freight depot there.

The Muncie-Newcastle Traction company reports having secured the right-of-way the entire distance between the two cities. The promoters are preparing to begin the work of construction as soon as the frost is out of the ground.

A company of local capitalists has been given a franchise by the city of Crawfordsville to operate an electric street-car line over the streets of the city for a term of 50 years. The franchise carries with it the privilege of operating a hot-water heating plant for the same term of years, the city to receive one per cent. of the gross receipts of the plants.

An Indianapolis jury recently gave a verdict against the local street-car company, awarding $500 to a woman who deliberately stepped off a car and walked around the rear end of it and in front of another approaching from the opposite direction. The verdict was a surprise, as it was shown that the gong was sounded.

The effort of the taxpayers to prevent the construction of a municipal electric-light plant at Richmond has proven a failure. Judge Fox held that as fraud was not alleged and that as the construction of the plant would not involve the city in an indebtedness beyond the constitutional limit, the court had no right to interfere. The work of building the plant will proceed.

There is every indication of a lively trolley war along the Wabash River during the next 60 days. The first hostile steps of the Dieterichs syndicate is to appeal to the councils of Wabash, Huntington and other towns not to bind themselves by granting franchises to other electric lines until the syndicate is heard from. Every effort is being made to hold up franchises on the promise of the syndicate to build a passenger and freight line from Ft. Wayne to Lafayette. The promoters of the two roads now under construction say their lines are not for sale, but it is believed the syndicate's purpose is to begin at Lafayette and build north, paralleling the two lines named, and ultimately to compel them to sell or combine all the interurban lines along the Wabash.

The Indianapolis and Lebanon Traction company, incorporated with a capital stock of $400,000, has two franchises for routes between Indianapolis and Lebanon. The promoters of the project have been quietly at work for a long time and had everything ready to begin work before launching the company. There is little choice between the two routes and a decision will be made in a few days and work will begin.

The work of the Indiana Legislature is nearing the end. Only one week remains of the present session. A bill has been passed relating to the incorporation of street-railroad companies which so changes the former law as to include interurban lines. The bill for track elevation of steam lines has been defeated, and the bill requiring such roads to sell a 500-mile mileage book for $10 has passed the House, but will probably meet with defeat in the Senate. A bill has passed the Senate which will make possible a consolidation of all the street railroads and interurban-railroad interests in the state. It is rumored that the Union Traction company is partly owned by the interests behind the Indianapolis Street Railway company, and that these same interests will soon control the Greenfield and Greenwood Interurban companies. The bill passed gives street-railroad and interurban companies the right of eminent domain. The bill was examined by the attorneys of all the roads and amended to satisfy all the companies consulted. The bill contains a proviso that the power of cities to give or refuse a street-railroad company the right to operate is not taken away. F.

Northwestern Notations.

Minneapolis, March 2.—The Water and Light company of Chippewa Falls, Wis., is putting in a large new waterwheel and making other extensions and improvements to the plant.

Konold Bros. contemplate establishing an electric-light plant for Clear Lake, S. D.

W. E. Martin has withdrawn his application for a franchise for electric lighting at Mt. Ayr, Iowa. The city was unable to meet the cost of service which Mr. Martin requested a contract for, and sought to reduce the amount to bring it within the range of the municipal finances, whereupon Mr. Martin concluded the contract would be made too small, and withdrew his request.

A local paper in St. Paul, from the amount of fares collected within the limits of that city last year for street-car service, $1,120,375, or 22,407,500 fares, figures that the entire population of St. Paul rides 138 times a year, or an average of 61,370 fares a day.

The Twin City Rapid Transit company will refuse to pay taxes on $4,600,000, the amount assessed against the company by the state board of equalization of Minnesota, but will contest the matter in the courts if necessary.

A bill is before the Minnesota Legislature which places street-railway companies on the same footing as regards publicity of their business and supervision by the State Railroad and Warehouse Commission with railroads and other common carriers. The bill provides that the street-railway companies shall report to the commission, showing in detail the amount of capital stock issued and to whom assigned, and the amount paid for it. The amount of dividends paid, the surplus fund maintained and the number of stockholders must be shown.

The promoters of an electric railroad from Creston, Iowa, to Des Moines, will get the project before the people of Creston by petition, since the council refuses to submit it. It is claimed that there is a sentiment in favor of the projected enterprise.

The British Columbia Electric Railway company of Vancouver, B. C., has induced the council of Vancouver to consolidate the five different franchises held by it, so that no portion of the system can be purchased by the city before 1918.

The milling company at Sacred Heart, Minn., will install an electric-lighting plant, if the village will contract for a certain number of street lights.

Citizens of Eden Valley, Minn., are discussing electric lighting.

The Seattle Central Railroad company of Seattle, Wash., has filed a mortgage of $50,000 to the Scandinavian American Bank for the bondholders.

Municipal ownership of the electric-lighting plant of Aberdeen, S. D., is under consideration.

The Seattle Electric company of Seattle, Wash., will build a line to Renton Hill on Fifteenth avenue.

The Waterloo and Cedar Falls Rapid Transit company is arranging to extend its system from Cedar Falls, Iowa, to towns near-by.

The council committee of Duluth, Minn., recommends steam power for the proposed electric street-lighting system R.

PERSONAL.

Professor Tait, who has occupied the chair of natural philosophy at Edinburgh University for over 40 years, has resigned his position, owing to ill health.

P. C. Burns, president of the American Electric Telephone company, has gone to Mexico on a combined pleasure and business trip. It is expected that Mr. Burns will be absent from Chicago for about a month.

Captain George N. Stone, president of the City and Suburban Telegraph association of Cincinnati, and largely interested in street railways and other enterprises, is very ill with appendicitis, and his friends fear that he may not recover.

J. R. Harrigan, superintendent of the Chippewa Valley Electric Railway company of Eau Claire, Wis., will resign to take a similar position with the Dayton, Springfield and Urbana railway, an Ohio trolley system which will be 200 miles long when completed.

H. H. Coughlan, vice-president of the Iowa Electrical association, has tendered his resignation as superintendent of the Ottumwa Electric and Steam company of Ottumwa, Iowa, to engage in the electrical supply business in Burlington, Iowa, according to a Burlington report.

At the reception given for Governor and Mrs. Yates by the Union League Club of Chicago last week, Mr. B. E. Sunny, the vice-president of the club, presided, in the absence of the president. Mr. Sunny was accompanied by Mrs. Sunny and did the honors with an ease and self-possession which were the envy of his electrical friends.

Thomas H. McLean, vice-president and general manager of the Toledo Traction company, and formerly general superintendent of the Indianapolis Street Railway company, died of double pneumonia on March 1st in Toledo, Ohio. He came to Indianapolis from New York and became an exceedingly popular officer. From Indianapolis he went to the City of Mexico, where he had charge of all the electric roads. After successfully managing the system he was invited to take charge of the roads in Toledo, and did so successfully for nearly two years. Mr. McLean leaves a wife, but no children.

Captain Almerin H. Lighthall, a well-known engineer and inventor, died of heart failure in his room at the Bartholdi Hotel in New York city on February 26th. At the time of his death he held in his hand a check for $10,000, which, it is said, was the price of a patent he sold a few weeks ago to a street-railroad company. Mr. Lighthall was a veteran of the Civil War, having served in the United States navy. He was one of the patentees of the cable system in street railroading, and he superintended the building of the Highgate Hill tramway road in London and the cable roads in Omaha, Cincinnati, Kansas City and San Francisco. Mr. Lighthall was chief engineer of the Third avenue railroad of New York city and superintended its conversion into a cable road. He remodeled the sewerage systems of Mobile and New Orleans, which he finished two years ago. He leaves a widow, a son and a daughter.

ELECTRIC LIGHTING.

The city of Weiser, Idaho, will issue $5,000 bonds for a lighting plant.

C. E. Wood is considering the installation of a lighting plant at Genesee, Idaho.

The council of Pullman, Wash., is considering a proposition from E. S. Aldrich to supply power for

an electric-light plant and waterworks. The utilization of waterpower is proposed.

The Bluff City Lumber company of Pine Bluff, Ark., will install a power and lighting plant.

Ed. Everett of Nashua, N. H., is heading a movement in favor of a municipal lighting plant.

An election at Collinwood, Ohio, has resulted in favor of an issue of $22,000 electric-light bonds.

The council of Hagerstown, Md., has been asked to issue $23,000 additional in bonds for a new lighting plant.

The Empire Planing Mill company of Bells, Tenn., intends to install an electric plant for lighting the town.

Legislative authority has been granted for an issue of $10,000 electric-light bonds at Harbor Springs, Mich.

The Sheep Creek Light and Power company of Spokane, Wash., has been incorporated, with $200,000 capital stock.

Frank O. Chesney contemplates the development of waterpower for an electrical transmission plant at Neck City, Mo.

The lighting plant at Livingston, Mont., will be rebuilt this summer. C. S. Hefferlin is at the head of the local company.

Bonds have been authorized for a lighting plant at Tullahoma, Tenn., and the matter is in charge of Charles L. Phillips.

Samuel G. Pace, mayor of Mt. Airy, N. C., has charge of the arrangements for the installation of a lighting and power plant there.

An electric-light plant will be installed at Culpeper, Va., and information concerning the plant can be obtained from the mayor.

The Etowah Milling company, Cartersville, Ga., has made a proposition to install an electric-light plant in its mill, with sufficient power for lighting the city.

Henry W. Hughes, S. Frank Cole and associates have applied for a franchise for the establishment of a light, heat and power plant for the town of Denton, Md.

It is reported that A. J. Dyer of McMinnville, Tenn., will incorporate the Great Falls Power company, to develop about 2,000 horsepower for delivery in Nashville.

Citizens of Delphos, Ohio, will soon petition the council to call an election to vote upon the proposition to issue $15,000 bonds, for the erection and maintenance of a municipal electric-light plant.

E. S. Aldrich of Livingston, Mont., and J. B. Brown of Duluth, Minn., have bought the lighting plant at Snohomish, Wash., and will remodel and enlarge it, installing a two-phase system. The plant will also furnish the water supply for the town.

W. N. McAnge, chairman of committee, Suffolk, Va., will open bids March 15th for lighting the streets and municipal buildings. About 30 1,200-candlepower arc and 50 32-candlepower incandescent lamps are required. A franchise will be granted for commercial lighting.

The Big Bend Power company of Spokane, Wash., has been organized for the purpose of establishing plants for the generation of electricity for power, illuminating and other purposes. The capital stock is $300,000, and the incorporators are W. E. Eldridge, W. T. Stoll and others.

It is reported that D. Lottman of Marriottsville has purchased water rights along the boundaries of Howard, Baltimore and Carroll counties in Maryland, and proposes extensive improvements, which include the utilization of the waterpower of the upper Patapsco River in operating a large electrical plant.

In response to advertisements for bids for municipal lighting, City Electrician Ellicott of Chicago has received bids from the Commonwealth Electric company of $103 for each 2,000-candlepower arc light to burn all night on overhead circuits, and from the Chicago Suburban Water and Light company of $102.50 each, for arc lights in the annexed portion of Austin.

ELECTRIC RAILWAYS.

A franchise has been granted the Berkshire Street Railway company, to lay tracks in the town of Lenox, Mass.

The car sheds of the Metropolitan West Side Elevated Railroad company at Harrison street and Forty-sixth avenue, Chicago, together with eight cars, were destroyed by fire on March 2d.

It has been decided that the city of Chicago cannot compel the Chicago Union Traction company and the Chicago City Railway company to operate single cars instead of trains under the present ordinances.

W. D. H. Washington and others have purchased the Glenwood and Polytechnic street railway of Fort Worth, Texas, and, it is reported, will make a number of improvements to the line, which is 18 miles long. It is stated that it will become a part of the proposed electric system between Dallas and Fort Worth.

The City Electric Railway company and the Rapid Railway company will erect new car barns and repair shops in Pontiac, Mich. The buildings will be quite elaborately constructed of white brick with terra-cotta trimmings and will have a capacity of 48 cars.

An electric-railway line is projected between Ashmore and Newman, Ill., by J. C. Taber, S. C. Pemberton, Judge Winkle, S. P. Curtis and W. B. Fanning, all of Oakland, Ill. The promoters are desirous of receiving estimates and other information from contractors.

A consular report from Auckland, N. Z., states that a New York firm is to build an electric tramway there at an outlay of about $1,000,000, the material and equipment, as well as the force of men necessary to put the road in operation, to be brought from the United States.

The Blue Grass Rapid Transit company of Lexington, Ky., has been incorporated for $30,000, with privilege to increase its capital stock to $1,000,000. It is proposed to connect Lexington by electric roads with other towns, and to furnish light and power to towns along the line.

A municipal street-railway system has recently been put in operation at Mannheim, Germany, power being furnished by the city lighting and power plant. The fares vary according to the distance traveled, being a little less than two cents for short lines and three cents for the longer runs, transfer privileges being included in each case.

The following-named companies have been incorporated in Michigan recently: The Kalamazoo and Lake Michigan Railway company of Benton Harbor, capitalized at $60,000; the Lake Shore railway of Benton Harbor, with capital amounting to $25,000, and the Lake Michigan and Eastern Railway company of Benton Harbor, with $25,000 capital.

The street-railway interests of Detroit, it is said, are projecting an electric belt line to pass around the entire city. This line, besides tending to develop the residence and other districts through which it will pass, will be used for the handling of the freight brought in by the many suburban lines radiating from Detroit, the freight being delivered at some central point near the foot of Woodward avenue.

February traffic on the Chicago South Side elevated road showed a daily average of 74,525 passengers, compared with 70,050 in February, 1900, a gain of 6.38 per cent. The report of the Metropolitan elevated showed a daily average of 97,659 passengers, against 92,618 for the corresponding month of last year. This is a gain of 5.4 per cent., and exceeds the record established in October, 1899, the month of the fall festival, by 3,229 passengers daily.

A recent consular report from Cardiff, Wales, contains an account of the overhead-trolley system now being installed there. The power station is described in a local paper as consisting "of a complete set of offices, together with the necessary engine room and boiler house." About 2,000 horsepower will be the capacity of the initial installation, and an increase to 3,500 horsepower is planned for the near future, as the station will give both lighting and power service. The equipment of the power plant is quite complete, and includes economizers, superheaters, individual condensers for the engines, and a modern coal and ash-handling installation. The feeders will be drawn through earthenware conduits.

AUTOMOBILES.

The Chicago Automobile Club has taken possession of its new quarters in Steinway Hall, where a suite of rooms has been furnished for the use of members. The club now has a membership of about 75.

The operators employed by the Illinois Electric Vehicle Transportation company went on strike on March 1st, asserting that the new percentage system of compensation would result in a reduction of their pay. The men asked $2 a day and the company offered 20 per cent. of the gross receipts.

The management of the automobile show to be held in the Chicago Coliseum the latter part of this month has been active, and a number of unique attractions are promised, among them being the largest steam truck ever built in this country, and an automobile fire engine, of which there are only a few in existence.

PUBLICATIONS.

The Commercialist is the title of a new publication from Scranton, Pa. It is issued by the Colliery Engineer company, the proprietor of the International Correspondence Schools.

The Olds Motor Works of Detroit, Mich., have issued a neat little catalogue devoted to their automobiles. Several illustrations of the Oldsmobile, the firm's gasoline runabout, depict the hard usage to which the vehicle can be submitted. A few pages are given up to the electric vehicles manufactured by the Olds firm.

An artistic catalogue illustrating the Clinton E. Woods automobiles has been recently issued by the manufacturers, Woods, Waring & Co. of Chicago. Large and clear illustrations of different styles of automobiles made by the firm are given, including a light stanhope, victoria stanhope, stanhope victoria, brougham cab and delivery wagon.

MISCELLANEOUS.

A 1,000-kilowatt Parsons steam turbo-generator at the Electrical Supply Works of Elberfeld, Germany, says London Engineering, has made the remarkable record of delivering an electrical horsepower-hour at the switchboard on 14.174 pounds of steam.

In an infringement suit brought by Addie F. Ide and others, executors of the late A. L. Ide, against the Trorlicht, Duncker & Renard Carpet company, J. F. Chuse and Richard Heap, in the Circuit Court of the United States for the Eastern Division of the Eastern Judicial District of Missouri, Judge Adams has handed down a decision, in which he holds that the engines manufactured by Messrs. Chuse and Heap do not infringe upon the patents of the complainants.

The war-tax-reduction bill, carrying with it a total reduction of slightly over $40,000,000, passed both the Senate and House of Representatives in Congress on February 28th. The bill repeals the tax on telephone and telegraph messages, the reduction from these two sources being officially estimated at $315,000 and $800,000, respectively. The provisions of the bill as agreed upon will take effect July 1st of this year. It is considered to be altogether likely that President McKinley will sign the bill.

A consular report has been received recently dealing with the use of coal dust as fuel in Germany. The method which has been most successful calls for a highly heated fire chamber to insure perfect combustion, and this is best obtained by the use of a flue boiler with the flues lined for about eight feet of their length with some fireproof material. It is stated that contact with the boiler walls impairs ignition. The lining offers the advantage of large heat-storing capacity, in addition to its ability to maintain a high furnace temperature, and thus produce smokeless combustion.

TRADE NEWS.

The Johnson and Seymour company of Utica, N. Y., will soon build a new factory for the manufacture of electrical supplies.

The Electric company of Warrenton, Mo., has been incorporated, with $6,000 capital stock, by F. E. Showgerdt, G. Hillemeyer and R. H. Kamper.

The W. G. Nagel Electric company of Toledo, Ohio, has been incorporated by W. G. Nagel, S. R. McLaren and R. B. Crane, with $50,000 capital stock.

The Bridgeport Brass company, 19 Murray street, New York city, calls attention on a card to the great strength of its Phono-electric wire, asserting that this wire has been found to be 41 to 47 per cent. stronger than hard-drawn copper wire.

The headquarters of the Northeastern sales department of the Standard Underground Cable company have been located in the Tremont building, Tremont and Beacon streets, Boston, Mass. A. B. Saurman is manager of this department, while Charles J. Marsh is general manager of the Eastern and Northeastern sales departments of the company.

George E. Linton & Co., Worcester, Mass., the well-known manufacturers of knife switches, have moved their office and factory from 35 Hermon street to 25 Hermon street, where they have secured larger and more commodious facilities for handling their rapidly increasing business. This firm's new catalogue fully illustrates and describes the various designs that they manufacture, and also gives a complete price-list on the switches manufactured by them.

The American Car and Foundry company of Detroit has let the contract for a new power house that is to run its new steel plant at the Peninsular branch, to Westinghouse, Church, Kerr & Co. The power house will have a capacity of 1,500 horsepower. Work will be commenced as soon as possible, as the plant must be in running order by June 1st. The car company desires to turn out 500 cars during that month. The contract includes the furnishing of motors and machinery complete.

It is reported from Newburyport, Mass., that representatives of New York capitalists have been making a canvass of the electric-railway-car manufacturing plants in New England with a view of securing control and consolidating the industry. With the proposed building of a large number of electric roads in New England the coming summer, the promoters look upon the great demand for cars as a prospect of big profits in this industry. It is said that a number of the companies have given options on their plants.

The many friends of P. B. Chaney, who, for several years, was traveling salesman of the Central Electric company of Chicago, will be interested in

the knowledge that he has organized the Columbus Battery and Specialty company of 25 West Scioto street, Columbus, Ohio, and that he is now traveling representative for the new concern. The company is making a specialty of the manufacture of small storage batteries of the sealed type, to be used for annunciators, gas engines, telephones, telegraphs, carriage lamps, etc. Repeated short-circuiting of these cells, even though they be heavily charged, seems to have no effect on them. Recently a small cell 3½ by 5 by 6 inches in size and weighing nine pounds was sort-circuited through an ammeter. No. 14 insulated wire was used to make the connections. The ammeter used was graduated up to 100 amperes, but this was not sufficient to indicate the amperage of the cell. The weatherproofing on the wire was melted and dropped off. Repeated short-circuitings brought the amperage down to the capacity of the ammeter. A voltmeter showed an average of 2.2 volts. This same cell had been short-circuited previously at least 100 times, and yet it showed no signs of disintegration or buckling of plates. The active material of the plates of the new cell is exceedingly hard and is dislodged from the grids only with difficulty. The following-named gentlemen are officers of the company: President, E. E. Bridgeman; vice-president, G. W. Frost; secretary, P. B. Chaney; treasurer, J. W. Frost; superintendent, Samuel Scott.

BUSINESS.

The Electric Appliance company, Chicago, reports large sales of its Eaco friction tape.

The American Bridge company has received a contract for the steelwork for an electric power plant to go to Ultimo, New South Wales, Australia.

Recent installations of the Ball Engine company of Erie, Pa., include two direct-connected, self-oiling engines, one of 150 horsepower and one of 100 horsepower, in the Pittsburg (Pa.) Bank for Savings building, and two 125-horsepower, direct-connected engines in the electric plant of the St. Vincent's Arch Abbey, Beatty Station, Pa.

The O. C. White company of Worcester, Mass., is adding a number of new styles of office, library, desk and draughting-room fixtures to its already well-known line of adjustable lamp fixtures. This company is continually making it a study to produce adjustable electric fixtures that shall secure the greatest possible convenience and efficiency of service from incandescent light. It manufactures fixtures adapted to all practical requirements from shop to library. The company says that its exhibit in the Electricity building at the coming Pan-American Exposition promises to be an interesting display.

Sales of motor-generators, motors, generators, Teaser equipments, etc., to the following-named corporations are reported by the Bullock Electric Manufacturing company of Cincinnati: Glasgow Evening News, Glasgow, Scotland; London Daily Express, London, England; Montreal Water and Power company, Montreal, Que.; Aberdeen Journal, Aberdeen, Scotland; Carnegie Steel company, Pittsburg, Pa.; Greuner & Co., Johnstown, Pa.; Brown & Sharp, Providence, R. I.; Wier Frog company, Cincinnati, Ohio; Pullman company, Pullman, Ill.; Mosler Safe company, Hamilton, Ohio; Susquehanna Valley Electric company, Sidney, N. Y.; Central Lard company, New York city, N. Y.; Buffalo Evening News, Buffalo, N. Y.

Charles H. Besly & Co. of Chicago have added several new salesmen to their city department, and are now in a position to handle the increased business promptly and carefully. They are just introducing a new solid oil cup called the Badger, which has an octagonal, cast-iron cap, with round thread and is said to be very desirable for use on agricultural machinery. The firm's tap and die department at the factory in Beloit is busy with orders. Among others, recent shipments have been made to Ohio, Massachusetts and New York, and also to the Rock Island arsenal at Rock Island, Ill.

The Sprague Electric company reports an increase of sales for February over the corresponding month last year. Among recent orders are five motors for the Cooke Locomotive and Machine company, Paterson, N. J.; 35 motors for the Central Lard company, New York; one 400-kilowatt generator, one 125-kilowatt generator, one 100-horsepower motor and six 80-horsepower motors, in addition to a number of small motors for the Wellston Portland Cement company; two generators and 25 motors for the Dunmore (Pa.) Iron and Steel company; one generator and two motors for the National Distilling company, Milwaukee; one 125-kilowatt generator for the Big Muddy Coal and Iron company, Murphysboro, Ill.; one 100-kilowatt generator for the Keystone Leather company, Camden, N. J.; 17 motors for the Norfolk navy yard, and two 300-kilowatt, 500-volt, street-railway generators for the Central States Construction company, Chicago.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued February 26, 1901.

668,622. Secondary Battery. William R. Bowker, Waltham, Mass. Application filed February 15, 1900.

The subject of the patent is an electrode which consists of a receptacle in the form of a porous plate, having a recessed face filled with the active material, and a conducting plate having its marginal edges bent inwardly beyond the active material, and enclosing the edges of the porous plate to prevent the escape of the active material and form vertical and horizontal conducting surfaces.

568,630. Electric-lamp Protector. Edward Eckl, Milwaukee, Wis. Application filed March 31, 1900.

A recessed backboard carries the socket. An annular open mantel surrounds the point of union between the lamp and socket, but is free from contact with either.

668,653. Telephone Signaling Device. William O. Meissner, Chicago, Ill., assignor to Peter C. Burns, Chicago, Ill. Application filed July 5, 1898.

A circuit-varying device is in circuit with the primary coil of the induction coil of the system. The circuit-varying device is moved so as to vary the current in the primary coil, thus inducing a current in the secondary coil which actuates the signaling device. A shunt cuts the receiver out of circuit while the circuit-varying device is being operated. Insulated contacts on a movable arm successively engage an opposed contact as the arm is moved.

668,661. Electric Bathing Apparatus. Oscar Schneider, New York, N. Y. Application filed July 12, 1900.

A bath tub is described, comprising a main compartment adapted to receive the bather, and containing metallic sheets interposed between non-conducting plates and constituting two separate electrodes, over one of which the bather lies, while the other forms a covering. Between the electrodes an electric current is generated, and heating devices are provided whereby heat is introduced to the bath tub.

668,662. Electric Switch. John H. Spangler, Pittsburg, Pa. Application filed February 21, 1900.

A switch-throwing mechanism is operated by a solenoid when energized. A pneumatic device is provided to cushion the movement of the core of the solenoid.

668,664. Storage-battery System for Signaling Circuits. Nathan H. Suren, Needham, Mass. Application filed June 19, 1899.

A working circuit and a charging circuit are connected to a throw-over switch so constructed that the batteries may be cut in and out of the working circuit without interrupting the conductivity of the latter.

668,666. Junction Box for Electric-lighting Systems. Montgomery Waddell, New York, N. Y., assignor to the Electric Axle Light and Power company, New York, N. Y. Application filed January 31, 1900.

The casing contains outlying terminals and a central oscillatory switch plate having operating handles. A stop limits the throw of the plate in opposite directions. The closing of the box cover is prevented until after the switch has been moved to one limit of its throw.

668,667. Charging System for Secondary Batteries. Montgomery Waddell, New York, N. Y., assignor to the Electric Axle Light and Power company, New York, N. Y. Application filed February 15, 1900.

A reversible engine or motor drives the dynamo. The reversing gear of the engine actuates means for preventing the dynamo from building up during reversal, the device consisting of a circuit-breaker interposed in a circuit of the dynamo to break the circuit upon the reversing movement of the engine or motor. (See cut on next page.)

668,689. Electric Attachment for Railway Scales. Matthew H. Reed, Pittsburg, Pa. Application filed March 30, 1900.

An electric circuit is connected with the rails on the scale and to the rails on the track outside the scale. An indicator in the circuit shows when the car is not in proper position to be weighed.

668,690. Electric Accumulator. Paul F. Ribbe, Charlottenburg, Germany. Application filed April 30, 1900.

A folded plate is used, containing slots, and strips threaded through the slots hold the folds of the plate separated.

668,702. Telephone Transmitter. David H. Wilson, Chicago, Ill., assignor to Jay Morton, Chicago, Ill. Application filed April 29, 1899.

The carbon holder is formed with an opening of greater depth at the center than at the edges, and the diaphragm is mounted in proximity thereto, with a guard between the carbon in the holder and the diaphram. The guard is provided with a central opening, through which the carbon is exposed so as to make contact with the diaphragm, this opening being beveled from the face inwardly so as to vary in cross-section and being located opposite the deep part of the carbon holder.

668,708. Electric Cigar Lighter. Charles A. Bernhardt, Detroit, Mich. Application filed January 15, 1900.

A lamp has a wick tube cut away on one side to expose a portion of the side of the wick and forming the fixed terminal of an electric circuit. A movable electrode forms the other terminal and projects into proximity to the exposed portion of the wick so as to light the latter by causing a spark on the breaking of the circuit.

668,710. Electric Railway. George H. Davis, New York, N. Y., assignor to Frank R. Ford, George W. Bacon and George H. Davis, New York, N. Y. Application filed September 15, 1900.

Several hangers or brackets carried on insulated supports are arranged parallel with the way. Each bracket has a lower and an upper member. A working conductor is secured to the upper members of the hangers or brackets and maintained in an inverted position, so that a contact shoe will make underneath contact with it. An insulating cap covers the bottom member of each bracket.

668,711. Electric Railway. George H. Davis, New York, N. Y., assignor to Frank R. Ford, George W. Bacon and George H. Davis, New York, N. Y. Application filed September 15, 1900.

Insulating pedestals supported parallel with the way carry a working conductor. Brackets supported parallel with the way adjacent to the pedestals support a continuous housing or casing arranged so as to enclose the working conductor. A supplemental housing carried on brackets on the other side of the working conductor forms between its upper edge and the casing a slot or conduit, and a contact device working in the slot makes contact with the upper surface of the working conductor.

668,712. Electric Railway. George H. Davis, New York, N. Y., assignor to Frank R. Ford, George W. Bacon and George H. Davis, New York, N. Y. Application filed September 15, 1900.

The contact shoe is in the form of a short section of a T-rail placed on its side, and is carried by an arm which is mounted on a piston working against a spring to keep the shoe in contact with the working conductor.

668,761. Apparatus for Connecting Storage Batteries with Charging Lines. Nathan H. Suren, Needham, Mass. Application filed June 29, 1899.

A terminal is connected with one pole of one of the batteries, and another terminal is connected with the opposite pole of another battery. Switch arms arranged in pairs are placed in connection with the remaining battery terminals, and have contacts provided for them. A wire connects one of the switch arms of each pair with one of the contacts of the other switch arm of the pair. A wire leads from one of the contacts of each switch arm to a corresponding number of terminals, and a switch connects all of the terminals with the charging circuit.

668,779. Apparatus for Controlling Connections of Storage Batteries with Charging Circuits. Nathan H. Suren, Needham, Mass. Application filed June 29, 1899.

The connections are controlled by a number of magnets and switches for connecting their coils with the charging circuit, in series or in multiple series with themselves, or in parallel with each other.

668,781. Electric-traction System. Silvanus P. Thompson and Miles Walker, London, England. Application filed October 22, 1897.

In a surface-contact, electric-traction system, a safety feeding switch is placed underground, having for its operating part a moving plunger or other piece of iron from which a magnetic field radiates into the air space above the roadway. The magnetizing coil is placed around the plunger and the plunger occupies that part of the magnetic field in which the resultant magnetic pull, whatever current may be passing in the magnetizing coil or coils, is less than the resultant of all the forces which tend to keep the switch open. (See cut, next page.)

668,791. Process of Electrical Separation of Conductors from Non-conductors. Lucian I. Blake, Lawrence, and Lawrence N. Morscher, Neodesha, Kan. Application filed March 16, 1899.

The process described consists in electrically charging the particles by submitting them to an electrostatic field of one potential, and then to a field of opposite potential, whereby the conducting and quickly electrified particles are repelled from the non-conducting particles of slow electrification.

668,792. Mechanism for Separation of Conductors from Non-conductors. Lucien I. Blake, Lawrence, and Lawrence N. Morscher, Neodesha, Kan. Original application filed March 16, 1899. Divided and this application filed August 7, 1900.

An electric charge is imparted to the mass of material on a conveying surface. A repelling surface is electrically charged at a different potential from that of the mass and arranged to receive the charged mass. Opposite the repelling surface are placed inclined shutters electrically charged at an opposite potential to that of the repelling surface.

668,798. Electric Switch. James Jones and James Jones, Jr., Brooklyn, N. Y. Application filed February 20, 1899.

A disk and a ratchet-and-pawl device are used in connection with a pivoted switch bar. A barrel supports a flexible hanging device which actuates it in one direction, and a spring returns it and the hanging device to their normal position. There is a connection from the disk and the ratchet-and-pawl device to the pivoted switch bar.

668,819. Railway Signaling Apparatus. Washington Hume, New Broad street, County of London, England. Application filed October 6, 1898.

Pairs of insulated contacts are arranged on the track with corresponding indicating devices located at a signal box or station. Electrical connections are made between each of the pairs of contacts, each of the indicating devices and a source of electricity. Audible signaling devices located at the signal box or station, and also in proximity to the pairs of contacts, operate each time a circuit is completed through any pair of contacts. A circuit-closing device carried by the vehicle whose approach is to be notified makes contact with a prearranged pair of the contacts.

668,838. Voltaic Battery. Henri de Rufz de Lavison, Paris, France, assignor to Ste. D'Etude des Piles Electriques, Paris, France. Application filed July 19, 1899.

The positive electrodes are formed of zinc plates covered with parchment paper and enclosed in cases of non-conducting material. The negative copper electrodes are hollow and have porous walls which contain an internal atmosphere of hot air in intimate contact with the electrolyte and capable of absorbing the hydrogen which is disengaged and tends to cause polarization.

668,842. Apparatus for Electrolytically Extracting and Depositing Gold and Silver from Their Ores. Albion M. Rouse, Denver, Colo., assignor of one-half to William G. Shedd and Frank Brooks, Denver, Colo. Application filed May 28, 1900.

The ore to be treated is placed in tubs each containing anodes and cathodes. An agitation tube has communication with the tubs at their upper and lower ends, and an agitator is located in the tube.

668,862. Mold Box or Form for Conduit Joints. Joseph O. Therien and Albert E. Gregory, Minneapolis, Minn. Application filed October 11, 1900.

A plate rests upon the bottom of the trench and overlaps the abutting ends of the sections. Flanges provided on

the plate bear on the walls of the sections, whereby the plate will be spaced therefrom. A receptacle provided for the cement forms the sides of the joint.

668,868. Alternating-current Series Arc Lamp. Malcolm H. Baker, New York, N. Y., assignor to the Manhattan General Construction company of New York. Application filed September 5, 1899. Renewed October 4, 1900.

A closed shunt across the arc includes a magnetic coil which operates a moving armature. A circuit-closer in a normally open shunt across the arc closes the shunt when the coil is energized, the moving magnet being independent of the circuit-closer. (See cut)

668,869. Relay. Sidney G. Brown, Bournemouth, England. Application filed November 14, 1899.

Separate initial excitation is provided for the field magnets of a dynamo. A relay circuit includes the armature, an instrument or instruments, and means for controlling the conditions of the magnetic field in such manner that induced currents pass from the armature to the relay instruments only at such times as signaling currents are received from the line.

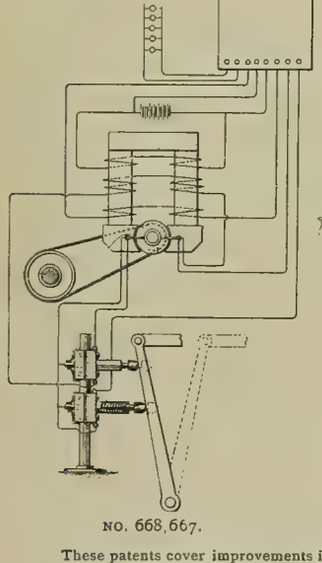
668,886. Electric Arc Lamp. Peter H. F. Spies, Mount Vernon, N. Y., assignor to himself and Jacob Norden, Mount Vernon, N. Y. Application filed June 5, 1900.

The mechanism includes a carbon holder and a reciprocating tube concentric therewith. A spring holds the tube against gravitation, and a maguet operates in opposition to the tube. An electrical connection is made between the carbon clutch and the tube, the spring being independent of the clutch and acting only upon the tube.

668,887. Electric Switch. Peter H. F. Spies, Mount Vernon, N. Y., assignor of one-half to Jacob Norden, Mount Vernon, N. Y. Application filed August 2, 1900.

A socket is arranged to receive a contact plunger in a series circuit. A local circuit and a cut-in device are so arranged that when the plunger and socket move out of engagement and the local circuit is broken the cut-in device maintains the series circuit unbroken. The circuits have flexible, compressible contacts, each formed of several interlocked helices.

668,889 to 668,894, inclusive. Telautograph. George S. Tiffany, formerly of Evanston, Ill., later of Brooklyn, N. Y., assignor to the Gray National Telautograph company, New York, N. Y. Applications filed October 19-December 20, 1900.



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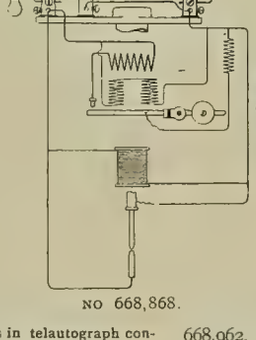

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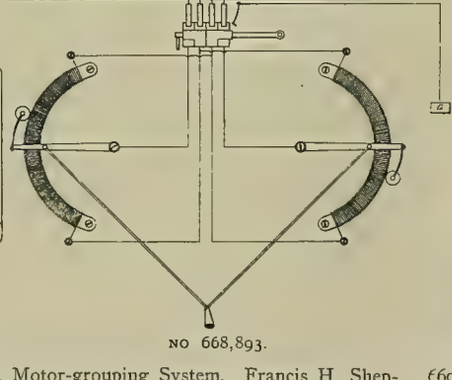


No 668,893.

These patents cover improvements in telautograph construction by which the secondary of an induction coil is connected to the line, and means are controlled by the transmitting tracer for closing the circuit through the primary winding of the induction coil and causing vibratory currents to traverse the primary winding and the main-line circuit to effect the movement of the pen in one of these directions. The patents also cover an improved inking device. (See cut.)

668,895. Method of Telautographic Transmission. George S. Tiffany, Brooklyn, N. Y., assignor to the Gray National Telautograph company, New York, N. Y. Application filed December 21, 1900.

The method of transmission by means of the apparatus described in the previous patents forms the subject of this patent, and consists in shunting into the main-line circuit, from an independent circuit including a source of electric energy, currents varying in strength in accordance with the movements of the transmitting tracer, controlling the movements of the receiving pen by such currents, and vibrating the moving parts connected with the receiving pen, throughout the time the transmitting and receiving instruments are in circuit, to reduce friction.

668,903. Electric Bond for Railway Rails. Harold P. Brown, Montclair, N. J. Application filed April 7, 1900.

A metallic plate bears against the sides of the adjacent conductors, leaving them free to move relatively to the bond. The bond is pressed against the conductors to maintain the contact, and an adhering metallic lubricant is spread on the contact surfaces.

668,904. Incandescent Electric Lamp. Charles A. Chase, Chicago, Ill., assignor to General Incandescent Lamp company, Cleveland, Ohio. Application filed December 8, 1900.

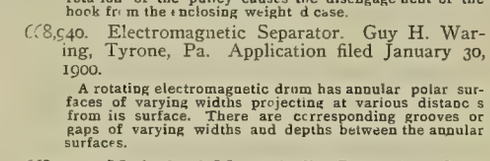
There is a relatively small neck-like portion leading from the connection part to the bulb, and an outwardly bulging annulus formed in this neck-like portion between the connection part and the bulb and entirely removed from the connection part, the annulus being connected in both directions with the glass of the neck and bulb by gently curving surfaces.

668,905. Automatic Circuit-closer for Arc-lamp Circuits. George R. Davison, Newark, N. J., assignor to Manhattan General Construction company, Newark, N. J. Application filed July 24, 1900.

A reversing switch arm co-operates in one of its positions with the terminals of a local lamp-circuit, and in the reverse position with the terminals of a cut-out for the lamp. A spring, when unresisted, locks the switch-arm in the second-described position, and the lamp operates by its weight to overcome the spring and reverse the switch.

668,909. Electric Switch. Christopher J. Doran, Jersey City, N. J. Application filed September 11, 1900.

A wheel is mounted between wheel supports carried on a base support and is composed of separate sectors, each of which is provided with a projecting tooth, the alternate sectors being composed of insulating material. A brush connected with the base support bears on the side of the wheel. Line wires are connected with the brush and with one of the wheel supports. A tubular button is mounted on a post, secured at the rear of the wheel. A spring inside of the button rests upon the post to hold the button normally in a raised position, and a spring-operated dog mounted upon one side of the button adjacent to the wheel rests upon the sector below it.



No 668,781

668,931. Trolley Catcher. Francis W. Powers and Martin L. Snyder, West Lafayette, Ind. Application filed January 8, 1900.

A swinging hook or detent is suspended in the upper portion of an elongated vertical enclosing case. A hollow weighted case is provided with means for engaging the detent by means of which it may be suspended in the elongated case and contains a pulley. A spring is connected to the pulley and held under tension. The rapid rotation of the pulley causes the disengagement of the hook from the enclosing weighted case.

668,940. Electromagnetic Separator. Guy H. Waring, Tyrone, Pa. Application filed January 30, 1900.

A rotating electromagnetic drum has annular polar surfaces of varying widths projecting at various distances from its surface. There are corresponding grooves or gaps of varying widths and depths between the annular surfaces.

668,941. Method of Magnetically Separating Ores. Guy H. Waring, Tyrone, Pa. Application filed April 21, 1900.

The mixture is introduced into a magnetic field, having mechanically graduated spaces of equal magnetic potentials, between surfaces of alternate polarity, within which the particles may freely arrange, assort and move themselves in the line of magnetic flow according to the direction of their longer diameter.

668,962. Motor-grouping System. Francis H. Shepard, New York, N. Y., assignor to the Sprague Electric company of New Jersey. Application filed January 21, 1901.

Means for operating a motor-grouping switch are controlled by the motor circuit and by a governing circuit, and the motor-grouping switch is locked by a device controlled by the motor circuit. (See cut.)

668,967. Selective Signaling Apparatus. John A. Barrett, Summit, N. J., assignor to the American Telephone and Telegraph company of New York. Application filed September 20, 1900.

A polarized actuating electromagnet is fitted with an oscillatory armature which actuates a bell hammer to strike a gong. A neutral retaining electromagnet and an armature therefor are associated with the bell-hammer rod. The two electromagnets have windings and resistance of like magnitudes, and the bell mechanism is responsive to an alternating electrical current exciting the polarized magnet only, but irresponsive to a similar alternating current exciting both magnets, or the neutral magnet alone.

668,978. Controlling Device for Electric Motors. Adolph G. Carlson, Chicago, Ill. Application filed May 19, 1899.

The circuit-varying device comprises a coiled conductor divided into three or more sections. A core for the conductor is made up of a series of pieces of magnetic material separated by pieces of non-magnetic material, the core and coil being movable with relation to each other. Conductors lead to and from the three sections of the coil, whereby the current may be successively admitted into the sections in a predetermined manner, so as to produce a progressive step-by-step relative movement of the core and coil. Contacts are associated either with the coil or core so that the relative movement of the parts varies an electric current.

668,979. Controlling Device for Electric Motors. Adolph G. Carlson, Chicago, Ill. Application filed May 19, 1899.

Two electromagnetic devices have movable parts adapted to be moved when the devices are energized. An opposed part of magnetic material movably mounted in proximity to the electromagnetic devices is connected with a circuit-varying device. The movable parts are adapted to engage the opposed part and to attract it magnetically when the electromagnetic devices are energized. The electromagnetic devices are alternately energized so as to produce a movement of the opposed part.

668,987. Electric Attachment for Elevators. David B. Fleck, Portland, Ore. Application filed February 2, 1900.

A plate and rods are secured to the cage. A contact frame has insulated openings through which shaft wires extend and is slidably mounted on the rods. Tension springs are located on the rods between the cage and the contact frame, and contact blocks have wire-engaging grooves and are located in the contact frame.

669,015. Electric Arc Lamp. Gustav Rasmus, New York, N. Y. Application filed November 30, 1900.

A tube extended downward from the solenoid carries a plate on its lower end, having an opening through which the carbon may move. An inner tube is attached to the core. Link connections are made between opposite carbon-clamping blocks and a part on the lower end of the inner tube, the blocks engaging with the plate and moving the blocks to open position.

669,051. Demagnetizer. Oakley S. Walker, Worcester, Mass. Application filed July 31, 1899.

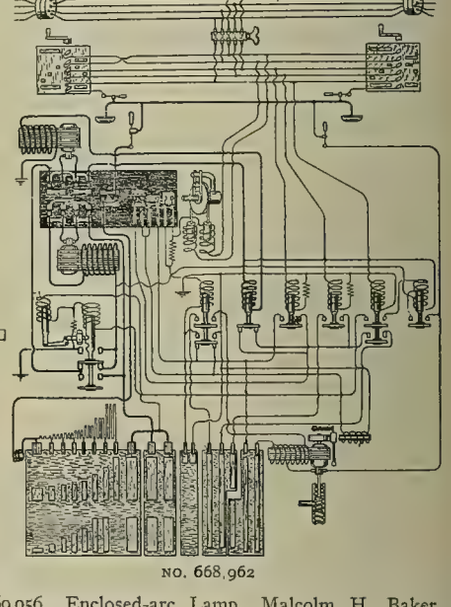
Two magnetic conductors are arranged to be magnetically united by the article to be demagnetized and a rotating electromagnet brings its poles into proximity with the conductors, whereby the polarity of the conductors is changed.

669,052. Attachment for Static Electrical Machines. Gustavus Werber, Washington, D. C. Application filed April 24, 1900.

A section of non-conducting material is attached to the discharge rod, with means for electrically connecting the pole with an electrode and the ball with a second electrode.

669,055. Electric Arc Lamp. Malcolm H. Baker, New York, N. Y., assignor to the Manhattan General Construction company of New York. Application filed September 5, 1899.

The carbon carrier is surrounded by a tube. A counterbalance for the carrier is provided external to the tube, and a pivoted arm or link joins the weight and carbon carrier.



No. 668,962

669,056. Enclosed-arc Lamp. Malcolm H. Baker, New York, N. Y., assignor to the Manhattan General Construction company, New York, N. Y. Application filed March 12, 1900.

An electromagnet is in shunt with the arc for moving the lower carbon upward in opposition to gravity. An arm moves with the lower carbon, and a rod located between this arm and the clutch for the upper carbon is operated by the arm to release the clutch when the lower carbon has risen beyond a predetermined position.

669,057. Electric Arc Lamp. Malcolm H. Baker, New York, N. Y., assignor to the Manhattan General Construction company, New York, N. Y. Application filed March 12, 1900.

A shunt magnet located above the carbons has a core connected to the lower carbon by a bent rod or lever. A trip for the clutch holding the upper carbon is connected with the bent rod or lever in line with a portion of the clutch.

669,058. Electric Amalgamator. Louis H. Barricks, San Francisco, Cal., assignor of one-half to Jesse G. Tunnicliffe, San Francisco, Cal. Application filed August 6, 1900.

A receptacle has a vertical porous partition separating two compartments, one of the compartments containing mercury and the other a saline solution. A sluice box located above the receptacle has an electrical conducting bottom plate, one end of which dips into the mercury. There is an electrical conductor for the other compartment and the sluice is adjustably supported by journal pins and boxes.

669,064. Secondary Battery. Leslie W. Collins, Chicago, Ill., assignor to Benjamin W. McCausland, Chicago, Ill. Application filed July 7, 1899. Renewed January 28, 1901.

A secondary-battery grid is described, comprising a two-part outer rim or frame with spacing notches or indentations. The ends of transversely extended confining strips engage with the notches in the frame.

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Alternating-current Lighting in Blue Island, Ill.

A modern type of alternating-current lighting plant, in which series arc lamps and series incandescent lamps of 50 candlepower for street lighting, and ordinary multiple incandescent lamps of 16 and eight candlepower for store and residence lighting are operated from one machine, has recently been placed in operation in the village of Blue Island, Ill. This town, which is located just outside the limits of Chicago and about 16 miles from the center of the city, covers an area of about two square miles and has 6,500 inhabitants. For several years the village has operated a lighting plant running alternating-current incandescent lighting for streets as well as commercial lighting off of two 1,000-light National alternators. The arc lighting was taken care of by two old series arc generators. As this divided system did not prove economical it was decided to install a single new unit which would be able to take care of the arc lighting entirely and for the greater portion of the day would carry the entire load.

Accordingly, the new machine shown in the foreground of Fig. 1, which gives a view of the engine room, was installed. The generator is a 120-kilowatt inductor alternator, manufactured by the Warren Electric Manufacturing company of Sandusky, Ohio. It is a 16,000-alternation, 1,100-volt machine, and is capable of supplying current for approximately 2,500 incandescent lamps. It has no moving wire, commutators or collector rings. The generator is belt-driven at 800 revolutions by a new-type, simple, four-ported, high-economy Ideal engine, built by A. L. Ide & Sons of Springfield, Ill. The engine has a 17 by 16-inch cylinder and operates at 225 revolutions a minute on 80 pounds of steam. A noticeable feature about both the engine and dynamo is that on neither machine is there an oil-cup used, self-oiling ring bearings being used throughout. The alternator is excited by an ordinary belt-driven Warren multipolar exciter. The engine and generator are placed on nine-foot concrete foundations.

The current from the alternator is conducted to the distributing switchboard, shown in Fig. 2, the residence and commercial lighting being supplied from the main portion of the board and the street lighting from the panel at the left. From the street panel the 1,100-volt current is carried to two 15-kilowatt step-up transformers, which raise the voltage from 1,100 to 2,000 volts. The 2,000-volt current is sent through two 25-light regulators of the Manhattan type, and on each circuit 17 arcs and 40 50-candlepower incandescent lamps are operated. The current is kept constant on these two series circuits by adding or taking away weights of the adjusting parts of the regulators, the amperemeter being placed in series with the lamps to indicate the amount of current used. Two panels of an old switchboard were yet to be placed on the switchboard when the photograph was taken.

The commercial incandescent lighting is operated at 1,100 volts primary, and by the use of transformers the current is stepped down to the secondary voltage of 110 volts, the transformers being placed as usual at points of distribution. The arc lamps are rated at 1,600 candlepower and are of the enclosed 100-hour long-burning Manhattan type, trimming being only necessary once a week. The street incandescent lamps are of the series Bernstein type.

The arc and the incandescent lights in this instance are each operated on 6.6-ampere circuits. Some of the circuits are two miles long and others five. The regulators regulate the arc current from 6.4 amperes to 6.8 without any attention. The two old-style series arc machines and one of the 1,000-light alternators were replaced by the new dynamo, and the service has been found satisfactory. The same arc lights as used on the series direct-current service are used for the new lighting system, so that no material changes were necessary.

The lighting plant occupies the greater portion of the white brick building shown to the right of Fig. 3, which gives a view of the municipal buildings of the village. The waterworks are located in the same building as the lighting plant. The water plant consists of two pumps, working on the Poplé air-lift system, which raise water from two 1,375-foot wells to a reservoir on the ground level, from which it is forced to a large tank built up on a stone foundation 50 feet above the ground level. From this tank, which has a capacity of 80,000 gallons, water is supplied by natural gravity flow. The capacity of the pumps in the station is 210,000 gallons a day. Steam for the generator engines and the pumps is supplied by four 100-horse-power fire-tubular boilers connected to a 100-foot steel stack. The additions to the lighting plant were installed by J. Holt Gates & Co. of Chicago, under direction of Mr. O. W. Bourke, the president of the village of Blue Island.

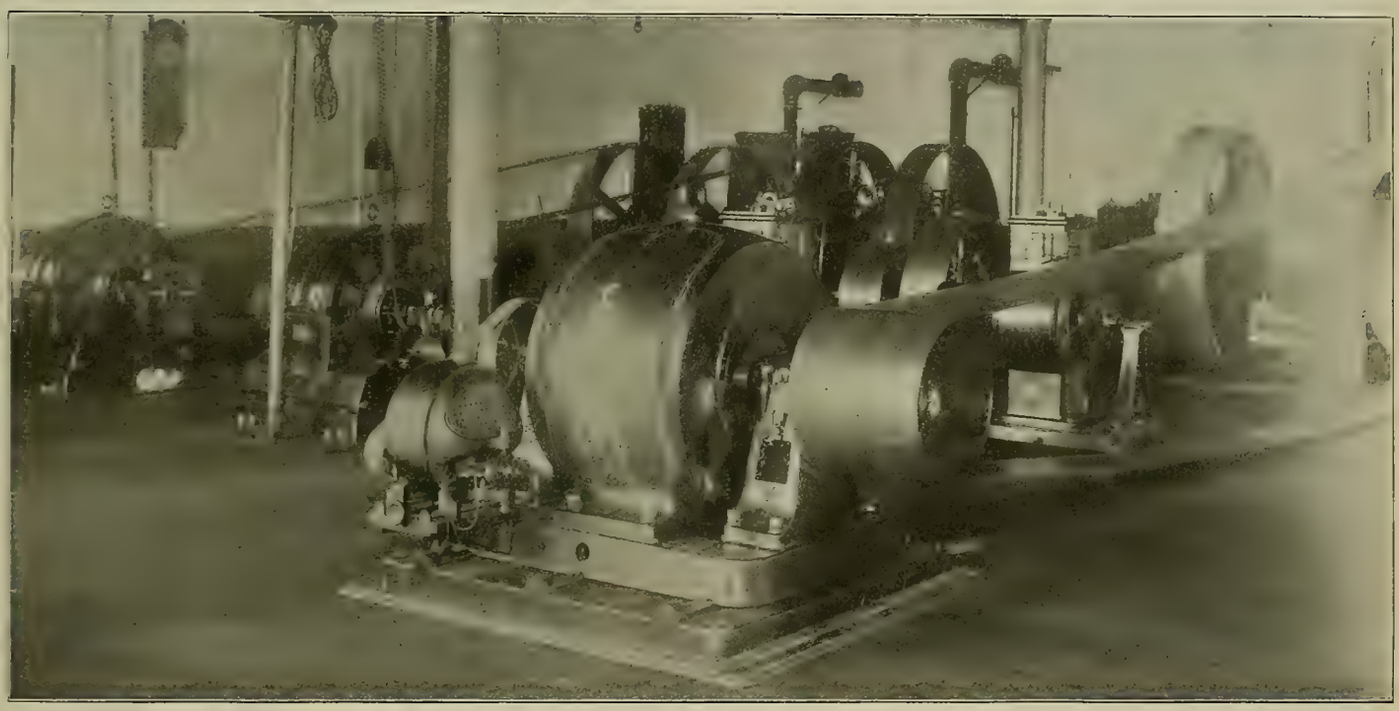


FIG. 1. ALTERNATING-CURRENT LIGHTING IN BLUE ISLAND, ILL.—ENGINE ROOM.

I. B. Perrine of Shoshone, Idaho, is backing a project to establish an electric-light plant, to cost $30,000. The plant will be located at Blue Lakes, and is designed to furnish electric light and heat for Shoshone.

The National Standardizing Bureau Established.

One of the important acts of the Fifty-sixth Congress during the last days of its second session was the passage of a bill establishing the National Standardizing Bureau. The bill states explicitly the functions of the bureau, and makes appropriations for the salaries of its officers and employes, for the purchase of ground for a building site, for the building and necessary furnishings, instruments, laboratory equipment, etc.

The bill received the unanimous indorsement of the members of the House committee on coinage, weights and measures, and of the members of the Senate committee on commerce. The proposed bureau was recognized by both the House and Senate as a public necessity, and the bill was passed with little, if any, debate, and has received the president's signature. The bill provides that this bureau shall have the custody of all standards and shall have charge of the comparison of the secondary standards used in scientific investigations, engineering, manufacturing, commerce and educational institutions with the standards adopted or recognized by the government. To this bureau is also given the power to construct, when necessary, certain standards, their multiples and subdivisions.

The new bureau will have charge of the testing and calibration of standard measuring apparatus and the solution of problems which arise in connection with standards. The determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere, may be made by this bureau. The right of inquiry is, of course, accorded to the United States government and to any state or municipal government within the United States and, in addition, to any scientific society, educational institution, firm, corporation or individual within the United States engaged in manufacturing or other pursuits requiring the use of standards or standard measuring instruments.

The director of the bureau is appointed by the president. His annual report of the business management of the bureau is to be made to the secretary of the treasury. Power is given the director to issue, when necessary, bulletins for public distribution, containing information of value to the public.

The following appropriations were made to cover the requirements of this bill: Salaries, $34,900; fireproof laboratory and office buildings, $250,000; building site, $25,000; equipment of laboratory, $25,000.

This exceedingly meritorious measure was urgently demanded. The respective committees of the House and Senate were fairly deluged by indorsements most commendatory in character, coming from the various departments and bureaus of the United States government, governors of states, mayors of cities, scientific bodies, scientific men, men engaged in educational pursuits, railroad corporations, iron and steel industries, manufacturers of electrical machinery and appliances, and industrial associations. These indorsements were not perfunctory, but were characterized by a remarkable zeal and earnestness, indicating clearly and strongly the desires of the people making them in this connection. To workers in the electrical field the bureau will be of great benefit. The need of reliable and authoritative electrical standards of all kinds has been felt in every physical and electrical laboratory in the country, whether maintained for commercial or educational purposes, and was emphasized by the statements made before the sub-committee of the Senate committee on commerce by Carl Hering, Professor Henry A. Rowland and John W. Lieb, of which notice was made in a recent issue of the Western Electrician.

Professor Samuel Wesley Stratton, who has been appointed director of the National Standardizing Bureau, has been for some months prominently connected with the Bureau of Weights and Measures, and it is largely due to his personal efforts that the new bureau has been established.

Professor Stratton was born at Litchfield, Ill., in 1862, and was graduated from the University of Illinois at Champaign in 1884. He became professor of physics and electrical engineering at that institution, but resigned in 1892, when he came to the University of Chicago as a member of the faculty of the department of physics. Last fall he went to Washington in connection with the Bureau of Weights and Measures. Under the direction of Secretary Gage Professor Stratton prepared the bill authorizing the National Standardizing Bureau. Professor Stratton was for a number of years actively connected in an official capacity with the Illinois Naval Militia, and during the Spanish-American war held a commission as lieutenant in the United States navy, serving on the Texas during the greater portion of the time.

A. B. Chandler on Government Telegraphs.

At a recent meeting of the Industrial Commission in Washington, A. B. Chandler, president of the Postal Telegraph-cable company, spoke of the present state of the telegraph in this country. The number of messages transmitted last year by the Postal company was 16,528,444. Mr. Chandler said that for about 12 years there has been an agreement between his company and the Western Union, under which both have practically the same scale of rates. The companies are continually working to establish uniformity in this respect by extending the same rate over as much territory as can be done without impairing the service. Mr. Chandler is reported to have expressed the opinion that the telegraph systems of the country could be operated satisfactorily by the government, and that as the latter would not be under the necessity of paying dividends, the service could probably be a little cheaper without lowering the present standard of efficiency. He thought that the best way to secure the valuation of the telegraph property was to adopt throughout the Union the method employed in Connecticut, where a single assessment is made, which is paid to the state authorities, who divided it among the several municipalities.

Proposed Combination Conduit.

One of the many schemes for the betterment of electrical conditions in Chicago originating in the fertile brain of the city electrician, Edward B. Ellicott, and referred to briefly in the annual report of the Department of Electricity, summarized elsewhere in this issue, is a proposal that the electrical companies of the city unite with the city itself in the joint construction and maintenance of conduits for buried electrical conductors.

The removal of poles and overhead wires on city streets is certainly a desirable improvement, but the cost of placing the necessary conduits and cables is prohibitive in many instances on account of the small revenue derived from the business done as compared with the cost of placing the wires underground. That the first cost of the underground work may be reduced to the least amount, a combination conduit system has been devised, embracing the necessary ducts for all the corporations maintaining wires and poles on the streets where it is considered advisable to remove them. It is believed that the cost of the combination system will be less than one-half the total cost to the corporations which have been installing conduits for their individual use. The combination system would take less space in the streets, require a less number of objectionable manhole covers and simplify the general construction now in use. It is to secure these results that the combination system has been devised, and the plans as drawn apparently eliminate all reasonable objections heretofore raised to such a system. The plans permit each company to have as many ducts as it may now or hereafter require; the cables of each company will terminate in a manhole to which no one else will have access; the wires of the company will not come in contact with those of any other company, and there will not be any chance of interference to the respective services. The cost of construction will be reduced to such an extent that more work can be done each year, and in districts where the cost of individual conduit systems would be prohibitive. The work for all corporations would be executed at the same time, and vexatious delays to street paving be avoided.

An ordinance was prepared requiring that hereafter all streets to be permanently improved should be (before paving) provided with such conduits as may be at present or hereafter required by any of the existing companies. It is intended that due notice shall be given to the different companies having authority to install conduits in the streets, so that they may provide themselves with the necessary space required, as there will be no further permits issued for the opening of streets during the life of the guarantee on the pavement. An equitable division of the cost of constructing the combination system can be arrived at by charging to each company such part of the total cost as would equal the space the company desired to occupy and reserve for future use. It is not only possible, but entirely practicable, for a company to anticipate such space as might be required for reasonable future extensions of business on any particular street where such a combination system should be installed.

The combination system will admit of the adoption of suitable means of ventilating the manholes and will, it is hoped, effectively prevent the danger of explosions. One company cannot afford to maintain a mechanical ventilating system, which seems to be necessary, while a division of expense would bring the cost within reasonable limits.

The construction of the conduit is shown by the accompanying drawings, the plan shown providing for the use of three companies, although it may be varied to accommodate as many more as necessary. The conduits are to be laid in one trench, each company having a layer of conduits, consisting of as many ducts as it may require. The ducts of company No. 1 are placed on the bottom and terminate

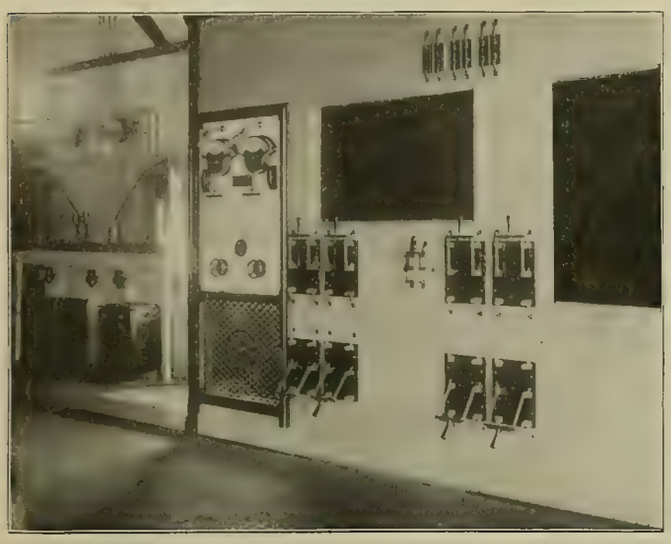
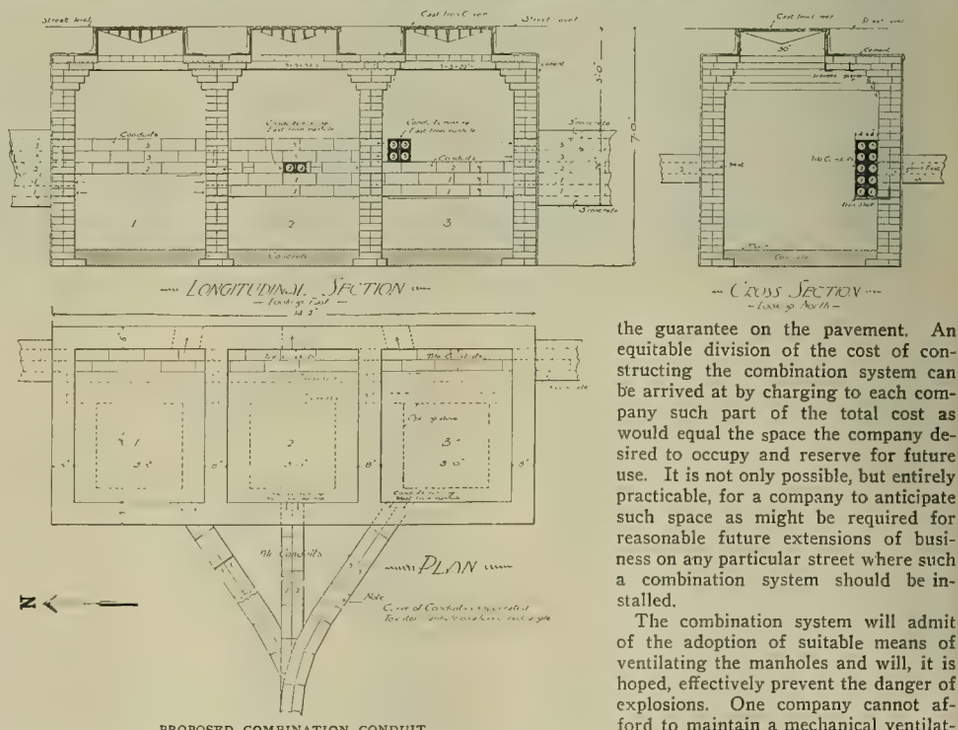


Fig. 2. Switchboard, Transformers and Regulators.

Fig. 3 Power Station and Other Village Buildings.

ALTERNATING-CURRENT LIGHTING IN BLUE ISLAND, ILL.



PROPOSED COMBINATION CONDUIT.

in manhole No. 1. The conduits of the other two companies pass through one side of this manhole, and the ducts of company No. 2 terminate in manhole No. 2, through which the ducts of No. 1 and No. 3 both run. The ducts of company No. 3 terminate in manhole No. 3, through which the ducts of company No. 1 and No. 2 run. It will be seen that the conduits terminate in each of the manholes at different levels, but on the same level in all the manholes which the company may install.

For the purpose of making lateral connections or leads at right angles of the main conduits, it will be necessary, in order to maintain a uniform construction, to make a slight bend in the conduits of company No. 1 and No. 3, in order to maintain their uniform level and continue the main run in one trench. The curve necessary in these conduits is not sufficient to in any way interfere with the drawing in of the cables, as they will only be required to spread 2½ feet, as shown in the lower figure. The cross-sectional drawing shows the end section of the conduit system which is designed for 10 ducts.

The form of the ordinance covering this class of construction is not all that it should be, and it will undoubtedly be necessary to make some changes in the detail of the plans, as well as to amend the ordinance as introduced.

The ordinance was introduced and plans drawn for the purpose of bringing this matter before the council in an official way, in order that some definite results might be secured, either on the line of the plans as laid out, or possibly something better, that might be devised by the different companies interested. Such a plan must be devised, in order that there will be room enough in the streets for each of the companies who have ordinances for and require the use of conduit systems.

At the present time it is almost impossible to lay conduits across many of the Chicago streets for the reason that two, and sometimes three, sets of conduit systems will be found, each of them at a different level in the street, and in order to make a crossing it is necessary to go below the lowest one at a depth of from six to seven feet, and after crossing the street come up to the proper level of 3½ or four feet for a continuation of the run. These conditions make it practically impossible to make any long runs with unbroken cable. The system devised eliminates this difficulty and gives every company access to the manholes on the same level.

The companies that have been consulted regarding the matter favor the idea, and will undoubtedly favor the passage of the ordinance as soon as the details of construction are finally settled. Those principally interested are the Chicago Telephone company, Chicago Edison company, Commonwealth Electric company, Western Union Telegraph company, Postal Telegraph-cable company and the Department of Electricity of the city of Chicago.

J. P. Ord Resigns from the General Electric Company.

Joseph P. Ord has resigned his position as second vice-president of the General Electric company and is now permanently connected with the firm of J. Pierpont Morgan & Co. of New York city. It is reported that Mr. Ord resigned from the General Electric company for the purpose of becoming the financial adviser of the new United States Steel corporation, a position for which he is well fitted. Before the formation of the General Electric company Mr. Ord was second vice-president of the Edison General Electric company. Upon the consolidation of this latter company with the Thomson-Houston Electric company under the name of the General Electric company, Mr. Ord became second vice-president of the new company and he has held that position continuously ever since. Mr. Ord is not a technical man, his connection with the General Electric company being more in the nature of an analytical and expert accountant. He had direct charge of the bookkeeping department of the business and the care and custody of the company's funds. His excellent business and financial methods have had much to do in giving the General Electric company its present firm financial standing. Mr. Ord is a son of the late Gen. Pacificus Ord, and graduated from Yale University in the class of 1873. Before his connection with the electrical industry he was connected with the accounting department of the West Shore railroad. It was in this capacity that he attracted the attention of Mr. Morgan, in the interest of whom he went into the General Electric company.

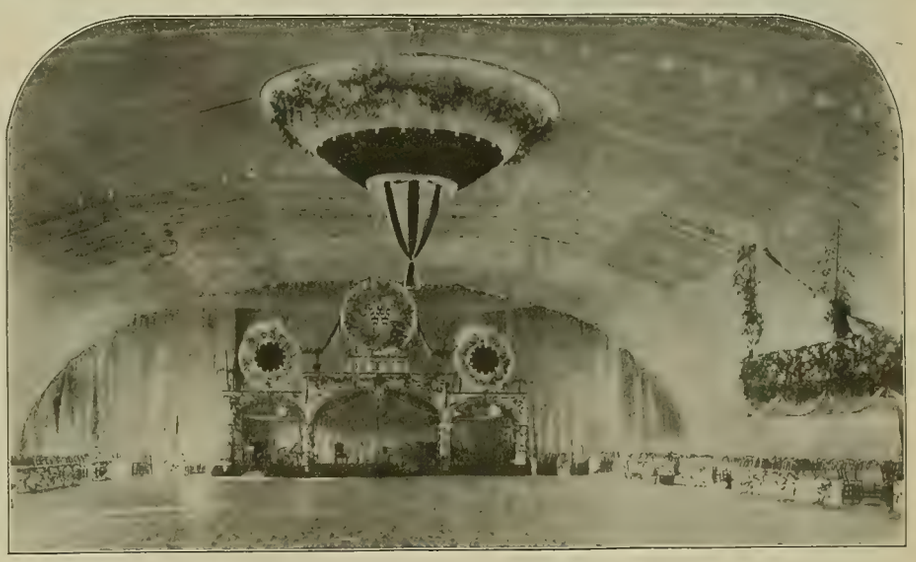
The Camden Interstate Railway company, Ashland, Ky., has announced that hereafter only married men will be employed as conductors or motormen. The company will raise the salaries of the conductors 4 1-6 cents an hour after April 1st.

Electrical Decoration for Ball at Madison, Wis.

The social event of the season at the University of Wisconsin each year is the "Junior Prom." This year the ball was given in the gymnasium of the armory at Madison, Wis., and is said to have surpassed in attractiveness any previous event of the kind in Madison. A description of the decorations is of interest.

The gymnasium floor is 130 feet long by 80 feet wide. The roof is supported by six large iron truss arches, having a distance of 35 feet from the floor to the center of the arch. The woodwork of the gymnasium is oiled and of a dark color, while the ironwork is painted dark red. The room is ordinarily lighted by 12 arc lamps, but as this was not deemed satisfactory for a ball, the question of illuminating and decorating the room properly was of considerable importance. After some study it was decided to cover the ceiling from one end to the other with white bunting. This bunting was supported by 12 rows of No. 14 galvanized-iron wire, which held it in place like a large canopy. This bunting was stretched after the room was divested of everything that was suspended from the ceiling or girders, even the arc lamps and their wires being removed. This gave a clear and uninterrupted space on the ceiling, as well as upon the floor.

The question of lighting the room with incandescent lamps was the next thing considered. As there was no incandescent circuit running into the room, an improvised cabinet was made, and located on the bandstand at one of the windows, through which the feeders were brought from the transformers that were temporarily located outside of the building in a wagon. Circuits were then run from this center of distribution to all parts of the house.



ELECTRICAL DECORATION FOR BALL AT MADISON, WIS.

In the accompanying illustration is shown the center of the ballroom and one end decoration. The end booth was built of woodwork, papered with building paper and calcimined. The trimming was done with gold paint. The lamps in the wheels or circles in the letter "W" and the figures "1902" were frosted, and gave forth a soft, mellow, but bright, light. The center chandelier gave a very pretty effect when illuminated. The first circle was 20 feet in diameter, studded with lights a foot apart. The white bunting was tacked to this circle and the one just below, which was 13 feet in diameter. From the middle circle to the lower one, of six feet diameter, was stretched red bunting. The whole arrangement was made on the ground and hoisted into position as fast as completed. The arches were studded with lights every four feet, terminating at each end with a cluster of seven lights. The room, when lighted up, was bright, and the light was extremely soft. It was pronounced the finest and most artistic decoration that had been seen in that part of the country. The effect probably could not have been obtained in any other way than with the aid of incandescent lamps.

The work was done by the Electrical Supply company of Madison, the designs and scheme for decorating being original with L. W. Burch, president of that company. It required about 1,000 lights and about 11,000 yards of bunting, as well as other accessories, to complete the decorations.

An election at Thorpe, Wis., has resulted in favor of the building of a $6,000 electric-light plant.

Rapid Transit in Boston.

Boston, March 7.—The elevated-railway structure has made giant strides lately toward completion, and experimental trains have been run from the Charlestown terminus over the new bridge for test purposes, and into the city as far as the North Union Station. Most of the superstructure throughout the city is now up, and in Washington street, beyond Dover street, on Atlantic avenue, and across the river to Sullivan Square, in Charlestown, the overhead rails are nearly ready at all points for the operation of the system.

At the Pleasant street exit from the subway, where a radical change in the approach to the underground system was deemed necessary by the engineers, the alterations are nearly completed. They have necessitated a large amount of excavating and masonry construction, and the work has been under way for a number of months. Before long the process of altering the station platforms and making some changes in the subway roadbed will be begun.

The subway to East Boston is progressing as rapidly as was anticipated. The work now under way is contracted for on the East Boston side of the harbor, and before long the bore under the harbor will be in progress.

Both the city government and the state Legislature are wrestling now with a demand for a subway under Washington street. This is a project that the Boston Elevated Railway company does not favor very much. It yielded without readiness to the mandate requiring the removal of Tremont street's tracks after the subway had been constructed beneath that thoroughfare, but Tremont street was not by any means the source of revenue that the tracks in Washington street are now and always would be. The proposition to relieve the congestion in the downtown retail-shopping district by removing surface cars therefrom would mean that hundreds, yes, thousands, of people would walk short distances in that district who now board a car to go a few blocks and yield a large daily revenue to the railway company. It would mean also that more suburbanites would purchase in their home localities, if they could not be landed at the doors of the large stores in the heart of Boston.

General Bancroft, president of the railway company, has expressed the determination of the company to fight any proposition to remove the surface tracks from Washington street, subway or no subway, very forcibly this week. The Legislature has granted hearings in the near future to petitioners for the subway. Mayor Hart of Boston is opposed to the project if it involves municipal expenditure at the present time, on the score of economy. It looks somewhat as though the plan would be shelved for a few years, pending the watching of operations on the overhead system with the present subway connections. Eventually, however, it is believed, a subway in the congested part of Washington street will be forced upon the people of Boston by the outside citizens of "greater Boston," who actually outnumber the residents of Boston proper, and are more influential in many ways than the city's actual inhabitants. Within a 12-mile radius Boston and its suburbs contain upward of 1,200,000 people, while the Hub itself enumerates less than one-half of that total.

All these people are deeply concerned in the means of transportation on all the spokes of "the wheel." They are watching the progress made by the elevated system eagerly.

The recent experimental trips were very successful, Superintendent Neff being quoted as saying that never before in his railroad experience had he known a new line to work so perfectly. Vice-president Sergeant, Chief Engineer Kimball and other officials have made the trip over the road and are delighted with results attained. Within a short time the motormen who are to run the cars permanently will be detailed to make the experimental run daily for practice.

B.

Street Lighting in St. Louis.[1]

By Henry H. Humphrey.

The company which recently secured the electric-lighting contract in St. Louis for the next 10 years proposed, at the time of the award, to build a new power house and plant complete, equipped for commercial lighting, as well as for public lighting. Many of the contracts for machinery were awarded and actually signed, when the sale of the stock of the company to local interests changed entirely the scheme and development of the plant. Believing that the engineering details in connection with this work may have some general interest, I will describe briefly the principal engineering features connected with the new electric-lighting system in this city.

The general design of this plant, as installed, was outlined in the report of the engineers of the Imperial Electric Light, Heat and Power company, under date of September 3, 1897, as follows:

"In an enterprise of this magnitude it seems to us advisable to bear in mind the possibility of doing the city lighting from this same plant. For a steady load, such as all-night street lighting, when the generators can be worked to their full capacity during their entire run, there is no apparatus that surpasses the direct-current machine and series direct-current arc lamp. The new series enclosed 150-hour arc lamp is being put upon the market now, and the reports that we have from it are entirely satisfactory. Large direct-current, multiple-circuit, series, arc-lighting generators can now be obtained, suitable for direct connection to engines, and give a large and efficient unit without the necessity of excessively high voltage. We believe that this type of generator would fulfill the requirements of city lighting better than any alternating-current or constant-potential, direct-current apparatus would do."

Anticipating the city-lighting contract, the company installed one extra duct throughout its entire underground system and a trunk line of 10 extra ducts north and south to the limits of the underground district for the purpose of arc lighting. This foresight has made it possible for the present contractors for city lighting to install their work in the underground district within the time available, an accomplishment that would have been impossible for any company having to install an entirely new system of conduits.

The question of type of apparatus, whether to use the direct-current series enclosed-arc lamp or its formidable rival, the alternating series enclosed-arc lamp, was promptly decided by the adoption of the former. The comparative difference in candlepower of the two lamps, with the same consumption of energy, was unquestioned, and since the city-lighting contract calls for an expenditure of 480 watts at the arc, leaving the question of candlepower entirely out of consideration, it was the desire of the company to give the public the benefit of the 16 per cent. increase in light.

Advocates of the alternating-current system claim that they can deliver more light from alternating-current lamps, operated from large constant-potential, alternating-current generators, than can be obtained from the use of direct-current apparatus. While this is an open question, and one dependent almost entirely upon the economy of the steam-generating and steam-using apparatus in the station, it did not enter seriously into the consideration of design of the plant under the existing conditions. The Imperial plant was already in operation with a direct-current system that had proved its efficiency and adaptability to the service intended, and the city-lighting load, consisting of but 525 kilowatts, was too small a factor to affect seriously the design of the entire plant. It is admitted that driving these arc dynamos by means of compound-condensing engines would be more efficient, from coal to watts-at-arc, than the present motor-driven units which, as shown below, give an efficiency of transformation of 80½ per cent. About one-third of this 19½ per cent. loss is probably in the motor, and could have been saved by driving direct from the engine. It is believed, however, that the practical advantages to be obtained from a plant of this design, where a multiplication of small units is avoided, where one man can operate the entire station, and where each large unit in the Imperial plant is a reserve unit for the city-lighting work, are so great that they overbalance the saving in coal obtained by placing the prime movers directly connected to the arc machines.

The arc-lighting plant consists of 12 110-light Western Electric series arc dynamos, built upon that company's standard 125-light frames, and each machine guaranteed capable of operating 110 500-watt, series enclosed-arc lamps through 40 miles of No. 8 B. & S. circuit. Each two arc machines are driven by a 200-horsepower, direct-current, 500-volt motor, the three comprising a self-contained unit, five of which are capable of operating the present city lights, leaving one unit as reserve. These machines are located at present in a temporary building adjoining the Imperial plant on the east side and located on the south side of St. Charles street, just west of Ninth street. In the design of the complete plant these arc generators will be on the second floor of the building, leaving the entire ground space available for boilers, engines and 500-volt, direct-connected generators. Fig. 1 shows these machines.

The 500-volt, constant-potential switchboard is equipped with switch, starting box, amperemeter, etc., for each motor-driven unit. The center of the board contains an illuminated-scale, Weston 500-volt voltmeter, showing the potential upon the bus-bars at all times. Enclosed fuses for each circuit are placed on the rear of the board. The arc board contains 12 dynamo circuits and 12 outside circuits. The terminals are widely separated, the positive being at the top of the board and the negative at the bottom. Each circuit contains a combination Weston amperemeter and polarity indicator. There is a transfer bus across the middle of the board, so that a dynamo at one end of the board can be connected to a circuit at the other end without stretching long connecting cables across the front of the board. The center of the board contains a Weston 10,000-volt voltmeter with terminal plugs. There is also a plug for ground connection and two plugs for 500-volt connection used for testing circuit during the day. At the rear and above the board are the static arresters, which will be mentioned later.

The arc machines are of the ironclad, Grammering armature, bipolar type, each equipped with the well-known Western Electric regulator. A special lightning arrester is placed upon the pole of the machine in such a manner that the stray magnetism from the pole-piece blows out the arc when a discharge takes place.

The motors are six-pole, ironclad machines, and operate at a speed of, approximately, 675 revolutions per minute. Each motor has a special field rheostat, by which the speed can be regulated through a range sufficient to provide for the variation in volt-

Fig. 1. Motor-driven Arc Dynamos.

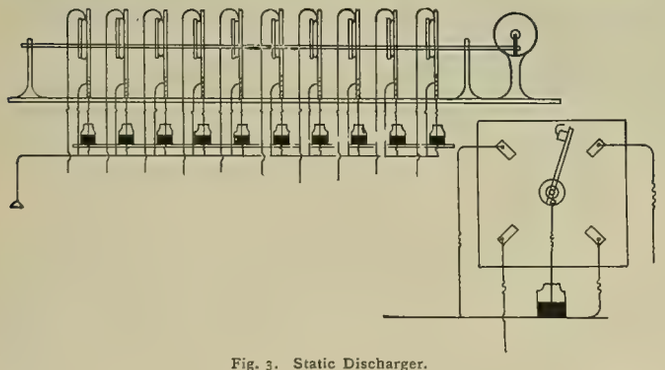


Fig. 3. Static Discharger.

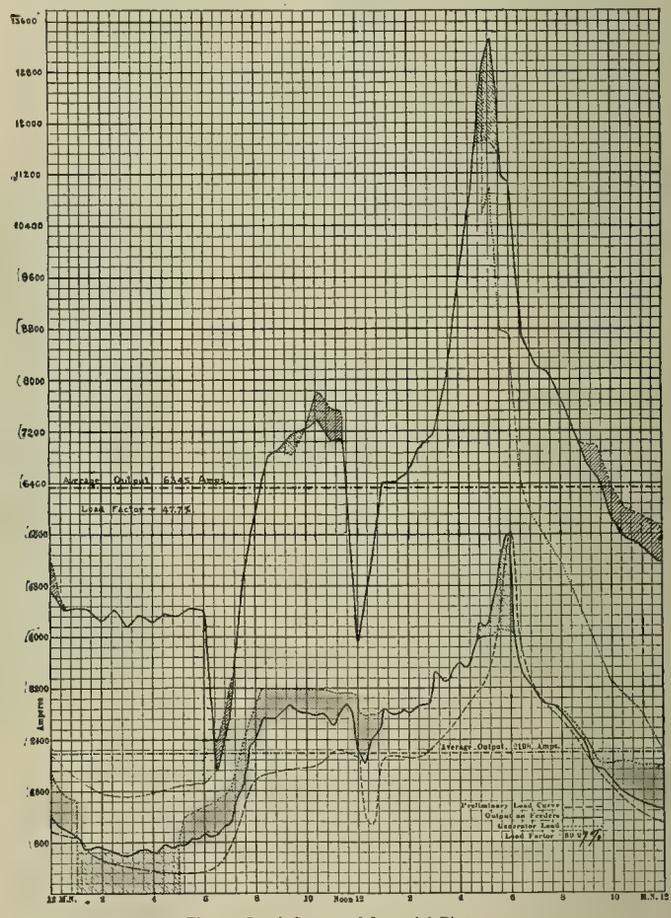


Fig. 5. Load Curves of Imperial Plant.

STREET LIGHTING IN ST. LOUIS.

There are three circuits in the underground district, each containing, approximately, 105 lamps. These are supplied through No. 8 B. & S. lead-covered cables, manufactured by the Standard Underground Cable company, having six-thirty-seconds inch of rubber and three-thirty-seconds inch of lead. The cables are drawn into the ducts in continuous lengths, from the base of the iron arc-lamp pole on one corner to the base of the iron arc-lamp pole on the next corner, thus avoiding all joints, either inside the ducts or in the manholes. The district north of the underground district is supplied by four overhead circuits, each containing, approximately, 90 lamps. They are carried through the underground district to its limit at Ninth and Wash streets by means of a 12-conductor, lead-covered cable, the 12 wires being placed in one cable and surrounded by a lead sheath one-eighth inch in thickness. This cable provides for four extra wires for increase of plant or for use in case of trouble on any one conductor.

The district south of the underground is supplied by three circuits of approximately 90 lamps each, carried to the limit of the underground district at Seventh and Spruce streets through a similar 12-conductor cable. For the overhead circuits, triple-braided, weatherproof wire is used, supported on double-petticoat glass insulators.

The lamps are suspended at the corners of street intersections by means of iron arc-lamp poles. The interior of the pole, as shown in Fig. 2, contains a

1. Abstract of paper presented before the Engineers' Club of St. Louis, November 21, 1900

hoisting windlass and pulleys for raising or lowering the lamp. The figure also shows the method of insulating the wires where they leave the iron pole and swing up to the lamp. The lead-covered cable is brought from the manhole, or service box in the street, through an iron-pipe lateral, both cables of the circuit being placed in the same 2½-inch iron pipe. In the base of the lamp they end in special hard-rubber terminals, placed over the end of the lead sheaths and filled with paraffin, to prevent any possibility of moisture entering the cable. From this special terminal a rubber-covered duplex cable, consisting of two No. 12 B. & S. flexible wires surrounded by seven-sixty-fourths inch of rubber and the two conductors braided together, extends up through the pole. This cable passes out through the

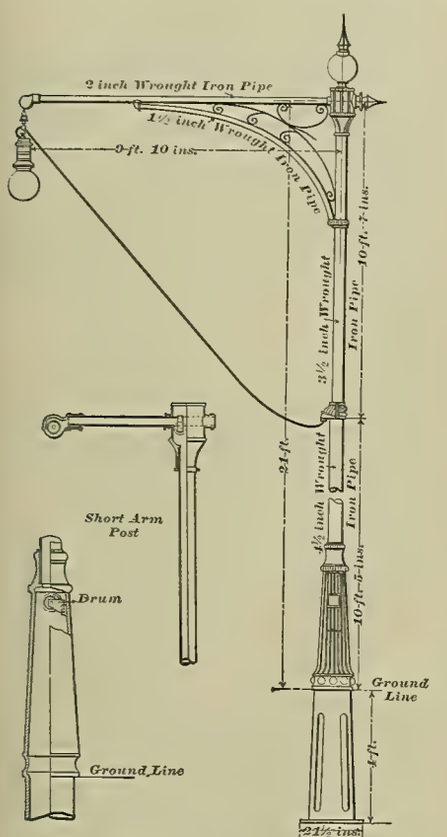


FIG. 2. STREET LIGHTING IN ST LOUIS—IRON ARC-LAMP POST.

special porcelain insulator and up to the lamp, being supported above the lamp upon a porcelain-knob spreader and connected to a solid wire which enters the binding-post of the lamp, providing a solid and secure connection at the binding post. These solid wires are bared for a short distance at a point midway between the porcelain knob and the binding-post of the lamp, providing a space where a specially constructed "jumper" can be readily attached whenever it may become necessary for a lamp to be changed while the circuit is in operation. The linemen carry insulated stools, upon which they stand while handling the live circuits.

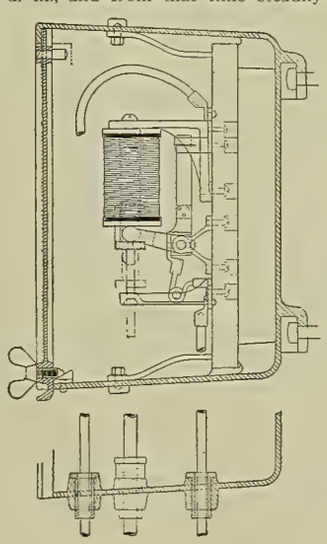
The use of a switch in the base of these poles, by which the lamp could be cut out of circuit entirely while a lineman is working upon it, would be very desirable, and such a switch was installed before the plant was put into operation. It took a very short experience, however, with these switches, which were the best the market afforded, to convince all connected with the enterprise that they were a failure in the position in which they were placed. Being convinced that it would be impossible to design a practical switch which would occupy the limited space available in the base of these poles and still be safely operative upon 8,000-volt circuits, they were abandoned entirely and the solid connection was made, as above described.

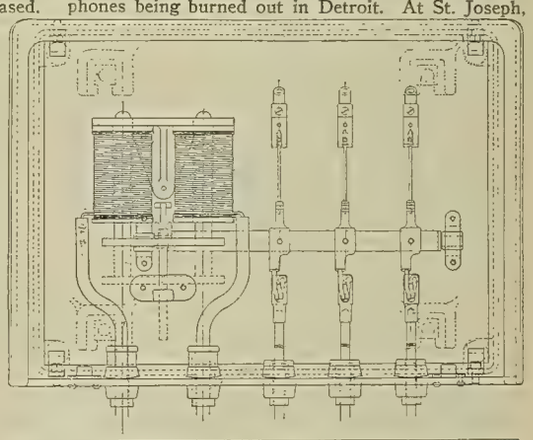
The use of iron poles for the suspension of arc lamps was a condition of the city contract which left the engineers no option. The use of special terminals and the cable above described in the underground district, and the use of special triple-petticoat glass insulators on the poles on the overhead circuits will, we believe, render the circuits safe from anything but the ordinary mechanical accidents incident to any class of apparatus placed upon the streets of a city.

As intimated above, some trouble, due to the static discharge from the underground cables, was encountered. This was not unanticipated, but it was believed that drawing both cables through the same iron duct, where they enter the base of the iron arc-lamp pole, would provide a sufficient connection between the two, so that the lead sheaths would be practically connected together throughout the entire circuit. At the plant all of the six cables of the three circuits were drawn into the same duct of the conduit and with the same object in view. It was ascertained, however, soon after starting the plant, that these contacts were not sufficient. The static effect from the cables manifested itself in the short-circuiting of arc lamps through the insulation at the top of the enclosing globe, where the full difference of potential of the lamp is effective. The lead sheaths of all the cables were securely soldered together in the manholes where they enter the lateral which goes into the lamp poles. They were also connected securely together at the plant just behind the switchboard. These efforts had little, if any, beneficial effect upon the operation of the circuits. In addition to this, a special static discharger, shown diagrammatically in Fig. 3, consisting of an ordinary Leyden-jar condenser, was connected to the copper of each circuit at the rear of the switchboard in the plant. Each condenser is provided with a revolving contact arm, driven by a small motor, which alternately connects the condenser to positive wire, to ground, to negative wire and to ground, thus receiving a charge from the line and discharging it to ground about 30 times a minute. Since this apparatus was installed the static effect of the cables has so entirely disappeared that it is not appreciable in the operation of the plant.

The city contract includes 739 32-candlepower incandescent lamps, located in the alleys throughout the electric-lighted district. These are all supplied from the regular three-wire, 235-470-volt mains of the Imperial company, requiring, therefore, no special apparatus. It might be of interest, however, to show a special switch designed for switching these circuits in and out by means of the arc-lighting current. This switch, which was designed by Mr. E. P. Warner of Chicago, is shown in Fig. 4. When the arc current is turned on it operates upon the solenoid, which, acting through the lever, closes a three-wire, 500-volt switch, switching on the alley incandescent lights throughout the district controlled by this particular switch. When the arc circuit is shut down in the morning the plunger of the solenoid is released, and, in falling, it opens the switch, cutting the incandescent lights out of circuit. This simple arrangement saves the services of a man with horse and wagon, to go around and start the incandescent lights, saving also the loss of current in switching lamps on ahead of time, where a considerable district must be covered and all the lamps in the district started not later than the schedule time.

The total capacity called for in each of the arc machines is 110 500-watt arc lamps, through 40 miles of No. 8 B. & S. wire. This is equivalent to a total voltage of 8,750 volts at seven amperes. In a test of one of the motor-driven units it was shown that the machines ran above their rated load during the entire test, the load on one reaching as high as 0.979 volts, which is 15 per cent. above the rating. The guaranteed efficiency of the unit was 78¼ per cent. The average efficiency during test was 80½ per cent., reaching, in one case, as high as 82½ per cent. and in another 82.4 per cent. The machines came well within their guarantees regarding rise in temperature of all of their conductors. The temperature of the motor fields reached its maximum at 3 a. m., and from that time steadily decreased, although the work being done by the motor increased slightly during the test. This decrease in temperature is probably due to a slight increase in the speed of the unit following the high voltage at the bus-bars. The voltage readings of the arc circuits show but slight increase during the night, after the number of lamps in circuit was allowed to remain constant.





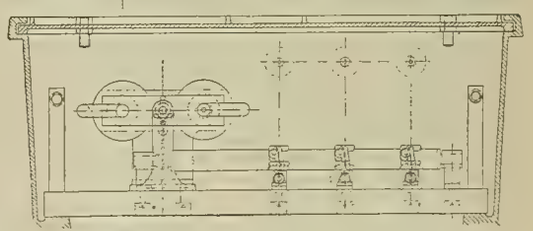


FIG. 4. STREET LIGHTING IN ST. LOUIS.—500-VOLT SWITCH ELECTRICALLY CONTROLLED BY ARC CIRCUIT.

In a paper read before this club last year I showed the load curve of the Imperial plant, which I will reproduce in Fig. 5. I repeat it here for the purpose of showing what a small effect the city-lighting load has upon the total load of the plant. The lower line gives the preliminary load curve, prepared by the engineers before the plant was built and submitted in their preliminary report covering the design of the plant. The second line gives the load upon the plant one year after it had started and a year and one month ago. It illustrated the use of the battery at that time, and attention was called to the large all-night load, the comparatively low peak or maximum load, and the high average for the entire 24 hours, which is 39.27 per cent. of the maximum. A year ago the peak of the load was 5,600 amperes. The third or highest curve gives the present load-curve of the plant, showing the changed use of the battery, which is no longer able to carry the night load and allow the shutting down of the plant. It is still available for doing its full-load capacity at the peak of the load, and its use as a balancer and equalizer of pressure is the same as it was a year ago. The increase in the all-night load is only partly due to city lighting, the city-lighting load being only about half of the present total all-night load. The dotted curve shows the load on the plant, exclusive of city arc lighting.

The station at present shows a maximum load of over 13,000 amperes, which is more than twice the maximum of 13 months ago, which was 5,600 amperes. The average load for the 24 hours has increased from 2,198 amperes to its present amount of 6,345 amperes, approximately three times as much as that of a year ago, and greater than the maximum load on the plant at that time. The load factor of the plant has increased from 39.27 per cent. to 47.7 per cent., giving a load factor that can be equaled by few, if by any, plants in this country.

Overhead Wires Damaged by Storm.

A severe wind and sleet storm swept over the upper Mississippi valley on the night of March 9th and the following Sunday morning. The storm began with a strong wind and heavy rain, which afterward turned to sleet. Besides injury to property and buildings caused by the wind and rain, the greatest damage resulted from the ice breaking and pulling down telephone and telegraph poles. In Chicago the service of the elevated and surface railways was seriously interfered with. The damage to the lines and service of the Chicago Telephone company was particularly heavy, being estimated at $15,000, while the Bell long-distance telephone service, it is estimated, will be a loser by about $85,000 as a result of the storm. Communication between cities throughout the West was maintained with difficulty, and in some places shut off entirely. Milwaukee was left with but one telegraph line, that one making connection with St. Paul. In Chicago the city fire and police-alarm systems suffered considerably. The Commonwealth Electric company's overhead lines were but slightly damaged. It is estimated that the loss to the Western Union Telegraph company was $35,000 and that to the Postal Telegraph-cable company was $20,000. The railroads centering in Chicago were also heavy losers on account of damage to their telegraph services.

Outside of Illinois the states of Texas, Arkansas, Kentucky, Missouri, Michigan, Indiana, Wisconsin and Iowa suffered the most on account of the storm. The Michigan Telephone company's service was damaged to the extent of $20,000, about 1,000 telephones being burned out in Detroit. At St. Joseph, Mich., 400 telephones were put out of service by a broken trolley wire. Grand Rapids, Benton Harbor and Ionia were other places in Michigan which lost heavily by reason of the storm. In Indianola, Iowa, the electric-light plant was put out of service and the Mutual Telephone company suffered to the extent of $20,000. In Southern Wisconsin the damage was particularly heavy. The Wisconsin Telephone company's entire system was paralyzed, Racine, Kenosha and most of the other lake-shore towns being entirely cut off. Outside of the considerable losses resulting to the electrical companies, the private-property losses were heavy.

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HIGH WATER MARK

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CONVENTIONS AND EXPOSITIONS.

Automobile Show, Coliseum, Chicago, March 23d to 30th.

Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Boston, Mass., June 19th.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Everyone interested in electrical progress in the United States will rejoice at the establishment of the National Standardizing Bureau by Congress in the closing days of the recent session. The act, as noted elsewhere, provides for the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce and educational institutions with the standards adopted or recognized by the government. Prof. S. W. Stratton, late of the department of physics of the University of Chicago, has been appointed director of the new bureau. The new institution has great possibilities of usefulness before it in establishing and verifying units of measurement, both scientific and industrial, and it starts out, we are sure, with the hearty appreciation and good wishes of all the scientific and technical organizations in the country. We trust and expect that it will prove equal to its opportunities.

When the figures of the electric-lighting industry in a city like Chicago are taken in the aggregate they are surprisingly large, even to those generally familiar with electrical development. Thus, the report of City Electrician Ellicott for the year 1900 shows that under the jurisdiction of the Department of Electricity of the municipal government there are 921 electrical generating plants, from which current is supplied to 41,557 arc lamps and 1,154,582 incandescent lamps. There are 53 central stations in Chicago and 852 private isolated plants. The averages are: For each central station 412 arc lamps and 12,704 incandescents; for each isolated plant 18 arcs and 560 incandescent lights. These figures are of much interest and show at a glance the great extent of electric lighting. The number of incandescent lamps given is probably less than the actual number in use, however, as no account seems to be taken of those used in lighting the thousands of elevated and surface cars in daily use throughout the city. No statistics appear to be given of the number and horsepower of electric motors in operation in Chicago, which is to be regretted, as the use of electrically transmitted power for machinery has extended even more rapidly than that used for light.

Heretofore electrical fires have been regarded as accidental rather than incendiary. As a matter of fact, electrical men have generally held the opinion that in many cases electricity has been used by underwriters and others as a convenient scapegoat for any fire of mysterious origin. Happily, however, the electrical and insurance interests have of late years come to a better understanding of each other. On the one hand it is admitted that poor construction and material may bring about an undue fire risk; on the other it is conceded that, properly safe-guarded, electrical wires and apparatus, so far from increasing the fire hazard, tend to lessen it by supplanting more dangerous sources of light and power. Safety lies in the use of properly constructed apparatus properly installed. A new element has lately entered into the consideration of "electrical" fires, however, by the statement attributed to the chief inspector of the Chicago Department of Electricity that electrical fires are sometimes deliberately caused. The method alleged to be employed is thus described: "Ignition is secured by removing the insulation from the point of contact where two wires cross. The insurance 'shark' gathers together some inflammable material, for instance, shavings or light paper. He removes the insulation and brings the wires together at the point where the metal touches. Of course, the current is turned off while he is arranging his scheme. Above the crossed wires the storekeeper places the stuff that he wishes to ignite at the proper time. He withdraws from the store or house and when everything is ready and his connection with the affair is least to be suspected he turns on the current. The rubbish is ignited and the report of a 'mysterious' fire comes into the fire-alarm office after the place has been gutted. The assertion that the insulation had worn away is not hard to make if the fire that follows does not altogether destroy the covering on the wires."

This is a startling statement and raises the question whether, if it is true, "defective insulation" has not suffered in the past for many sins that should be attributed to the rascality of men. Possibly some of the "electrical" fires were really of electrical origin without any fault attaching to the electrical apparatus. However, the assertion is easy to make and difficult to prove. The remedy proposed is the passage of an ordinance prohibiting the stringing or insulation of wires intended for electric current by any person except a licensed electrician. This arrangement would necessitate the filing with the city clerk of a plan of the work accomplished, so that ready reference might be made to it should the suspicions of the fire inspector be aroused. But it may be doubted if this plan would prove efficacious if there is a real tendency toward electrical incendiarism. It does not take much mechanical ability to scrape off insulation and throw a switch. If there are electrical "insurance sharks," the ordinance suggested will have little terror for them.

As in the design of naval ships there has been a long struggle to determine whether the resistance of the armor or the penetration of the projectile should finally prevail, so, somewhat similarly, in crowded centers of population it has been for years a question whether improved methods of intramural transportation could keep pace with the growth of population. In London, on account of its great size, and in New York, owing partly to topographical conditions, this problem has been especially perplexing. In Paris, Berlin, Boston, Chicago and other large cities the requirements are not, at the present time, quite so onerous, although in every progressive city of over a million inhabitants it is probably true that transportation problems are pressing for settlement. It is a serious question. In New York Mr. Vreeland admits that the street-railway men do not attempt to do gilt-edge railroading; they simply bend their energies to the attempt to keep as many cars moving as rapidly as possible. Every other city, likewise, has its own conditions to meet—London, the immense volume of traffic offered and the conservatism of the populace; Boston, the narrow, crooked streets; Chicago, an intersecting navigable river and streets so low-lying that conduit drainage is difficult; and so on to the end of the chapter.

The question is: What is to be done to meet the situation? The New York Sun, considering the conditions in that city, says: "The underground road will bring some relief; but before its trains are running the increased facilities afforded by it will be no more than equal to the augmented demand meantime created by the growth of population. It will be only a single line added to the many already provided. Another bridge to Brooklyn will relieve the strain on the present structure, but the rapid increase of population will soon tax all the facilities of both, and the situation will be no better than it is now. Already every avenue leading from the lower town has its elevated or surface road, or both, and the capacity of the Brooklyn Bridge is taxed to the utmost. Add the demand from an increase of a million in the population, and what will be the situation in 1910?" The only remedy the Sun can suggest is decentralization—"building up centers of trade and industry which will make it unnecessary for a great mass of people to rush morning and night to and from the lower part of town." Harlem and Brooklyn, it thinks, must become more and more independent communities. In other words, the railway men must fairly confess their inability to meet the requirements of the situation within a period as short as 10 years. Then, the congestion and inconvenience and even danger of travel having reached a point where relief is imperatively demanded, men will seek to create new centers of commerce to relieve the strain.

This does seem to be a possible outcome of the city transportation problem in American cities, but the experience of London, where these "centers" have been, in a measure, long established, does not indicate that the remedy is complete. The great banks, the principal business offices, the smart retail shops, government and municipal departments and many other important interests refuse to be widely segregated. There is a market, an "atmosphere," an activity, which they thrive upon and demand. So, while the process of decentralization may be partially carried out, experience leads to the belief that every great city will have always a center of "centers" to which the great tide of city travel will ebb and flow. The city railroader, in all probability, will have this problem to meet in 1910 and 1920 no less than in 1901 and in greater degree. Unless double-decked streets or aerial navigation come to his relief, the problem of carrying the people will continue to give the liveliest exercise to his intellectuals.

OBITUARY.

Captain George N. Stone.

On Friday afternoon, March 7th, Captain George N. Stone, president of the City and Suburban Telegraph association of Cincinnati, died, after hovering between life and death for several days. An operation for appendicitis had been performed a few days before, from which the patient failed to recover. When first taken ill Captain Stone was preparing to leave on an extended trip through California, in which Mrs. Stone was to have accompanied him.

George N. Stone was born on July 17, 1840, in Stark, N. H. While still a youth he went to Boston, where he was employed at a small salary in a mercantile establishment. At the beginning of the Civil War he joined a Rhode Island regiment as lieutenant and afterward was made captain. After the war he went West and after an unfortunate Colorado mining venture finally drifted to Cincinnati. He became interested in organizing the Chester Park Driving association and was made its president. It was soon after this that he brought out Maud S., the racing mare which afterward became so famous.

In 1878 Captain Stone became identified with the local telephone company, the City and Suburban Telegraph association, as a director, and in 1882 became the general manager of the company. It is stated that it has been due to his efficient management of the company's affairs that no rival telephone organization was ever attempted in Cincinnati. Captain Stone inaugurated the system of giving every employe in the company a dividend at the end of each year, amounting to 10 per cent. of his salary.

Besides his connection with the telephone company, he was a director in the Cincinnati Street Railway company and the Cincinnati Gas Light and Coke company. He was prominent in nearly all of the leading business and social organizations of the city. At one time he was president of the Board of Aldermen and was a member of the Cincinnati Board of Councilmen. He is survived by his wife and three daughters.

The death of Captain Stone will leave several vacancies to be filled in the companies in which he was interested. C. H. Kilgour is vice-president of the telephone company, and becomes its executive head, and R. T. McComas, the assistant manager, will be the acting manager until further arrangements are made.

Francis O. Matthiessen.

Francis O. Matthiessen, president of the Weston Electrical Instrument company and former treasurer of the American Sugar Refining company, died at his residence in Paris, France, on March 8th. Mr. Matthiessen had for 30 years been regarded as one of the strongest factors in the sugar industry in the United States. He retired from active business about a year ago and has since spent his time in travel for the benefit of his health. Mr. Matthiessen was born in Germany in 1833, and after serving an apprenticeship in a small sugar refinery came to America at the age of 26. From that time till last year he was actively engaged in the sugar refining business and had amassed considerable wealth. He was also interested in several electrical and allied interests, having been president of the Weston Electrical Instrument company of Newark, N. J., for several years. At the time of his death he was a director of the Goubert Manufacturing company, North Jersey Street Railway company, and of the Glucose Sugar Refining company of Chicago. He was a member of the South Side Sportsmen's Club and New York Club, Metropolitan Museum of Art, American Museum of Natural History, Blooming Grove Park association, and the Chamber of Commerce of New York city. He is survived by a widow.

Prof. G. F. FitzGerald.

Prof. George Francis FitzGerald, fellow of Trinity College, Dublin, died on Thursday, February 21st, at his residence in Dublin. He was born in Dublin 50 years ago, and was the son of Dr. FitzGerald, Bishop of Cork. He was educated at Trinity College, Dublin, where he had a distinguished career. In 1880 he was appointed registrar of the University Engineering School, and in the following year he was elected to the post of Erasmus Smith professor of natural and experimental philosophy. He took his degree of doctor of science in the University in the summer of 1891. Professor FitzGerald was president of Section A of the British association at its congress in Bath in 1888, and he held the position of examiner for London University in experimental sciences since 1888. He was elected a fellow of the Royal Society in 1883, and he acted as honorary secretary of the Royal Dublin Society between the years 1881 and 1889. Dr. Oliver Lodge, in the London Electrician, says: "At the same age as Clerk Maxwell, FitzGerald has gone from us. There has been no equal blow to physical science between the two events, in this country, possibly not in the world, for the untimely death of Hertz himself was no greater blow."

Gilbert Wilkes.

Gilbert Wilkes, president of the firm of Gilbert Wilkes & Co., electrical and mechanical engineers and contractors, with offices in Detroit and Denver, died at his home in Denver on Sunday night, March 10th. Mr. Wilkes was a very well-known engineer in Michigan and throughout the West. He was at one time in the United States Navy, and during his residence in Detroit was commander of the Michigan Naval Reserves. Throughout the Spanish-American war he was lieutenant-commander of the Yosemite. The other members of the firm of Gilbert Wilkes & Co. are Henry L. Woolfenden and William Van R. Whitall.

C. L. Magee.

Christopher L. Magee, president of the Consolidated Traction company of Pittsburg, and prominent in banking and insurance circles there, died on March 8th. He was an active Republican, principal owner of the Pittsburg Times, and president of Mercy Hospital in Pittsburg, to which he was a large contributor.

Electrical Illumination at the Washington Inaugural.

[From a correspondent of the Western Electrician.]

Washington, D. C., March 8.—The recent inauguration of the president of the United States was accompanied by one of the most elaborate electrical displays in the history of the capital. Pennsylvania avenue, for 17 squares, was resplendent with streamers and festoons of electric lamps; electrically illuminated flags, shields, stars and arches were everywhere to be seen, as were many electric signs. The Court of Honor, with its towering white columns, was lighted by thousands of incandescent lamps. In the outside decoration of the government buildings, however, less attention was given to electrical display than was noticeable on the part of private concerns. On the War Department building there were shown, outlined by electric lamps, a large six-pointed star, the insignia of the Sixth Army Corps, and the crossed anchor and cannon of the Ninth Army Corps, to which Mr. McKinley was attached during the Civil War. The Treasury building was lighted on the east side by a row of incandescent lights behind the capitals of the long row of columns, and by a few small stars set with electric lamps.

The most noticeable display of electrical effects was found in the ballroom in the Pension Office, where light was shed over the dancers and promenaders from 16,500 incandescent lamps. For the inaugural ball and the concerts the gas-lighted building was transformed into a veritable fairyland of brilliancy, lit by electric lamps, aggregating 76,000 candlepower. As the building had never been wired, it was necessary on this occasion to run three 500,000-circular-mil insulated copper cables to supply the 2,500 amperes required to light the ballroom and banquet hall. In order to meet the extraordinary demand for current during the time of the ball, the Washington street storage-battery plant, one square distant, was utilized. With a corps of from 15 to 30 expert electricians and wiremen, the work of installing a complicated temporary switchboard and 10 or 12 miles of electric wiring was accomplished in five days. The ballroom was the court of the Pension building, being 316 feet in length by 116 in width, surrounded by three tiers of balconies. The first and second balconies are supported by 76 newly gilded pillars, which, with the gilded vases of flowers and yellow drapery of the walls and ceilings, was emblematic of the supremacy of the gold standard. Over the center of each of the 76 arches, below the first balcony, was placed a five-pointed frosted star, studded with 11 16-candlepower lamps.

Between each star hung a festoon of 28 16-candlepower lamps, and from each star a pendant of 25 small lights, ending with a 16-candlepower lamp enclosed in a 12-inch ground-glass globe. Each of the 76 gilded pillars on the ballroom floor was encircled below its capital by electric lamps. The pillars along the first balcony were twined about with strings of 30 lights. From the crowns of the arches of this row of pillars hung pendants of 25 tiny electric lamps, ending in clusters of three 16-candlepower lamps in yellow, tulip-shaped paper shades. Secured at the same point were two strings of 25 lamps each, which were looped to the tops of the columns, the two loops forming a large festoon. The short columns along the top of the second balcony were surmounted by 12-inch globes containing 32-candlepower lamps. Pompons of needle pines concealed these columns and the wiring leading to the globes. The wiring and lamp bases of the streamers and festoons were skillfully hidden by being twined with southern smilax. The fountain basin in the center of the ballroom was filled with flowers and palms, and among these were numbers of tiny incandescent bulbs.

The electric wiring and fixtures are well worthy of detailed mention. In the first place, all the festoons, streamers and bowknots of electric lamps were made in the shops of the Electric Motor and Equipment company of Newark, N. J., some time before they were shipped to Washington. A large temporary switchboard was installed, consisting of boards covered with asbestos paper, to which feeder cables aggregating 1,500,000 circular mils conveyed current from the street mains of the local electric-lighting company. These cables led to a three-wire, 2,500-ampere fused switch, controlling branches leading to five 600-ampere switches. On the left of the board, above the main switch, was a Weston 300-volt voltmeter, and directly above it were placed two Weston 1,500-ampere station ammeters, one being connected on the positive and one on the negative side of the line. Arranged across the top of the board were eight wattmeters. The connections for the wattmeters were quite complicated; as the meters were of capacities varying from 100 to 300 amperes, it was necessary in some cases to connect two or more circuits through one meter, the idea being to secure the aggregate reading only. The five circuits consisted of 250,000-circular-mil cables on the outside legs, and No. 1 B. & S. gauge wire for the neutral. These circuits were approximately 600 feet long, so that for the five an aggregate of 6,000 feet of 250,000-circular-mil cable was necessary. For the banquet-hall circuit No. 4 wire was used, with No. 1 wire for the neutral. On account of the large amount of illumination throughout the city, it was necessary to supply the Pension Office building from the central station, one sub-station and the battery plant. The current used was about 2,480 amperes at 220 volts. The wiring was all by the three-wire system and the line was balanced within 20 amperes, a creditable showing, even under the very best of conditions. One very noticeable feature was the symmetrical regularity of the festoons, due to the use of the Brewster receptacle, which permitted the lamps to be held in a horizontal position, thus giving a maximum amount of light.

The last strains of the grand concert given by the United States Marine Band had scarcely died away when the work of removing the electric installation was begun, and within two days the ballroom was restored to its former condition. The work was accomplished without the slightest hitch and the service rendered was perfect. Mr. George E. Davis of the Electric Motor and Equipment company of Newark, N. J., had entire charge of the installation. The writer is indebted to him for much of the technical information contained in this brief description.

B. C. W.

Proposed Detroit-Buffalo Electric Railway.

[From the Ohio correspondent of the Western Electrician.]

Columbus, Ohio, March 9.—If present plans materialize, Ohio will soon have one of the greatest electric-railway systems in the world. Henry A. Everett, B. Mahler and some of the other capitalists of Cleveland are proposing a high-speed electric road from Detroit to Buffalo. While it is not altogether settled that they will purchase all the roads they will need for their operations between those two points, there will be an arrangement whereby they will come into control of them so far as they need them for this purpose, and then close up the gaps with new roads.

The new company will be known as the Lake Shore Electric Railway company, and it is said that it will be capitalized at $4,000,000 and will have a bonded indebtedness of the same amount. According to reported arrangements, B. Mahler of Cleveland will be the president of the company. The plan at this time includes the Lorain and Cleveland road, from Cleveland to Lorain; the Sandusky and Interurban, now completed from Huron to Norwalk, and the Sandusky, Norwalk and Southern. The Sandusky and Interurban is building from Huron to Lorain, which will close the gap on that side. A line is also building directly from Huron to Norwalk, where connection will be made with the Toledo, Fremont and Norwalk line, and it is understood that traffic arrangements to this effect have been about completed. The Toledo and Western, with its Michigan company organized some time ago, would give a through line to Detroit, since Mr. Everett already controls the street railways of Detroit and a suburban line from there to Wyandotte. From the state line, or from Monroe, where a road now in course of construction will extend from Toledo, is but a short distance, and this the new company may build.

This will give the company a through service without very much new road, and it is said that it may be in operation between Cleveland and Toledo by May 1st. It is possible that when the plan is in thorough working order all the roads will be absorbed into the one system. Nearly all the lines to be used are over private right-of-way, and it is expected that the cars will make a speed as high as 50 miles an hour. Some cars will probably be run through by way of Sandusky, but at this time it is not believed that the latter will be on the main line, although the roads are arranged so that it can be. The new company will have 130 miles of track.

C.

DEVELOPMENT OF THE TELEPHONE FIELD.

What the Berliner Decision Means.

C. W. Farr, president of the Farr Telephone and Construction Supply company, Chicago: "The recent decision in the Berliner transmitter case will no doubt stimulate the Independent telephone business everywhere in the United States. New capital can now be enlisted. As a general thing, investors now engaged in the business had no fear of a decision in favor of the Berliner patent, but capitalists uninformed as to the real situation were timid and slow to invest in telephone projects. The decision removes all obstructions and business will go on booming."

J. F. Hemenway, secretary and treasurer of the Ericsson Telephone company, New York: "Before the incorporation of this company, we noted, with interest, the advertisement in some of the electrical papers by the American Bell Telephone company of its patent No. 403,569, which is the well-known Berliner patent, issued November 17, 1891, and covering all forms of microphone transmitters. The recent decision in the United States Circuit Court is of the greatest interest to all Independent telephone people, meaning everyone outside of the American Bell Telephone company, for numerous reasons, one of which is that the persistent advertising by that company of the patent referred to has made capitalists and investors very cautious. While the Independent telephone movement has gone forward by leaps and bounds, it would have increased much more rapidly and will hereafter. In our opinion, the effect will be to increase the confidence of those already interested in the Independent telephone movement, whether the manufacturer, the jobber or the exchange owner. Through the success of those outside of the American Bell company, many others will now become interested, with the result of stimulating the growth of the business. With the growth in the Independent fields should come improvements and standardizing of apparatus, with a continued growth in favor of the best goods."

Holtzer-Cabot Electric company, Brookline, Mass.: "We believe that the Berliner decision will instill new confidence in those who are investing in Independent telephone securities, and will doubtless assist greatly the undertaking of large telephone enterprises independent of the Bell company. We believe, however, that there was very little fear of this particular patent. In fact, it seemed a foregone conclusion that it would be declared invalid, and it was rare indeed that the question of infringing this patent was considered when any telephone enterprise was on the tapis. If the decision had been in favor of the Bell company, it would have paralyzed the Independent companies, temporarily, at least, but we do not believe it would have ultimately affected the development of that field. Of course, there is the possibility of the case being brought to a higher court, with the risks of a different opinion being handed down, but the decision of Judge Brown was so complete in refuting any claims of Berliner that no person is likely to fear any further action that might be taken."

Phœnix Electric Telephone company, New York: "We believe the principal effect to be looked for from this decision is that the investing public and bankers generally will look with more favor upon the securities of Independent telephone companies. Those conversant with the facts of the case have not lost much sleep on account of the Berliner patent, but investors, generally, are ever averse to putting money in a possible lawsuit, which has to a considerable extent hampered the Independent companies in receiving money to fight the monopoly. It is our opinion that prices to be derived from well-equipped Independent telephone exchanges will now attract the investing public and that honest enterprises of this character will no longer have difficulties in floating their securities."

W. F. Richardson, manager National Telephone Equipment company, Detroit: "In my opinion, it is impossible to estimate the value of the Berliner decision to the Independents. It means to the manufacturer that he will be unable to get equipment out fast enough to meet the demand; it means to the supply houses that they will be taxed to their utmost capacity; it means easy money to the promoter; it means success to the exchange owner; it means success and prosperity to all of us."

S. P. Sheerin, vice-president of the New Telephone company of Indianapolis, said: "It means the beginning of a new era in Independent telephone service, and it disposes of the Bell monopoly. It also saves us much trouble in almost numberless minor suits. Six years ago there were in Indiana about 12,000 telephones, and now there are over 60,000. The development of the Independent telephone idea has been the most remarkable in recent history, and this development has been in spite of the methods used by the Bell company. Not only that, but previous to the last six years telephones in farmhouses were unknown. Now they are common. We are connected with 27,000 telephones over our own lines, and, through contracts with other Independent companies, with over 50,000. Now, if there has been such a development as this in Indiana, in the face of threats, what will it be now that the ground for those threats has been removed? Further, the immediate effect will be the organization of other Independent companies, as now investors will not fear to put their money in these enterprises. I have an idea there will be a perfect stream of money toward Independent telephone companies. We regard this decision as settling the case to all practical intents and purposes, and I have been assured by many lawyers that it has that effect."

Telephone News from the Northwest.

The telephone company in Marinette, Wis., is unable to met the demand for telephones. There are 335 in use now, and the number will soon reach 400.

The People's Telephone company won the contest with the Bell company at West Superior, Wis. The latter sought to re-enter the county building by offering free service, but the friends of the People's company were able to have the offer rejected. The People's company is connecting with all the public schools.

The bill in the Minnesota Legislature which permits telephone companies to string wires along public highways without securing permission has been referred to a committee from the cities of St. Paul, Minneapolis and Duluth. The objection is that it will remove the last hold that cities have upon the companies to compel them to remove their wires.

Farmers of Lake View, near Cedar Falls, Iowa, have formed a company to build a telephone line to Wall Lake, Sac City, Early and Odebolt.

The Northwestern Telephone Exchange company in St. Paul and Minneapolis now refuses orders for limited-service, nickel-in-the-slot or party-line connections. Nothing but individual service is offered. This makes a practical increase in rates from the minimum of $1.50 for residences to $4, the lowest priced individual service. The company says the reason is that it is unable to further extend its service owing to pending litigation in Minneapolis. The new East Side sub-exchange of the company, Minneapolis, is expected to be ready for business by May 1st.

The La Crosse (Wis.) Telephone company has begun work placing its wires underground in the downtown district.

The Minnesota Electric Telephone company contemplates extending its toll wires from Akeley, Minn., to Cass Lake.

The new electric-light company of Fort Benton, Mont., will establish a local telephone system.

The court holds that the franchise of the Seattle Automatic Telephone company in Seattle, Wash., is alive and in force. The company will now push the construction of its system with all possible haste.

The Tri-city Telephone company of Clinton, Iowa, has filed amended articles, increasing its capital stock from $35,000 to $90,000.

The Standard Telephone company of Dubuque, Iowa, has 500 instruments in operation.

The Union Mutual Telephone company of Union, Iowa, has been incorporated, with $2,000 capital stock.

It is announced that J. C. Hubinger of Keokuk, Iowa, has bought back all his telephone lines in Iowa, which were recently transferred to a Chicago corporation.

A barb-wire telephone line has been completed in Palouse County, near Pullman, Wash. It is nine miles long, has four connections and cost less than $100.

The Hooper (Neb.) Telephone company has been incorporated, with $50,000 capital.

The Town Council of Garrison, Iowa, refuses to put the application of the Benton County Telephone company before the people, to be voted upon.

The People's Telephone company of Winthrop, Minn., has been incorporated, with $10,000 capital stock.

A. W. Ewing has been granted a franchise for a local exchange at Dawson, Minn.

The Fergus Telephone company of Fergus Falls, Minn., will establish a local system at Pelican Rapids, Minn.

The Albert Lea (Minn.) Telephone company will probably extend a line toward Glenville, for the benefit of farmers.

A local exchange is being constructed for Ellendale, N. D.

A new local exchange is planned for Grand Rapids, Minn.

The La Crosse (Wis.) Telephone company will enlarge and improve its central office. This company has made arrangements to unite with other Independents, between La Crosse and Milwaukee, for a long-distance service.

The Price County Telephone company will build toll lines from Phillips, Wis., to Medford, as soon as the weather will permit.

The People's Telephone company of West Superior, Wis., will enlarge its field and cover more territory in that city, at once.

The Supreme Court of Washington state holds that a telephone company cannot demand that a City Council grant a franchise, nor does such refusal to grant a franchise constitute an exclusive franchise to the company already operating.

The Columbia Telephone company will extend its lines from Nelson, B. C., to Rossland, by way of Traill.

Local exchanges are projected at Osceola and at Murray, Iowa.

The E. H. Martin Telephone company is an applicant for a local franchise at Lohrville, Iowa.

The Conway Telephone company has added a new 100-drop switchboard and 50 new instruments at Bedford, Iowa.

Farmers south of Humboldt, Neb., have started an Independent telephone line.

T. A. Potter, Thomas Way, E. P. Healy and B. C. Way of Britt, Iowa, and Jos. Kirby and J. F. McMahon of Sioux Falls, S. D., have filed amended articles of incorporation in Iowa for the Iowa, Dakota and Minnesota Telephone company. The capital stock is $100,000, being decreased to that figure from $500,000.

J. W. McKnight is the owner of the telephone line from Choteau to Dupuyer, Mont., 32 miles. This line is said to be the best paying line in the United States. Originally Mr. McKnight wanted to form a company to construct the line, but finally built it himself, at a cost of $2,500. The line paid from the start, and in two years had paid for itself. Since then it has increased in business and pays now about 65 per cent. of the original cost.

The Sumner Telephone company of Sumner, Iowa, has bought the M. Robish line for $22,500. The line has toll lines in Chickasaw and Fayette counties and has exchanges in New Hampton and West Union. The lines are to be extended, and in the spring will be continued into Minnesota. R.

Ohio Telephone Notes.

The annual meeting of the stockholders of the Columbus Citizens' Telephone company was held in Columbus on March 4th, and a dividend of three per cent. was declared on the capital stock of $750,000. It is believed that this company will continue to grow and that its office will become one of the important centers for Independent telephone business, because of the central location and easy access to all parts of the country. All the directors and officers who have served for the last year were re-elected. The directors are as follows: Henry A. Everett, Henry A. Lanman, Edwin R. Sharp, H. D. Critchfield, James M. Thomas, William A. Hardesty, Edwin W. Moore, James B. Hoge and James B. Hanna. The officers are: President, Henry A. Lanman; vice-president, Henry A. Everett; secretary and treasurer, Edwin R. Sharp; general manager, Frank L. Beam; consulting engineer, Maxime Keber; counsel, H. D. Critchfield and Frank A. Davis.

C. S. Thayer, president of the Columbiana County Telephone company, has resigned the position to accept an important place with the United States Telephone company in connection with the construction of the line between Cleveland and New York. Mr. Thayer's new position is an important one, and is in the nature of a promotion, his abilities as a telephone man having been recognized by the officers of the larger company, which is always on the lookout for good men. Mr. Thayer organized the Columbiana County company and has seen it extend its service not only all over the county for which it was named, but to many places outside of its limits.

The multiplex telegraph system invented by Henry D. Bartholomew of Newark, Ohio, was tested between that city and Pittsburg a few days ago, and is said to have been a perfect success, telegrams being sent by the new system and the Morse system simultaneously, without interference. Further tests will be made soon to determine the extent to which it can be operated successfully. The inventor claims that it is less complicated than any of the other systems.

It is said that all the cars of the new Toledo, Fostoria and Findlay Electric Railway company will be equipped with telephones of the regulation type for the convenience of the patrons. Connection will be made from the car to a telephone wire along the track by means of a jointed rod.

An ordinance is before the council of McConnellsville to admit the lines of the Central District and Printing company of Pittsburg, in order that the town may secure the long-distance service.

The Home Telephone company of Dayton has renewed its application for a franchise to build a plant in that city. It asks that immediate action be taken, that it may know what to depend upon, as it is the intention to begin work early in the spring. It is probable that the matter will be taken to the Probate Court if the application is not acted upon at an early date.

Harry T. Manner has brought suit against the Farmers' Co-operative Telephone company of Mansfield, on a claim of $4,250, which, he says, is due for services in preparing papers and rendering legal services in various ways. He asks the court to appoint a master to ascertain the stockholders' liability, and says the company is insolvent.

The Ravenna Home Telephone company has filed notice with the secretary of state of an increase of capital stock from $10,000 to $20,000. H. L. Beatty is president of the company and W. S. Drake, secretary.

The officers of the Zanesville Telephone and Telegraph company and of the Central Union Telephone company at Zanesville have been engaging in public debates as to the advisability of having an Independent company operate in the town.

The New Carlisle Telephone company, New Car-

lisle, Ohio, was incorporated a few days ago, with a capital stock of $10,000, to build a system in the town and toll lines to other portions of Clark County. Jacob Hauss, F. J. Maisen, J. H. Goeke, George W. Pierce and one or two other citizens of that place are the incorporators. O. M. C.

Indiana Telephone Items.

The City Council of Alexandria has granted a franchise for a new telephone system to L. C. Niscoson, J. G. Brannum and J. H. Bradley.

W. N. Turner and C. A. Jay of the Kokomo Independent Telephone company have made application to the City Council at Logansport and the commissioners of Cass County for franchises for a long-distance telephone line connecting Logansport and Kokomo.

The Citizens' Telephone company of Terre Haute, which recently began preparation to extend its system throughout the city and county, is meeting competition from the Central Union company. The latter is planning to extend its service, and has also begun a system of rural lines that will place every farm in the county in connection with the city, and lively competition in all quarters is looked for.

The Farmers' Co-operative Telephone company, with rural exchanges at Thorntown, Advance, Hazlerigg, Elizaville, Shannondale and a number of Montgomery County towns, has petitioned the City Council for an exchange in Lebanon, Boone County. The Lebanon Telephone company has offered all Boone County patrons of the Co-operative company free service with any of its subscribers and free service to their homes when in the city. The Co-operative company demands that this offer be extended to all members of the co-operative system, irrespective of county lines, and that patrons of the Lebanon company be granted free communication with the Co-operative company's members. The Co-operative company declares that unless this concession is made it will put in a system in Lebanon, providing a franchise is granted.

The city of Bedford granted franchises to three new telephone companies last week, the Hoosier Telephone company being the largest. Exchanges will be put in and war will be made against the Central Union company.

J. J. Netterville, president of the Anderson Telephone company, has applied for a franchise for his company to build and maintain a system in Elwood. The Bell company has no opposition there and is operating a large number of telephones.

The Home Telephone company of Wabash has four copper wires on the line connecting Wabash with Marion. One night recently unknown persons cut and carried away a quarter of a mile of each wire, destroying communication for 24 hours.

The Pittsboro Telephone company (capital, $13,000) has been incorporated. The directors are C. R. Snowden, W. D. Lewis, Samuel James, and others.

The warfare between the Central Union and the Indiana Telephone company at Hartford City has reached the point where it is almost as cheap to talk as it is to keep silent. The former maintained an exchange for 10 years, beginning with $5 a month for business houses and residences 50 cents less. The latter company was then organized and the rate went down to $2 and $1.50, and now the Central Union has cut the residence rate to $1 a month.

An innocent-appearing bill was introduced in the state Senate providing that telephone companies may place their poles, posts, piers, abutments, wires and other appliances or fixtures along the highways and streets without obtaining the permission of county commissioners or town councils of towns of 15,000 inhabitants or less. It developed that it would give the Bell company power to enter any city under 15,000 inhabitants without consent. The Bell company lobbied for the bill's passage and the bill was stolen and changed so as to read 20,000 instead of 15,000. The Independent companies neither advocated nor discouraged the bill, but the towns and countrymen flooded the Legislature with letters and telegrams to kill the bill, which was done. The discussion provoked a number of personalities and the methods pursued were regarded as scandalous. F.

Proposed Telephone Competition in Chicago.

The committee on gas, oil and electric light of the Chicago City Council has recommended for passage the ordinance granting a franchise to the United Telegraph, Telephone and Electric company for an Independent telephone system, to compete with that of the Chicago Telephone company. The United company has a franchise granted by the town of Hyde Park previous to the annexation of the district south of Thirty-ninth street. It has operated a telephone system in that portion of the city for several years, and now seeks permission to extend its operations over the whole territory covered by the city of Chicago. The Illinois Telephone and Telegraph company has a franchise authorizing it to supply telephone service in Chicago. This ordinance was passed by the City Council on February 20, 1899. By its terms the company is to have a telephone exchange with 2,000 subscribers in operation within five years from the date of the franchise; otherwise, the concession is forfeited.

Bell Telephone Company of Canada.

The annual meeting of the Bell Telephone company of Canada was held at the office of the company at Montreal on the 28th of February. According to the annual report, which was read and approved, 3,437 subscribers have been added during the year, the total number of sets of instruments now earning rental being 38,360. The company owns and operates 343 exchanges and 494 agencies. About 2,430 miles of wire were added to the long-distance system in 1900. The long-distance lines now owned and operated by the company comprise 21,350 miles of wire on 6,525 miles of poles. There were $190,000 of five per cent. bonds sold during the year, the net premium on which was $18,775, and 500 shares of stock were also sold at a net premium of $35,105. These premiums, aggregating $53,880, have been carried to the contingent account. There has also been $46,119 carried from revenue to contingent, making this account $900,000; $32,898 to the insurance reserve account, making it $100,000 and $50,000 written off the plant and patent account. The entire capital stock having now been issued, and funds for construction being required, the shareholders, at a special meeting, held on December 5, 1900, authorized application to the Dominion Parliament for power to increase the capital from $5,000,000 to $10,000,000, and the petition will be presented in due course. An additional bond issue of $2,550,000 has also been authorized, to be placed on the market as funds are required. The gross revenue for the year was $1,614,262, and the expenses were $1,229,977, leaving a net income of $384,285.

GENERAL TELEPHONE NEWS.

A. C. Moore, Tampa, Fla., wishes to correspond with manufacturers of telephone-exchange equipment.

There are over 15,000 subscribers to the government telephone system in Tokyo, Japan. The highest subscription is $52 per annum, the lowest, $36.

George W. Finch, proprietor of Finch's Telephone Exchange, Escanaba, Mich., is installing a new 800-subscriber board of the latest type. During the winter Mr. Finch has built and equipped 70 miles of toll line between Escanaba and Channing, and is at present improving his lines in the city, replacing the old poles with large ones, and his exchange has about 450 subscribers. Mr. Finch claims distinction as "the first man in the United States who caused a sub-Bell telephone company to pack up, bag and baggage, and quit a town."

At a special meeting of the stockholders of the New York and New Jersey Telephone company, held on March 1st in the main offices of the company, 81 Willoughby street, Brooklyn, it was voted to increase the capital stock of the corporation from the present amount, $8,000,000, to $15,000,000. The increase of capital will be devoted to the enlargement and improvement of the plant of the company. The new stock, it was stated, would be offered to the present shareholders from time to time in such amounts as may be needed in construction requirements. The regular annual meeting was also held, at which the old board of directors was re-elected.

On February 1st the Valley Telephone company, operating exchanges in Saginaw, Bay City and Flint, Mich., had 2,774 telephones in service. Of this number 1,263 were in service in Saginaw. The company has prepared a statement showing that, with an average of 1,202 telephones in operation, there were only 2,012 cases of trouble in 215 days, or one case of trouble a day to 129 telephones. The company's reports and records of trouble are very complete and minute, and any trouble reported, no matter how insignificant, is included in the figures. The company invites comparison by other telephone companies with same sized exchanges in the United States, either Bell or Independent. The apparatus used by the Valley company was manufactured by the American Electric Telephone company of Chicago.

MANUFACTURERS AND DEALERS.

The F. Bissell company of Toledo, Ohio, is distributing folders descriptive of its telephone cable, pole houses and seats, distributing and cross-connecting boards, cable heads, etc.

The Independent Telephone company of Chicago has been incorporated, to manufacture telephones and appliances. The capital stock is $3,000, and the incorporators are Arthur W. Underwood, I. F. Dinwiddie and J. J. Comer.

Part 5 of the Ericsson Series, published by the Ericsson Telephone company, 296 Broadway, New York city, treats the subject of transposition of wires, which is of interest to all telephone men. Diagrams illustrating different transpositions are shown. The leaflet also contains a short account of the telegraph and telephone systems of Switzerland.

The Holtzer-Cabot Electric company of Boston, Mass., has issued a unique folder, the outside of which represents a reply postal card, calling attention to its Ness automatic intercommunicating telephone system. This system is used in some of the largest business establishments in the country, and is said to give lasting service and excellent talking qualities.

Electrical Construction in the German Navy.

The Elektrotechnische Zeitschrift recently published some interesting details concerning the present practice of the German naval constructors with regard to wiring installations. It appears that in the German service separate lead and return wires have been generally adopted, concentric cables being used in the neighborhood of the ship's compasses. Attempts to employ the ship's structure as a return have not attained successful results, and, so far as large vessels are concerned, this practice has been entirely superseded; but in the case of new torpedo boats, where economy in weight is a vital consideration, the practice still holds. In all places exposed to the danger of mechanical injury, such as the engine rooms and stock holds, lead-covered, iron-armored cables are employed, while elsewhere cables well insulated with rubber, but otherwise unprotected, except in some cases by thin, rust-proof wire, are used. The wood casing formerly employed has been abolished, owing to its inflammability. Hitherto, the telegraph and telephone cables have been of the lead-covered, iron-armored type; but the newest ships have been provided with a central subway, like a corridor, as well as side corridors, below the armored deck, which may be used for the electric cables, telegraph and telephone wires, thereby avoiding danger of mechanical injury. It is proposed to dispense with the iron armor in the future, even for the lighting and power cables, retaining only the lead protection.

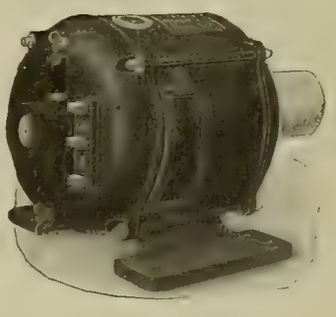
The practice of soldering branch connections has been discarded in favor of branch fuse boxes, in which the connections are made with terminal bars. These branch circuit boxes are made for two, three, four, six and eight lamps, and are, of course, watertight. Their introduction seems to have been a complete success, facilitating, as they do, systematic supervision of the ship's wiring.

Although slate is at present generally used for switchboards in the service, it is interesting to learn that iron is proposed as a substitute, owing to the unavoidable breakages which occur. Small machine boards of iron have already been introduced, but the difficulty of insulating the terminals and connections has hitherto prevented the adoption of the plan on a large scale. With the exception of the connections with the measuring instruments, all the switchboard connections on the Fürst Bismarck were for the first time (in the German naval service) made with bare copper bars, whereby a neat, solid construction is obtained which is also accessible. The necessary protection against moisture is provided by enamel, which also serves to distinguish the poles, red and blue being used. This type of board is particularly advantageous, where the available space is limited in depth, since the connections behind require no supervision, and the screw terminals may all be withdrawn from the front of the board.

Emerson Small Direct-current Motors.

A line of direct-current motors of one-fourth to one-half actual horsepower has been brought out by the Emerson Electric Manufacturing company of St. Louis, Mo. As this company has been making alternating-current motors only up to the present time, the adding of a line of direct-current motors is in the nature of a new departure, and the particular type of motor produced (shown in the accompanying illustration) is believed to be radically different, in some few respects, from any direct-current motor hitherto made.

The field of the motor is made of laminated iron, in the same manner as the field of the company's



EMERSON SMALL DIRECT-CURRENT MOTOR.

induction motor, and even in small sizes is of the six-pole type. The armature and commutator are mounted upon the same casting, so that the relative positions of the commutator and armature are not disturbed, if, for any reason, it is necessary to change the shaft. This is the form of construction used in large engine-type generators, and, the company believes, is somewhat of an improvement over the types in which the commutator and armature are mounted upon the shaft independently of each other. The commutator is large and with an unusual number of segments, and the shaft and bearings are unusually heavy for these small sizes, the motor being designed for severe and continuous use. Every motor is tested for 50 per cent. overload and a full guarantee is given with each machine.

Electrical Data of the City of Chicago.

The annual report of the Department of Electricity of the city of Chicago for the year 1900, which has just been submitted by City Electrician Edward B. Ellicott to the mayor and City Council, is carefully prepared and well arranged. It makes an interesting volume of over 100 pages, with a number of excellent illustrations. The work of the department is treated under different sections, relating, respectively, to the bureaus of municipal lighting, fire-alarm telegraph, police-alarm telegraph, electrical inspection, gas lighting and repairs, underground work and removal of poles and wires.

Municipal Street Lighting.

It is shown that on January 1, 1900, there were in operation from the municipal electric-lighting plants 3,502 arc lamps. During the year a total of 787 lamps was added to the system and 50 discontinued, making a total of 4,239 lamps in service on December 31, 1900. Conduits have been installed for 235 more lamps, and overhead wire put up for 135 lamps, the erection of which was made impossible on account of a reduction in the appropriation as originally made.

The installation of lights on underground circuits was more expensive during 1900 than during the previous year. The average cost per foot of duct, including manholes and lateral connections to lamp-posts, was 40½ cents, as against 37 cents in 1899. A total of 80,364 feet of duct was laid for electric-light service, 56,998 feet of which has not been placed in service on account of the reduction in the appropriation. The department installed and placed in service 95,508 feet of No. 6 Simplex electric-light cable for the lamps erected on underground circuits. Where conditions permitted, the poles of the traction, lighting, telephone and telegraph companies were used for supporting wires and lamps, without any charge. The saving thus effected has been estimated at not less than $8,000. A total of 727 poles were set during the year, including 150 poles for the fire and police-alarm systems.

On account of the wide distribution of the lights in service, the cost of installation was higher than that which would have been possible if each street were lighted by electric lights. The object has been to light the more important business streets and those on which there was the most travel at night. In carrying out this plan of installation the distribution of lights has been made over 66 square miles of the city. Some of the outlying wards are not served from the municipal system as yet, and it was to meet this condition, in part, that the R. A. Waller station was built at Sixty-third street and Wentworth avenue. This station is designed for 2,000 lights' capacity, and there are now 1,100 lights operated from it. The full capacity will probably be in service by July of 1901. To provide for the increase of this station at some future time, the property adjoining the plant has been purchased, giving 33 feet additional frontage on Wentworth avenue.

Upon the vexed subject of "Cost of Operation," Mr. Ellicott says:

"The wide distribution of lights has made the cost of operation and maintenance more expensive on account of the additional cost of trimming and repairing lamps. To reduce this cost of trimming, a system of enclosed-arc lamps, which are intended to burn 100 hours without retrimming, has been installed, and a practical test is in progress. The results thus far obtained are not entirely satisfactory, owing to the cost of replacing inner globes and the excessive outages, as compared with the open-arc lamps.

"It is gratifying to note that the enlargement of the system and the wide distribution of lights, which condition in any ordinary business would increase the cost of labor, have had but little effect in increasing the cost of the lights. The cost of all kinds of labor has been 77 cents per light more than in 1899, although the territory covered by the lighting system has been extended 13 square miles. The cost of labor, materials, repairs and maintenance has averaged 55 cents per light less than in 1899, while the cost of fuel has averaged $7.82 per light more than in 1899, due entirely to the advance in price, less coal per light being used than in 1899. This is good evidence that the city can operate an extensive system of street lighting without an abnormal increase in the cost of labor or repairs. The cost of station labor has been greater than it should be, on account of the necessity of operating two small stations during the increase of the larger stations—a condition that will not exist during the coming year."

The following table gives Mr. Ellicott's figures of the cost of maintaining the system during the year:

Cost of Material and Labor for the Year 1900.

Average Number of Lamps, 3,867.

Material.	Total.
Coal	$ 86,870.12
Carbons	16,707.76
Oil and waste	3,149.15
Globes	1,720.93
Engines	3,275.92
Boilers	3,119.56
Steam pipes	780.79
Dynamos	4,725.30
Lamps	11,807.13
Conduits and circuits	2,414.39
Buildings	1,090.42
Rental of real estate and current	3,626.48
Sundry expenses, including repairs to belts	2,497.58
Total material	$ 141,785.53
Labor.	**Total.**
Engineers, ass't engineers and dynamo engineers	$ 10,635.41
Dynamo tenders	4,947.60
All-night lamp trimmers	1,565.95
All other lamp trimmers	36,936.16
Firemen	19,498.06
Stableman	720.00
Machinists and teams	1,623.31
Laborers	2,538.18
Total labor	$ 78,464.67
Material as above	141,785.53
Labor as above	78,464.67
Total cost of plants	$ 220,250.20
Testing and repairing circuits and conduits—including cables replaced	11,708.13
Total cost	$ 231,958.33
Total cost per lamp	59.98
Per cent. of office salaries	1.00
Grand total cost per lamp	$ 60.98
Less amount paid per lamp for betterments and account depreciation	2.73
Net cash operating cost	$ 58.25
Total number of lamp hours	15,121,612
Average lamp hours, each lamp, less outages	3,910
Average cost per lamp per hour	$ .015496

The total cost for material per lamp for 1900 was $36.66, as compared with $30.15 for 1899; for labor the expense in 1900 was $20.29 per lamp, as compared with $19.50, in 1899. Mr. Ellicott concludes his review of this subject as follows: "The cost of operation also includes a total of $10,574, which has been expended on account of depreciation and betterments, but charged to operating expense, there being no other fund out of which to make the repairs which are due to depreciation. The condition of the system is constantly being improved by putting in new lamp-post foundations, painting lamp-posts, rebuilding lamps, painting fixtures, and numerous minor details. The intention has been to expend $1,000 a month on improving the system and charge it to operating expenses. Results show that this amount expended properly each year will provide for all reasonable depreciation."

Fire-alarm System.

The operation of the fire-alarm telegraph system during the year was without serious interruptions of any kind, and, so far as could be determined, no alarms were lost due to circuits being open or boxes out of repair. The total amount of cable in service for fire-alarm and police systems at the end of the year was 394,589 feet, in which there are conductors aggregating 5,714,252 feet of wire, or an increase over last year of 555,581 feet. Thirty-eight additional fire-alarm boxes were placed in service, making a total of 1,365 boxes now in use. The total number of alarms received during the year was 7,043, which is 602 less than in 1899. A table showing the number of alarms for each hour of the day gives the greatest number between the hours of four and seven in the afternoon. January had the greatest number for any month, and Saturday for any day in the week.

Police Telegraphs.

In the police-telegraph system the total number of boxes at street intersections is shown to be 996 and the number placed in private residences and business houses is 378, making a total of 1,374. During the year a reduction in the rental of telephones from the price of $5 per instrument to $1.50 per instrument was secured, with an additional concession made by the Chicago Telephone company by which the city secures a public telephone in each police station to permit of telephonic communication between every station in the city. The use of these telephones is given the city without any charge, but they are limited to the transaction of police business.

General Electrical Statistics

The report of the bureau of electrical inspection submitted by Harry H. Hornsby, chief electrical inspector, is interesting and extensive. The application of electrical power to fill new requirements and the extension of uses to which it was previously applied increased the number of motors used and the horsepower developed during the year in Chicago to a point far in excess of that indicated in previous reports. The use of series arc lamps for lighting the interiors of buildings has been decreasing, and as a substitute constant-potential lamps are being used. The reports show that 74 per cent. of the arc lamps installed are on constant-potential systems, while previous to 1898 the greater number of arc lamps installed were of the constant-current series type. Particular attention was given to the investigation of private electric-light plants which have been furnishing service to buildings outside of those in which the plants were located. The losses from electrical fires during the year were nominal, with one exception, where a loss of $30,000 was caused by the short-circuiting of a low-tension key socket on a motor circuit.

A number of tables show the following facts: During 1900 there were 2,464 motors inspected, aggregating in capacity 18,715¼ horsepower, the corresponding number for 1899 being 2,196 of 8,686¼ horsepower. From February 14, 1884, to December 31, 1900, the bureau inspected 53,797 arc lamps and 1,320,857 incandescent lamps. The following table shows the number of electric-lighting stations and lamps in the city under the jurisdiction of the department:

	Number of Stations.	Number of Arc Lamps Operated.	Number Incandescent Lamps, Equivalent to 16 Candlepower.
Commercial companies, central stations	53	21,825	673,336
Isolated plants	852	15,462	477,066
City plants, street lighting	4	4,239	.....
City plants (isolated), including City Hall and waterworks	12	31	4,180
Totals	921	41,557	1,154,582

On the subject of inspection fees Chief Inspector Hornsby says: "Regardless of the increased work done by the bureau, the expenses of maintaining the department were less than in 1899, and the receipts for inspections were $495.22 in excess of that year. The profits shown by the bureau aggregate $6,748.45. His Honor, Mayor Harrison, has recommended to the council an amendment to the present ordinance, which will have the effect of reducing the fees now charged for inspection. The reduction will amount to fully 15 per cent. of the rates charged now, and it will be the third reduction made during the last three years and represents a total reduction of 40 per cent. of the rates formerly charged for the different classes of inspection."

Mr. Hornsby believes that an ordinance requiring a license for all electrical contractors, wiremen and electrical operators is very much needed. "To inspect electrical apparatus and see that it is properly installed is but the first requisite; it must be maintained in that condition; but under present circumstances it is almost impossible to secure the proper maintenance, as it is a common practice among mercantile establishments to utilize incompetent help on the repairs and changes to existing wires, and notice of such changes does not always come to this bureau."

Gas Lighting.

The statements referring to the bureau of gas lighting and repairs show the number of gas lamps in service for street lighting on December 31, 1900, to be 24,980 and the number of 60-candlepower gasoline lamps, 4,276. The number of street gas lamps discontinued on account of electric light was 1,503; 155 gasoline lamps were discontinued for the same reason.

Underground Construction.

The style of conduit used in the underground construction was three-inch vitrified conduit, with socket connections between the sections. The conduits are cemented and made practically watertight. Two ducts are always placed in the street, one for electric-light and one for fire-alarm and police wires. The standard manholes are three feet four inches by five feet and five feet six inches deep, with eight-inch walls laid in cement. Heavy cast-iron frames and covers are used and placed upon angle-iron supports. All lateral connections are composed of 2½-inch steel pipe. The average cost per duct foot, including manholes, covers and lateral connections, was 40½ cents. The total street length in lineal feet of main and miscellaneous ducts laid in the year 1900 was 85,801, making a total length of ducts of 159,605 feet.

Removal of Overhead Wires.

The removal of poles and wires necessitated by the paving of many streets required a great deal of extra work. A series of illustrations is given showing some of the principal streets before and after the poles were removed. On this subject, the concluding topic of the report, the following is said:

"Over 30 miles of streets were cleared of poles and wires during the year—more than in any two recent years. This department made a special effort to secure the removal of all poles and wires, and succeeded on all streets being improved within a radius of three miles from the center of the city. It was impracticable to require the removal of poles on streets which were in the outlying districts. The cost of a conduit system on such streets would be prohibitive to any company at the present rates of service. To reduce the first cost and to simplify the conduit systems, this department has recommended to the council an ordinance requiring each company desiring conduit space in any street to agree upon a suitable form of combination conduit, which shall be jointly constructed and occupied. The cost to each company will be reduced fully one-half, and will make possible the furnishing of underground service in many sections where it is now prohibitive on account of the excessive cost as compared to the income at prevailing rates. It is predicted that such a combination system will do more to clear the streets of poles than anything that could be done by the companies acting as individuals and expending large sums of money needlessly.

"The following-named companies complied with the requests of the department and removed all poles and wires from the streets that were being improved with a permanent paving:

Chicago Telephone company	18 miles
Western Union Telegraph company	6½ miles
Commonwealth Electric company	3½ miles
City also removed	3½ miles
Total miles of pole lines removed	31½ miles

"The removal of poles and wires from the 31½

miles of streets represents an expense to the companies of over $400,000, and is a very creditable indication of their efforts to keep pace with the permanent improvements of the city."

Electrical Vote Recording in Legislative Bodies.

During the early part of the recent session a bill was introduced in the House of Representatives by Mr. Otey for the erection of an electrical device or appliance in the rear of the speaker's desk and facing the main entrance, to be connected with each member's desk, so that each member would be enabled, individually, to touch a button and show the record of his vote by a small incandescent light. After the presentation of the bill Mr. Otey laid the matter before the acting architect of the capitol, who is somewhat of an electrician, Mr. Elliott Woods, in order to obtain from him suggestions as to what would probably be the best method of attaining the desired end—namely, saving of time—over the present method of recording a vote. Mr. Woods calls attention to what he considers to be three essential features to make such a device a working success: First, the names of the members should be visible from every part of the house, as well as their vote; second, there should be a duplicate device placed in such a position that it would be in front of the tally clerk; third, the device should be so arranged that it would place upon record, on paper, the result of the vote, so that it could become a part of the record.

It is suggested that the principal device should consist of a large board, placed so that it would be well above the speaker and in full view of the members, this board to be so divided that there will be a number of spaces equal to the number of members, the name of the member to be shown in black on white porcelain or glass. At the right of the name would be two small spaces, one to register the "aye" and the other the "nay" vote. The duplicate would be a miniature representation of the first, and could be placed under a sheet of plate glass in the top of the tally clerk's desk. At the right of this tally device would be arranged an automatic punching and adding machine to record the vote.

The other end of the device would be a set of two buttons, to be placed in each member's desk, to record the vote, and a third button and a corresponding space are suggested in order that there might be a record of "present, not voting."

To perfect such a device would take some time, and it is thought that the cost might be anywhere between $10,000 and $15,000. It is suggested that such a device would completely revolutionize methods of procedure in the House. A. F. T.

A similar device is suggested for the Chicago City Council. Here it is proposed to attach an electric register to the wall in the vicinity of the mayor's chair, this register to be controlled by buttons placed on the desk of each alderman. Opposite the name of each legislator would be sufficient space to include the words "yea" and "nay" on blocks concealed by shutters except when the machine is in operation. After the measure to be voted upon was read and at the conclusion of the chair's announcement it would be an easy matter for each alderman to express his approval or disapproval by simply touching the "yea" or "nay" button on his desk. The device could be so arranged that if an alderman changed his mind after recording his vote he could, within the usual time, change it by simply reversing the buttons. With such a system in vogue the vote could be announced on any proposition, no matter how important, within the time ordinarily given to the calling of the first four wards.

Ozone for Treatment of Consumption.

A sanitarium is to be started in Cleveland soon for the treatment of consumptives by an ozone process lately devised. The use of ozone for the purpose is not new, but the method to be used is somewhat different from that formerly employed. Col. W. S. Rogers of the Brush Electric company, who is largely interested in the project, states that the object in establishing sanitariums is to enable patients to remain in an atmosphere permeated with ozone until relief is afforded. Ozone is produced by the electrical process. The plan is to organize a parent company in Cleveland and, after demonstrating the success of the treatment in the first sanitarium there, establish others throughout the country.

The People's Light and Power company of Reading, Pa., has been organized by James K. Getz, Alfred Gunkel, Ellsworth Leinbach, Milford N. Ritter, Frederick M. Yeager, Frank Brobst, A. L. Roth, Daniel J. Driscoll and Albert Webber, who have applied for a charter to do an electric-lighting and heating business.

Problems of Electrical Power Transmission.

By William Gilbert Irwin.

The economic storage, transmission and utilization of waterpower for the modern purposes of industry by electrical methods as now conducted at Niagara Falls and throughout the western states and in foreign countries have rightly aroused an interest in the processes of this interesting latter-day development of power and transmission. The problem to be solved in the electrical transmission of waterpower over long distances lies more in the invention or discovery of cheaper apparatus for its transmission than in obtaining higher pressure, for under ordinary conditions the cost of equipment is of greater consequence than the limits of practical voltage. In the wholesale transmission of waterpower energy over long distances the vital question is the delivery of such energy at the points of utilization at a saving over the cost of producing similar energy from coal at those points, so as to enable it to compete with the steam or gas engine. Under ordinary conditions the cost of, and losses in, the electrical machinery necessary for the extended transmission of electrical power are such as to more than offset the difference in favor of cheap waterpower, when compared with power generated from coal when ordinary prices for this fuel prevail. However, it must be borne in mind that the transmission of power on a large scale to large cities or great manufacturing establishments is widely different from supplying small and scattered consumers with such power, since these latter power users are not in a position for producing their own power at an economical figure. With the great power users the mere difference in cost between the cost of unit energy from waterpower and the cost of a similar production by fuel consumption at the point of use determines the matter. In spite of the fact that the power of falling water is easily utilized, it is true that a great many of the best waterpowers in this country have been developed at a large investment of capital upon which the power developed brings but a small return.

Some figures of past experiences in this direction may be of interest at this time. Assuming 90 per cent. each for dynamos and motors, 95 per cent. each for two sets of transformers and 85 per cent. for line efficiency, we would have a combined efficiency of electrical transmission equipment of 62 per cent., and, assuming that $15 would be the actual annual cost per horsepower per year, the cost at the point of utilization would be $24.19. At present the cost of electrical transmission equipment is $86.15 per horsepower of delivery capacity at the point of utilization, at the price of $25 per horsepower capacity of dynamos and motors and $10 per horsepower for transformers, the total dynamo capacity being 2.45 and transformer 2.49 times the power delivered or capable of delivery. If we allow $60 per brake horsepower for the machinery of a steam-power plant at the point of the power utilization, an additional expense of $26.15 per delivered horsepower would be entailed. Assuming that the annual interest, depreciation, repairs, etc., would be equal to 16 per cent. of this additional outlay, we would have an annual cost of $28.37 per horsepower per annum for electrically transmitted power, against $11.25 for a similar plant equipped with steam power, admitting the assumption that the same labor of operation and building cost for the two stations and electric transmission would be equal to that of a steam power capable of a similar power.

The combined efficiency of the modern electrical transmission power plant of to-day, omitting the consideration of line loss, is about 73 per cent., so that for each horsepower delivered by the motor 1.37 horsepower must be supplied to the dynamo. Giving the motor the capacity of 1, step-down transformer 1 ÷ 0.9, step-up transformer 1.11 ÷ 0.95 and dynamo 1.16 ÷ 0.9, it will be readily seen that the cost of electrical equipment is 1 + 1.22 times $25, and transformers, 1.11 + 1.16 times $10, which would give a total cost of $78.20 for each horsepower per annum delivered, to which an addition of 16 per cent. must be added for taxes, repairs, depreciation, etc. The cost of coal, according to the best steam-engine practice now in vogue, at $3 per ton does not exceed $12 per annum for each horsepower delivered, and in gas engine practice there would be a further economy. These figures are applicable wherever economic fuel is available, which leaves the inference that many improvements in equipment and manner of electrical power transmission must necessarily follow before this form of energy can compete with steam power for all the purposes of modern industry.

National Contractors' Association Proposed.

The United Electrical Contractors' association of New York state, which was organized in August, 1899, for the protection of the mutual interest of the members and the promotion of a more cordial feeling in the contracting trade, has issued a call for a meeting at the Builders' Exchange building in Buffalo, N. Y., on July 17th, for the purpose of forming a national electrical contractors' association. The New York association includes the larger contractors in all the cities of the state and has proved itself a benefit to all the members. W. H. Morton, 31 Catharine street, Utica, N. Y., is secretary of the association, and he will be glad to furnish any information desired in regard to the proposed national organization.

Mars and the Earth.

[From the Monthly Weather Review.]

On December 16th Professor Pickering, of the Harvard College Astronomical Observatory, received from his assistant at the Lowell Observatory at Flagstaff, in Arizona, a telegram saying that a shaft of light had been seen to project from the planet Mars, lasting 70 minutes. Whenever anything remarkable is observed in the heavens the facts are at once telegraphed to all interested astronomers in order that they may concentrate attention upon the subject, and add as much as possible to our knowledge before the fleeting phenomenon has vanished. This was done in the present case, telegrams being sent to astronomers in both Europe and America. The Lowell observatory gives especial attention to the planet Mars, and has already published a magnificent volume showing the apparent changes that occasionally occur.

This simple announcement of an observed fact has come back to America as a news item scarcely recognizable, viz., that Professor Pickering has been in communication with the planet Mars. This story has brought out from Tesla the statement that he also has observed on his telegraph wires electrical oscillations that may have come from Mars or some other planet, though he does not give us any data by which to judge of the rationality of this conclusion. Following him, Mr. William A. Eddy of New York announces that ever since 1890, or whenever he flew his kites by means of metal wire, he was liable to receive electric currents that must have come from some planetary region, or, possibly, the sun, or the upper atmosphere.

Following upon these newspaper paragraphs, an occasional correspondent inquires, first, as to their authenticity, and next as to their relation with meteorology.

We think we have said enough to show that the original observation published by Professor Pickering is reliable. We believe the other observations by Tesla and Eddy are probably explicable as the result of the ordinary irregularities in terrestrial magnetism, and do not necessarily place us in connection with planetary bodies. Finally, we agree with our colleague, Mr. Talman (and others who have written on the subject for a century past), as to the extreme improbability of there being anyone alive on any of the planets with whom we could have intelligent exchange of ideas, even if optical or electrical signals could be sent and received.

Recent studies by means of liquid air have shown that the earth's atmosphere is undoubtedly constantly giving to and taking from interplanetary space a little of the more volatile gases, hydrogen, helium, neon, argon, xenon and krypton—we might thus occasionaly interchange a molecule or two with Mars or Jupiter—but these interesting possibilities should not be heralded as the meteorology of the future. Meteorologists are not studying these finer but the ordinary grosser phenomena of the earth's atmosphere.

At the present time there is absolutely no evidence that the moon or planets have any appreciable influence on the earth, except the well-known ocean tides and the astronomical perturbations due to their gravitational attraction. Of course, they give us a little light in the nighttime, but that would scarcely be spoken of as a powerful influence.

London Metropolitan Railway Contract.

The Chicago Inter Ocean published this special cable dispatch on March 7th: "The District Underground railway has adopted the Sprague multiple-unit system of traction." Inasmuch as the Inter Ocean is controlled by Mr. C. T. Yerkes, who is himself largely interested in London traction enterprises, the dispatch attracted attention. However, in answer to a telegraphic inquiry from the Western Electrician, the Sprague Electric company wrote, under date of March 8th, that "up to the present time" it had not received the London Metropolitan contract.

According to the London correspondent of the Chicago Record, Charles T. Yerkes has arranged to secure a controlling interest in the Metropolitan District Railway company, at a price not far from $9,750,000. It is stated that this is nearly all American capital, and that the line is the key to the whole traction situation in London, as almost every other road in the city is tributary to it. The District route will afford Mr. Yerkes a great trunk system, piercing the heart of London from east to west. Its eastern terminus will be at Whitechapel, its western at Harrow. At Charing Cross, the geographical center of the metropolis, a junction will be effected with the Hampstead line, affording a branch outlet eight miles long to the northwest, with surface road and underground extensions.

Twenty of the leading business men of Kokomo, Ind., have organized an independent electric-light company, and will at once begin the erection of a new plant.

Proposed Philippine Tariff.

A new tariff bill for the Philippine Islands has been forwarded to the secretary of war by the Philippine commission for publication in the United States. The bill is a radical revision of the draft made public about two months ago. After the measure has been examined by manufacturers, exporters and others interested, it will be returned to Manila about April 15th, with such amendements as have been approved by the War Department. Of the articles and materials scheduled, the following are of interest to the electrical industry:

Copper wire, galvanized or not, 1 mm. or more in diameter, net weight, 100 kg	$ 4.00
Copper wire, galvanized or not, less than 1 mm. in diameter, net weight, 100 kg	5.00
Copper wire, galvanized or not, gilt, silvered or nickeled, net weight, kilogram	.35
Copper wire, covered with tissues not elsewhere provided for, or with insulating materials, cables for conducting electricity over public thoroughfares, net weight, 100 kg.	5.00
Marine engines and steam pumps; hydraulic, petroleum, gas and hot or compressed-air motors, net weight, 100 kg.	1.50
Boilers, sheet-iron, gross weight, 100 kg	.50
Boilers, other, gross weight, 111 kg	.75
Apparatus and appliances (not machinery) for electric lighting and power:	
a. Switches, cut-outs, lamp sockets, shade holders, rosettes, plugs, brushes of copper and carbon, wet and dry batteries complete, tapes and compounds for winding wires, testing sets, testing bells for current, arc lamps and fittings for same, fuse boxes, insulating coils, and all insulating materials not elsewhere provided for, net weight, 100 kg	3.00
b. Galvanometers, amperemeters, voltmeters, net weight, 100 kg	25.00
Only articles used exclusively in the generation and distribution of electric currents for light or power shall be classed under this number.	
Storage batteries for lighting or power, net weight, 100 kg..	25.00
Dynamos, generators, exciters and all other machinery for the generation of electricity for lighting or for power, also transformers, net weight, 100 kg	5.00
Automobiles for passengers, each	60.00
Automobiles for merchandise, each	60.00
Tramway carriages of all kinds, each	45.00
Submarine telegraph cables	Free

Commercial Cable Company.

The report of the board of directors of the Commercial Cable company of New York for the year ended December 31, 1900, was presented at the annual meeting of the shareholders on March 4th. The gross earnings from cables and net earnings from land lines during 1900 were $3,696,150.87, the net traffic earnings having increased to the extent of $339,946.65 over the previous year. The expenditures during the year were $1,012,765.33. Out of the balance to the credit of the revenue account there has been set aside $350,000 as an addition to the reserve fund and also an amount of $150,000 to the fund for insurance of stations, apparatus and repair steamer. The reserve fund now amounts to $3,947,232.97 and the insurance fund to $519,409.60. After providing for all operating expenses and reserves, the balance of the net revenue, including the amount brought forward from the previous year, amounted to $2,007,730.18, out of which were paid interest amounting to $720,000 and dividends and bonus on the capital stock of $1,066,664, leaving a balance of $221,066.18. On December 4, 1899, the share capital stock of the company was increased from $10,000,000 to $15,000,000, and of the increase $3,333,300 has been issued at par. An additional cable has been laid between New York and Canso, N. S., and a cable has also been laid between the latter place and Fayal, Azores Islands. The company has entered into traffic arrangements with the Deutsch-Atlantische Telegraphen Gesellschaft, which will be of mutual benefit. There has been added to the company's land-line system 482 miles of poles, 12,693 miles of wire and 62 new offices. The report is signed by John W. Mackay, president of the company.

Metropolitan Elevated Extensions.

The Metropolitan West Side Elevated Railway company of Chicago has issued a letter to holders of the common-stock trust certificates of the road asking authority for the voting trustees to vote in favor of the proposed bond issue at the meeting of the stockholders on April 8th. The letter says the extensions proposed now will cost, approximately, $1,400,000 and the stockholders will be asked to authorize a bond issue of $2,000,000 or more. The letter, in part, is as follows: "The extension of the Garfield Park line to West Fifty-second avenue is for the purpose of constructing an incline to reach the grade of surface tracks at that point where traffic may be conveniently interchanged with interurban roads. The railroad of your company has been in operation a sufficient length of time to justify the assertion that, to make the common stock dividend-paying within a reasonable time, it is necessary that the traffic of the road should be increased. It has shown a healthy growth, but it is believed that a system of feeders in the way of extensions will greatly accelerate such growth and hasten the time when the common stock shall receive dividends. It is almost impossible for outlying electric railroads to obtain permission to enter the city limits, and the nearer your railroad can approach to those lines the more certain it is of reaching the vast volume of outside traffic brought in by interurban electric railroads which are being built in all directions."

The West Nashville Light and Power company of West Nashville, Tenn., has been chartered, with $15,000 capital, by M. G. Cockrill, L. H. Davis and others.

CORRESPONDENCE.

New York Notes.

New York, March 9.—Work has been begun on the City Hall loop of the rapid-transit tunnel. The plans have been changed from those originally made, and as it has not yet been decided definitely whether or not the Brooklyn tunnel trains will run through on the Manhattan line or transfer their passengers, it is possible that further modifications in the loop terminal may be necessary. The route of the Brooklyn tunnel, as decided upon, seems to meet general approval excepting in the case of one Railroad company is chiefly interested in the road Brooklyn alderman, who thinks that the Long Island as planned, as it will run to the Flatbush avenue terminal of the Long Island railroad. President Alexander E. Orr, of the Rapid Transit Commission, however, states that no railroad company has appeared before the board, and that the latter has acted solely in the interest of the public in trying to relieve the congestion in Fulton street. Mr. Orr said that the tunnel might be completed by January 1, 1904.

The Rapid Transit Commissioners have appointed Dr. Louis Duncan and Dr. Cary T. Hutchinson as electrical experts to assist Chief Engineer Parsons. The compensation of the commissioners for 1900 has been fixed at $5,000 each by the Supreme Court.

Two test cases are about to be brought to determine whether the City Department of Taxes and Assessments has the right to fix the value of franchises held by New York city corporations, independently of the State Board of Tax Commissioners, in assessing the capital and surplus of these corporations. President Feitner of the city department fixed on a value of the franchise of the Metropolitan Street Railway company and included this amount on the corporation tax books. The Metropolitan Street Railway company contended that the local officials had no right to do this, and that their assessments were too high. The company obtained a writ of certiorari and the matter will now be fought out in the courts.

The Postal District Messenger company, with a capital of $10,000, has been incorporated in New Jersey by W. H. Baker and John O. Stevens, respectively vice-president and secretary of the Postal Telegraph-cable company, and Charles P. Brush. The articles provide that the business of the concern may be conducted in every state, territory and colony of the United States. The company is incorporated to include the business of a common carrier and construct telegraph and telephone lines. An officer of the Postal Telegraph-cable company said that the organization of the new concern was simply a matter of legal expediency, and that it would be to the Postal company what the American District Messenger company is to the Western Union.

The strike which was threatened among the bridge employes as a result of the withdrawal of passes by the Brooklyn Rapid Transit company was not called, and the employes have been informed that they will be allowed to wear badges which will entitle them to free passage. In defense of the action of the company in abolishing free passes President Rossiter said that the privilege had been abused.

The Chamber of Commerce has appointed a committee of three to investigate the overcrowding of the City Hall terminal of the Third avenue line, and the officials of the Manhattan Elevated and Brooklyn Rapid Transit systems have promised their cooperation, even to the extent of pledging their companies for the expense of engineering experts, if such were needed. M. L. G.

Canadian Intelligence.

Ottawa, Ont., March 9.—The Town Council of Thessalon, Ont., has decided to take steps to install an electric-light plant, to be owned and operated by the town.

The Grand Trunk railway has under consideration a plan to run electric cars of its own over the Victoria bridge, across the St. Lawrence, at Montreal. The cars will connect with electric lines on both sides of the river.

It is reported that arrangements are nearly completed for securing electric power for the city of Toronto, Ont., from Niagara Falls, by the end of the coming summer, at a great reduction in the present cost of power. Preliminaries for the production and delivery in Toronto have been worked out.

Messrs. Henry W. Garth, L. J. Tarte, J. O. A. Laforest, E. S. Manny and J. A. Thivierge, all of Montreal, Que., are seeking incorporation from the Dominion Parliament as the Laval Electric Power company, with a capital of $100,000. The object of the new company is to supply electric power, light and heat. The power house is to be located on Riviere de Prairie, where 10,000 horsepower can be readily developed at small cost. The expectation of the promoters is that their company will furnish light for all the villages along the north shore in that neighborhood, and ultimately they expect to reach and do business in Montreal.

The success which has attended the experiment made by the city of Winnipeg, Man., in operating its own electric plant, is put forward in this country as a signal victory for municipal ownership and operation of public utilities. On February 17, 1900, Winnipeg inaugurated a municipal system of electric street lighting, and also the lighting of all civic buildings. The result has proven more satisfactory than its most ardent advocates predicted. According to a report presented by Commissioner Stuart, the cost to the city per light per night has been less than 19½ cents. The year preceding the cost was 45 cents. In addition to the reduction in the cost, the light furnished has been very greatly improved.

Mr. J. B. Charleson, who is superintending for the Dominion government the construction of the all-Canadian telegraph line to the Yukon district, has arrived in Vancouver, B. C., with his party, and will start at once to exploit a route for 100 miles of telegraph between Fort Simpson and Hazleton. The line is regarded as of the greatest importance, as it will place the large fleet of northern vessels, passing Fort Simpson, in telegraphic communication with the outside world, as well as all the northern canneries and wrecks and casualties will thus be reported promptly. This line, the branch lines in the Omineca district, between Fraser Lake and Manson Creek, and in Cariboo, also that between 150 Mile House and Quesnelle, and the 35 miles of the all-Canadian main line, now unfinished, will be under construction at the same time, and all will be completed during the coming summer.

Lake Erie ports, on both sides of the international boundary, are threatened with loss through damage by the lowering of the level of the lake, the Niagara River drawing off great quantities of water to furnish electric energy. At the recent meeting of the Ontario Surveyors' association the matter was discussed and remedial measures considered. It was shown that the supply was drawn from the great lakes, over an area of 150,000 square miles, to provide electric power. It is suggested that the capacity of the Niagara River be increased by widening and deepening its bed for certain distances, or by raising the water in the lake above the river level. A dam at Black Rock harbor, near Buffalo, and a channel are proposed, the dam to have a total length of 2,810 feet, with a suitable channel, the cost of the channel to be $1,600,000 and the cost of the dam $800,000. During the discussion it was shown that, by damming in this manner, the level of Lake Ontario would be lowered, which would involve much expense in deepening the harbors of the cities along its shores. A. V. W.

Northwestern Notations.

Minneapolis, March 9.—A Pennsylvania electric-railroad company has looked over the ground between Cassville and Bloomington, Wis., with a view to constructing a trolley system.

Chicago capitalists are said to favor the projected electric railway from Keokuk, Iowa, to Peoria, Ill.

The street-railway company of Fort Dodge, Iowa, will extend a car line to Driving Park.

The council of Waterloo, Iowa, has passed an amended ordinance for the electric-lighting company.

Professor Springer, of the electrical department of the University of Minnesota, has been conducting a series of experiments at the courthouse in Minneapolis, with a device of his own invention, to determine the power and speed of the electric elevators in the building.

The Gas and Electric company of Aberdeen, S. D., has been sold by J. S. Bartholomew of Grand Forks, N. D., to Howard & Hedger of Aberdeen. The system will be extended and improved.

New York capitalists have made a proposition to the Wisconsin Valley Advancement association to construct an electric railway through the valley from Nekoosa to Eagle River.

The Electric Railway company of Oskaloosa, Iowa, is preparing to expend $225,000 in the construction of an electric-railway system.

An electric-light plant will be installed at the Institute for the Feeble Minded in Redfield, S. D.

An electric-light plant is projected for Wilton, Wis.

The Northern Electrical Manufacturing company of Madison, Wis., has filed amended articles of incorporation, increasing its capital stock from $50,000 to $500,000.

E. L. Stilson plans to put in an electric-lighting system at Corwith, Iowa.

A combination is proposed at Eau Claire, Wis., of the Chippewa Valley Electric Railway company, the Eau Claire Light and Power company, the Eau Claire Gaslight company and the Chippewa Falls Waterworks and Lighting company.

The street-railway company in St. Paul has changed the motors on the cars of the Selby Avenue line from two of 50 horsepower to four of 25 horsepower each. The result is the cars start more quickly. The change makes all wheels driving wheels, instead of having two dead axles on each car.

The Hutchinson (Man.) Lighting company has lowered its minimum lighting rate from $1 a month to 50 cents during the summer months and $1 a month for the remaining months.

The Beloit, Delavan Lake and Janesville Electric Railway company has been incorporated at Janesville, Wis., to build a line to Rockford, Ill. The capital stock is $100,000. Beloit refuses a franchise. In the event of the city refusing to permit the line, the company will run around that city.

The Seattle Electric company of Seattle, Wash.,

will build its Green Lake line through Woodland Park.

Work has been begun at Everett, Wash., extending the street-railway line. R.

Southern Developments.

Charlotte, N. C., March 9.—The Norfolk Railway and Light company has been granted a franchise to operate an electric line in Berkley, Va. The Berkley Street Railway company was also an applicant for franchise privileges.

A power plant is being constructed at Tallusee Shoals, near Athens, Ga., from which it is proposed to obtain power for a $300,000 cotton mill projected by J. R. White, W. T. Bryan and others.

The sum of $80,000 has been spent upon the new electric line at Selma, Ala., purchased last August by Colonel F. M. Abbott for Pennsylvania capitalists. The entire line has been reconstructed and at an early date work will be started upon a four-mile extension to a suburban park.

The citizens of Thomaston, Ga., have voted in favor of an issue of $10,000 electric-light bonds. The bonds will be sold and a system of electric lights established.

The electric-light plant at Albany, Ga., has been damaged by fire to the extent of several hundred dollars. L.

From the Buckeye State.

Columbus, Ohio, March 9.—There may be a through electric-railway line from Cleveland to Pittsburg before very long. The Chagrin Falls company will extend its lines to Warren, where they will connect with the Mahoning Valley lines, giving connection east to Pittsburg. The Painesville and Eastern will also be extended, possibly to Erie, Pa. The Northern Ohio will connect Canton and Akron, and a company was incorporated a few days ago with the intention of connecting Columbus and Cleveland, and possibly Cincinnati and Cleveland.

The Cincinnati Traction company has been negotiating with the owners of the street railway at Hamilton and also at Dayton to purchase the roads outright. The Philadelphia syndicate controls the Millcreek Valley road, it is said, and desires to secure the Hamilton road in order to gain an entrance to the town.

The funeral of Thomas H. McLean, manager of the Toledo Traction company, occurred at his home in Toledo on Saturday. It was attended by many close friends in Toledo and by all the street-railway employes who could be present. The remains were taken to Buffalo for interment. The physicians have stated that Mr. McLean's death was due to pneumonia. His successor has not as yet been chosen.

The commissioners of Portage County have agreed to grant the Northern Ohio Traction company a franchise to build a line through the county to Kent and Ravenna, over the Lake Brady road. The Portage Lake Traction company has made some changes in its route, and now announces that it will build a line from Ravenna to Kent. It is said the Little Consolidated road of Cleveland is behind the Portage Lake Traction company.

The United Heat, Light and Power company of Kentucky has been formed to light the Kentucky towns opposite Cincinnati. The company will be capitalized at $1,500,000.

McDonald & Cress are promoting a traction line from Dayton, Ohio, to Richmond, Ind. They have made application to the authorities of Richmond for a franchise. It is said that James Murdock of Richmond is backing the scheme. The new line will probably make connection with the Dayton and Western.

A committee of citizens of Findlay, appointed at a mass meeting a few days ago, has indorsed the Western Ohio Railroad company as the one they should support in its endeavor to build a line between Findlay and Lima. Two companies are seeking a franchise.

The Toledo, Napoleon and Defiance Railroad company has been granted a franchise by the Village Council at Maumee. The Toledo and Maumee Valley company has asked for a franchise from the center of town to the southern part, so that it may get to a point of connection with the proposed Toledo, Waterville and Southern, in which the same people are interested, but the people show a disposition to refuse the request on the grounds that the old road has not been lenient enough with them.

Sandusky and Toledo are both after a big plant which is to be established for the manufacture of convertible street-railway cars. H. Romunder of New York has the matter in charge and has been looking over the ground at both places. It is said that he has orders for a large number of the cars now and will, of necessity, have to decide upon some location soon.

There is some probability that the Findlay Southeastern Electric Railway company will connect Columbus and Toledo by connecting with the Toledo and Bowling Green, and with the proposed extension of the Columbus, Worthington and Clintonville at Delaware. There is a small stretch of road to be built yet to connect the Findlay street railway and the Toledo and Bowling Green, but this will probably be built this summer.

The Cincinnati, Milford and Hillsboro Railway company, Hillsboro, has been incorporated, with a capital stock of $10,000. The incorporators are H. L. Wiggins, J. B. Worley, M. McKehan, W. F. Roudebush, G. U. Roudebush, Joseph Higgins, Ed. L. Warson and D. W. Murphy. The plan is to build a line from Cincinnati to Hillsboro.

The town of Canal Winchester has granted a franchise to the Columbus, Winchester and Lancaster Traction company, after a hard fight, and the men interested say they expect to begin work by June 1st.

The Sandusky and Interurban company is purchasing a private right-of-way at Berlin Heights.

The Northern Ohio Traction company has let the contract for a large addition to its power house at Akron.

The Newark and Granville Electric Railway company is preparing to build a new power house and car barn at Newark. New engines and generators have been purchased.

H. W. Wiswell and others have arranged to open a factory at Niles for the manufacture of lamps and transformers.

H. C. Hutchinson has been promoted from general superintendent of the Cincinnati Edison Electric company to the position of assistant general manager.

The Sterling Electrical Manufacturing company of Cincinnati has been incorporated, with a capital stock of $15,000, to manufacture electrical appliances. The incorporators are Thomas McDougall, T. S. Williams, W. C. Rippey, Taylor McDougall and John E. Sheppard.

The City Council of Circleville has granted a franchise to the Columbus and Southern Railway company.

The officers of the interurban lines reaching Cleveland have purchased land on Boliver and Eagle streets, in that city, as a site on which to erect a union station. A building costing about $70,000 will be erected.

The commissioners of Belmont County have granted a franchise to the Ohio Rapid Transit company, which will build a line into Harrison County.

The injunction secured by the Western Union Telegraph company against the city of Toledo, to prevent its interfering with the stringing of wires for a messenger service, has been dissolved by the United States Circuit Court of Appeals and the action of the lower courts has been reversed. The company will now be compelled to obtain a franchise from the lower courts.

T. C. Harnish, formerly sales agent of the General Electric company at Cincinnati, has been promoted to the office of assistant first vice-president, with headquarters in New York.

The Columbus, Delaware and Northern Traction company of Columbus has been incorporated, with a nominal capital stock of $10,000, to build a line from Columbus to Marion, by way of Mount Vernon and Delaware. James M. Loren, a well-known attorney, O. J. Mitchell, Herman G. Dennison, James M. Schooler and Lorenzo M. Baker are the incorporators, and are all residents of Columbus. Should this road be completed it would be easy to make connections over various lines between Cleveland and Cincinnati. O. M. C.

Information from Indiana.

Indianapolis, March 11.—The City Council of Anderson has reported favorably on the acceptance of a loan of $200,000 to the city by Indianapolis capitalists to enlarge the city electric-light plant and for other necessary improvements.

Leading business men and capitalists are organizing a new electric-light company at Elkhart, and a petition for a franchise is now pending before the council. It is said that the council will grant the contract for the city lighting to the new company. Business men and manufacturers employing much light and power assert that this step is forced because of the excessive rates charged by the old company.

An electric-light franchise has been granted to L. K. Davis by the board of trustees of Greenwood. It is understood that the plant will be completed by September 1st.

James DuShane, representing the St. Joseph Hydraulic company, is closing up the purchase of land that will be submerged by the building of a dam 21 feet high to create power for an electric power and light station to be erected at Needham. The electricity will be utilized at South Bend, Mishawaka, Elkhart and in the surrounding country.

The new $10,000 municipal electric-light plant was put into operation at Thorntown for the first time during the last week. It is satisfactory in every way.

A franchise has been awarded to E. H. Dugger and J. E. Meredith for an electric-light and power plant at Bloomfield, the plant to be completed by December 1st.

Senator Binkley of Richmond succeeded in getting his bill through, authorizing incorporated cities not acting under special charter to create boards of electric-light commissioners, but not in time to prevent the letting of a contract for a local plant. The commission, however, will have charge of the new plant.

The election of George F. McCulloch of Muncie president and general manager of the Union Traction company caused the belief that the offices of the company would be transferred to Muncie. This will not be done, however, as Mr. McCulloch's predecessor, Charles L. Henry, had it inserted in the articles of incorporation that the head offices should remain in Anderson, which is geographically the center of the system, containing over 160 miles of electric road. Anderson is the hub, and has the $800,000 power house—the center, in fact, of the system.

The Muncie Interurban Railway company has secured the right-of-way for a road or extension from Muncie to Hartford City and Redkey, taking in a number of intermediate towns. It is said this line will be built even should the negotiations between the Union Traction company and the Muncie Interurban company be consummated, by which the latter will become a part of the former great system.

Philip Mater, vice-president of the Union Traction company, announces that the company has decided to extend the line from Marion to Converse, 12 miles west, and ultimately to Peru, 20 miles beyond. The Converse link will be the first completed and put in operation early in the summer.

A railway war is imminent at South Bend unless the two companies holding franchises from the city reach an agreement. Eastern capitalists, by the expenditure of a large sum, gave the city a system equal to the best anywhere, ran a line to Goshen, and now have in mind to build to St. Joseph, Mich., a well-known summer resort. Other capitalists from Michigan built a line from South Bend to Laporte. After a hard struggle in council, a franchise was granted them, but not until after they had hooked with the Indiana people, who threaten, under the rights of the franchise, to build lines on every street in the city if necessary to protect their rights under their franchise. The Indiana company bondholders are alarmed over the situation, and the proposed St. Joseph extension is threatened.

The Indianapolis and Frankfort Interurban Electric Railroad company (a new company) has asked the commissioners of Clinton County for the right-of-way over the highways of that county. The company is composed of Indianapolis men, headed by Senator Joss, and is backed by Eastern capitalists. The plan is to construct a trunk line connecting Indianapolis and Frankfort, and later to build branches reaching Tipton, Kokomo, Delphi, Logansport, Lafayette and intermediate towns.

A. D. Ogborn has secured a franchise through Newcastle and Spiceland for an electric line from Newcastle to Knightstown, where it will meet the extension of the Greenfield line.

The Union Traction company is about to establisl an express system over its interurban lines.

The Indianapolis and Lebanon Traction company has filed articles of incorporation, with a capital stock of $400,000. The board of directors is headed by William Helfenberger. The road will extend from Indianapolis to Lebanon.

Lee Sohngen and T. Jellison of Hamilton, Ohio, were in Richmond recently in the interest of a new line, to be constructed between Hamilton and Richmond.

A novel claim has been filed against the Indianapolis Street Railway company. A car that was to carry an East Michigan street resident to his home was 20 minutes late, and when he got there he found his kitchen on fire, as a result of increased gas pressure. He demands $90, contending that if the car had been on time he would have arrived before the fire started. If not paid suit will be brought.

Hugh J. McGowan, president of the Indianapolis Street Railway company, and selected for a similar position with the Cincinnati Traction company, has decided to reside in Indianapolis and divide his time between the two cities.

The loading and unloading of freight by the interurban lines entering Indianapolis is seriously interfering with traffic on several of the principal streets. New rules are asked for by the merchants.

The Indiana Appellate Court has decided that a person becomes a passenger on a car as soon as he steps upon the running board or steps of the car, if he has signaled the car from a stopping point, or its speed has slackened. Street railways are required to give passengers ample or reasonable time to get on and off, and when one enters a car as a passenger it is the duty of the conductor to see that he is in a place of safety before starting the car.

It is said the finest electric car on an electric railway in the United States will appear soon on the system of the Union Traction company. It is built according to an original design by Charles L. Henry, general manager of the company. It is 50 feet long, with exterior finish in dark olive green and interior of cherry red. The entrance will be from the side of the car near the center. There will be two desks and one compartment and a small electrically heated range, where a lunch or dinner may be prepared. In the other end of the private car will be a sitting-room with chairs and couch. The car is designed for the use of General Manager Henry while going over the system, and may also be used by the paymaster semi-monthly in making his rounds. It will also be used for private trolley parties.

A $350,000 electric power plant will be erected at the corner of Pennsylvania and Maryland streets, Indianapolis, by the Schmidst Brothers.

The Indianapolis Board of Safety is considering the proposition to give the Gamewell Electric Fire Alarm company $63,000 for a new fire-alarm system. There are other bidders now, and the board is advised to repair the present system, which can be done for a quarter of the sum named.

The Parry Manufacturing company of Indianapolis has been reincorporated and has fixed its capital stock at $1,200,000. The state's fee for filing

was $1,201.70. The company will manufacture automobiles in connection with the carriage department.

Almost every corporation in Indiana depending on a franchise has been stirred to a fierce fight to defeat a bill in the Legislature which gives any citizen the right, by quo warranto proceedings, to attack the possessor of a franchise on the ground that the conditions of the franchise have been violated. It is intended to give citizens power when prosecuting attorneys or other officials are careless. The telephone companies, the gas companies and the street-railway companies are jointly lobbying against the bill.

The bill introduced to prevent damages by electrolysis to water and gas pipes has been reported unfavorably, and this will be the last of it this session.

The automobile owners and drivers have become so numerous and careless about driving their machines rapidly over the streets at Indianapolis that the chief of police has suggested that the council pass a special ordinance to regulate the use of automobiles and punish scorchers. F.

PERSONAL.

Mr. A. Miller Belfield, heretofore associated with the Chicago patent-law firm of Charles A. Brown & Cragg, has been admitted to partnership. The new firm will practice under the name of Charles A. Brown, Cragg & Belfield.

Dr. M. I. Pupin of Columbia University, New York city, has been promoted from adjunct professor of mechanics to a full professorship in electromechanics, the position having been created especially for him in recognition of his recent work in long-distance telephony. It is stated that Dr. Pupin will represent Columbia University at the four-hundred-and-fiftieth anniversary of the University of Glasgow in June.

Mr. Marconi is about due to arrive in this country. He sailed on the Majestic on March 6th for New York and stated that he was coming to the United States mainly on private business, but that he would meet some members of the equipment bureau of the navy with the purpose of having his system of space telegraphy examined. He expects to fit up a number of coast stations for communication with lightships, and hopes to make trials on an American warship as well.

ELECTRIC LIGHTING.

An electric-light plant is proposed for Concord, N. H.

An issue of $65,000 bonds for a lighting plant is proposed at Mansfield, Ohio.

Citizens of Sabetha, Kan., are considering the erection of a $10,000 lighting plant.

The people of Winchester, Tenn., are in favor of issuing $30,000 five per cent. electric-light-plant bonds.

Between December, 1887, and January 1, 1901, the city of Chicago expended $2,786,112 on its electric street-lighting plants.

The Canton Light, Heat and Power company of Canton, Ohio, has increased its capital stock from $150,000 to $225,000. Extensive improvements are to be made to the plant to increase its capacity and efficiency.

The Electric Storage Battery company of Philadelphia, Pa., has recently closed a contract with the United Electric Light and Power company of Baltimore, Md., for the installation of a battery of Chloride accumulators, consisting of 132 elements, having a capacity of 1,200 ampere-hours, and with tanks allowing an ultimate increase by additional plates to a capacity of 2,100 ampere-hours. The battery is located 5,000 feet from the power house, and is to be operated in connection with two boosters having a capacity of 500 amperes at 35 volts. This battery is for the purpose of furnishing light and power to the Continental Trust building and the Merchant Bank building. The current is furnished from the power house at 220 volts. As it is intended to use 110-volt lamps and 220-volt elevator motors, a third wire will be taken from the center of the battery to form the neutral of a 220-volt, three-wire system. Two constant-current boosters will be used on the outside wires for regulating the elevator load.

ELECTRIC RAILWAYS.

An American company is proposing to equip the Manila street railway with electric power.

The Caro and Lake Huron Railway company has filed articles of incorporation at Lansing, Mich., with $200,000 capital stock.

The Union Traction company of Trenton, N. J., incorporated recently with $1,000,000 capital stock, has increased its capitalization to $15,000,000.

The Lyons and Sodus Bay Railway company was incorporated recently at Lyons, N. Y., with a capital stock of $400,000. The directors are James D. Bashford, Calvin Hotchkiss, Charles P. Williams and Daniel Barton of Lyons; Sanger W. Case of Sodus; Daniel B. Platt, Charles Van Voorhis, Ira H. Luddington and Stephen G. Hollister of Rochester, N. Y.

The Lexington Railway company of Lexington, Ky., of which R. Lancaster Williams is president, will increase the capacity of its plant and extend its road.

The Chicago commissioner of public works has proposed a plan for the surface lines in the downtown district, by which all trolley roads would make use of a double-track loop under the present elevated structure.

The Belleville Traction company of Belleville, Ill., is trying to obtain franchises for a system of roads between Red Bud, Ill., and St. Louis. The work is that for which the Mississippi Valley Traction company obtained franchises some time ago, but these were allowed to expire and the roads were not built. The lines are proposed in anticipation of the traffic expected during the St. Louis Exposition.

A consular report states that a concession has been granted for an electric road about five miles in length near Barcelona, Spain. The cars are to be drawn by accumulator locomotives, and the engines, accumulators and cars are still to be contracted for. The chief engineer is the Marquis Armand de Bourbon Neilson, and he may be addressed in care of Messrs. Corady y Cia., Boria, 1 plaza Angel, Barcelona.

It is reported that Benjamin T. Cable has secured an option on the Baker Street and Waterloo underground railway in London for Albert L. Johnson; it is also stated that the latter's brother, Tom L. Johnson of Cleveland, is interested in the deal, which is said to include another underground line connecting with the Waterloo road. Mr. Cable denied any knowledge of a proposed merging of the Johnson and Yerkes interests.

A decision was handed down in the United States District Court at Cleveland recently declaring unconstitutional the three-cent street-car-fare ordinance passed by the City Council two years ago. The court maintained that the ordinance interfered with existing contracts. The Cincinnati and Cleveland Railroad company is seeking franchises in Cleveland, promising to sell tickets good before 7 a. m. and between 6 and 7 p. m. at the rate of 25 for $1 and 50 for $1.50, and this application will probably be affected by the decision.

The Traction and Light company, with an authorized capital of $4,000,000, has been incorporated at Trenton, N. J., to manufacture light, heat and fuel, to do a transportation business in New Jersey not requiring condemnation of property, and to construct and operate railroads outside of that state. The stock is divided into $1,000,000 first and $1,000,000 second preferred, each with four per cent. noncumulative dividends, and $2,000,000 common. The incorporators are Samuel Thomas and Samuel B. Lawrence, New York, and James C. Young, Jersey City.

The success of the experiments conducted by Thomas W. Fordyce, with electricity as motive power for canalboats, has resulted in the incorporation of the Miami and Erie Canal Transportation company, whose purpose is to operate boats on the Miami and Erie Canal between Cincinnati and Toledo. The company will build a trolley line solely for the purpose of propelling boats between the termini of the canal. The capital stock is fixed at $10,000, and the incorporators are Thomas W. Fordyce, D. J. Ryan, R. F. Wirthwine, E. R. Buss and M. I. Watts.

At the meeting of the Chicago City Council on March 11th an ordinance repealing the extension franchise of the Calumet Electric Railway company, granted November 11, 1895, because of failure to pay compensation to the city, was introduced and referred to a committee. The Metropolitan West Side Elevated Railway company was granted a franchise for a surface line running east from Austin boulevard to South Fifty-second avenue, the present terminus of the road. The line is to be completed within 2½ years and only one fare is to be charged from Austin to the Union loop. An ordinance granting a franchise to the Chicago City Railway company for the extension of its lines in Sixty-third street from Hyman avenue to Chicago Lawn was sent to a committee.

Talk of a consolidation of the Chicago elevated railways continues, and the advance in Metropolitan shares is generally taken to mean that negotiations are now on with the principal owners of the property to bring it under the control of the Blair syndicate, which recently acquired the Yerkes elevated interests. In all probability as soon as the Metropolitan is taken over the South Side road will be negotiated for. A straight consolidation of all the five elevated properties would require a company of considerably more than $50,000,000 capitalization. The par value of the outstanding stock of all the companies amounts to $51,531,800. It has a market value of $34,287,744. The outstanding bonds have a par value of $22,333,100 and a market value of $21,406,927. The total market value of bonds and stocks figures $55,694,771. The net earnings of the four operating roads are figured at $2,625,000 a year, of which the Metropolitan makes 35.1 per cent., the South Side 27.9 per cent., the Lake Street 16.4 per cent. and the Northwestern 20.6 per cent.

AUTOMOBILES.

The strike of the operators employed by the Illinois Electric Vehicle Transportation company was settled by a verbal agreement on the part of the company to pay the former rate of $2 a day.

The plant of the Olds Motor Works in Detroit was destroyed by fire on the afternoon of March 9th. The firm manufactured gas and gasoline engines, motor trucks, gasoline launches and automobiles and gave employment to about 300 men. The loss is estimated at about $65,000, mostly covered by insurance. One of the chief losses was 20 or more electric vehicles nearly ready for the market. But one automobile was saved. The firm will rebuild immediately and hopes to be running again in a few weeks. The Lansing branch of the firm will assist the Detroit plant in meeting urgent orders.

PUBLICATIONS.

Laufketter & Bendit of St. Louis, Mo., are general sales agents and engineers and contractors for steam, electric and hydraulic power plants. They have recently distributed a wall calendar containing illustrations of some of the engines, pumps and auxiliary apparatus which they handle.

Belt-type machines, both dynamos and motors, in small multipolar sizes are described in bulletin No. 10, recently issued by the Crocker-Wheeler company of Ampere, N. J. The machines, styled form F, at present are built in sizes of three, five and 7½ horsepower. Illustrations show motors belted and geared to different types of machines.

"Hints" is the title of a booklet issued by the American Electric Fuse company of Chicago and New York, which is intended to convey to telephone men valuable hints in regard to the goods manufactured by this company. Fuses, fuse blocks, fuse wire, fuse links, McIntire and American connectors, paper insulators, magnet wire, distributing boards and lightning arresters are treated, and the descriptions of the construction and use of the different apparatus are very complete.

Two publications have been recently issued by the Sprague Electric company of New York city. One is a bulletin of 28 pages and presents the characteristic features of Lundell motors of different sizes and types. The other is a very complete catalogue of interior conduit. Brass-armored, iron-armored, flexible metallic, steel-armored and unarmored conduits are described, together with accessories, such as tools, junction boxes, fittings, switches, etc. The catalogue is well illustrated and has been carefully prepared, with table of contents and indices.

TELEGRAPH.

An amendment to the Postoffice Appropriation bill, as it passed the Senate, provides for an investigation concerning the establishment of a government telegraph system.

The Telegraph Age is authority for the statement that some cypress poles set along the line of the Savannah and Statesboro railway in Georgia are sprouting and sending out shoots at the top.

The extensive telegraph and telephone system between Norway, Sweden, Denmark and Germany, which has been in course of construction since November, 1898, has been completed. Communication has been established between Stockholm, Berlin, Hamburg, Gothenburg and Emden. In all, about 1,200 miles of cable has been laid, requiring about 400 tons of copper, and it is stated that the cable was all of Swedish manufacture.

POWER TRANSMISSION.

Reports have been received of the arrival at Bombay of a party of engineers from the General Electric company's staff accompanying the equipment for the power plant which is to be used for transmission of the power of the Cauvery River, in the state of Mysore, India, to the Kolar gold fields. This is said to be an innovation in Indian gold-mining methods.

The Niobrara Irrigation and Power company of Niobrara, Neb., has been organized, with $100,000 capital stock, to develop the power of the Niobrara River. A canal seven miles long will be built, and at present about 1,500 horsepower will be utilized. Arnold C. Koenig of Grand Island, Neb., has been engaged as chief engineer. Power will be supplied for about 35 miles of proposed railways in Knox and Boyd counties.

An Iowa paper notes the incorporation of the General Electric company of Mystic, Iowa, with capital amounting to $100,000, to supply power for mining operation. Until the first annual meeting, which will be held in March, 1902, the officers of the company will be: President, Alexander Orr; vice-president, James A. Helm; secretary, David Lodwick; treasurer, James A. Seddon; and these, with William Porter, John Morris, Gust Pearson, A. V. Venell, Daniel Davis and George Porter, are to constitute the board of directors.

The trustees of the Chicago Sanitary District have voted to introduce a bill in the Illinois Legislature, providing for an additional tax of one-fourth of one per cent., amounting to $2,500,000, to be

used in developing the waterpower of the drainage channel. If the bill is passed and the work is completed, it is planned to let the privilege of using the power to the city at a rental of $4 a year per horsepower.

SPACE TELEGRAPHY.

The Interisland Telegraph company of Honolulu announces the successful operation of its line to the island of Maui, and states that communication will soon be established with the town of Hilo, on the island of Hawaii.

It is stated that M. Guarini will attempt to establish communication between Brussels and Paris, 171 miles, by placing transmitters every 17 miles, which will automatically repeat the messages, the whole transmission occupying only a few seconds, it is said.

SOCIETIES AND SCHOOLS.

It is announced that the Chicago Manual Training School, which has for many years been at the corner of Twelfth street and Michigan avenue, is to be absorbed by the University of Chicago, and that it will be removed to the immediate vicinity of the University.

The trustees of the University of Pennsylvania at Philadelphia have announced that a donation of $25,000 toward the fund for a building in which the three departments of mechanical, civil and electrical engineering are to be located has been made by Burnham, Williams & Co. (Baldwin Locomotive Works). The improvement, it is estimated, will cost between $400,000 and $500,000. The building in contemplation will accommodate 500 students.

Professor H. S. Carhart, professor of physics and in charge of electrical engineering at the University of Michigan, delivered a lecture before the Science and Engineering society of Lewis Institute, Chicago, on the evening of March 8th. The subject of the lecture was "The Alternating-current Generator," and Professor Carhart treated of the design, tests and operation of a five-kilowatt alternator which had been designed and built at the University of Michigan.

The Permanent International Tramways union, an organization representing the tramway and light-railway interests of almost every European country, has accepted the invitation of the Tramways and Light Railways association of England to hold its next biennial convention in London in 1902. The dates determined upon are from July 1st to 4th. The second International Tramways and Light Railways Exhibition, promoted by the proprietors of the Tramway and Railway World, will also open on July 1, 1902, and continue to July 13th. The date of the exhibition had been placed in 1903, but it was decided to advance it one year on account of the continental convention.

The directors of the John Crerar Library of Chicago have had plans drawn for a library building which they hope to erect on the lake front, facing Michigan avenue, and extending practically from Randolph to Madison street. As planned, the building will be approximately 800 feet in length. The library, now temporarily located in the Marshall Field building, contains chiefly scientific and technical works, and is one of the largest of its kind in the country. With the completion of a new building, it is expected the library will become the center of organized scientific and technical work, offering to associations of mechanics, artisans and engineers rooms for their meetings, public lectures and exhibits, receiving from them assistance in making collections in the lines of their interests and deposits of their own collections.

MISCELLANEOUS.

The Franklin Institute of Philadelphia, through its committee on science and the arts, has recommended the award of the John Scott legacy medal and premium to Professor Elihu Thomson of Lynn, Mass., for his constant-current, alternating light transformer, manufactured by the General Electric company.

Experiments at the Berlin High School of Technology indicate that the Becquerel rays render almost every transparent substance luminous in darkness. It is said that the rays make it possible to tell genuine diamonds from artificial ones in the dark. The experiments have also resulted in obtaining, for the first time, larger quantities of the new element, by which the rays are produced. It is said to have been demonstrated that rays emanating from a larger quantity make the air such a conductor of electricity that it is hoped this property can be utilized in wireless telegraphy.

A new eight-track bascule bridge which spans the drainage channel at Campbell avenue, in Chicago, has been finished. The bridge is the largest movable bascule bridge in the world and cost, including extras, about $900,000. It will be used by the Panhandle, Chicago Terminal Transfer and Chicago Junction railways. The bridge consists of four independent double-track rolling-lift bridges, placed side by side, with a clearance of six inches between the trusses. When the drainage channel becomes navigable by large vessels the bridge will be operated by electricity. The spans will be operated jointly or singly by two operators, one on each side of the channel, the whole bridge being capable of being opened or closed in 30 seconds.

TRADE NEWS.

The Hardie-Tynes Foundry and Machine company of Birmingham, Ala., is in the market for a 65-kilowatt generator and several motors.

The International Zinc company, which owned zinc properties at Joplin, Mo., and was capitalized at $1,000,000, has gone into the hands of a receiver. The assets of the company are said to be practically worthless.

The western office of the American Circular Loom company, in charge of Thomas G. Grier, western manager, now located at 141 South Clinton street, Chicago, will be moved to 130 West Jackson boulevard, in the Electrical building.

The Berggren half shade, for which the Electric Appliance company of Chicago is selling agent, is a device whereby the shade is attached directly to the socket of an incandescent lamp, thus doing away with the necessity of a shade holder.

The Lowell Model company, manufacturer of gasoline motors, has removed its factory and office from Lowell, Mass., to North Chelmsford, Mass., about three miles from its former location. The company has greatly increased facilities in its new location and is prepared to furnish its full line of motors for launches, bicycles and vehicles.

A levy has been made by the assistant collector of the town of Cicero, Ill., on the property of the Siemens & Halske Electric Company of America for taxes. The amount assessed is $5,509 and the company refused to pay the tax for the reason that the board of review reduced the amount. The company has tendered $3,800 but it has been refused, as the collector claims the tax can only be lowered by the courts.

About 25 salesmen of the Westinghouse Electric and Manufacturing company were tendered a dinner recently at the Hotel Schenley in Pittsburg, the company being the host. The men went to Pittsburg from various parts of the country, as is the custom each year, to go over the manufacturing plants of the company in order to keep in touch with new work under way and new methods being employed. F. H. Taylor, fourth vice-president of the company, was toastmaster at the dinner.

The Electrical Lead Reduction company, the stock of which was dealt in in New York city for the first time a few days ago, is said to have a new process of converting lead ore—galena—into various lead compounds by electrical reduction. It is stated that it has no competition in its line, being the first concern in the United States to make lead or lead compounds by electrical reduction. Its factory is at Niagara Falls, and the ore is procured at Joplin, Mo. The company also makes pure sulphuric acid as a by-product.

The municipality of Newberry, Mich., has just started a 1,200-light Warren inductor alternator, direct-connected to an Erie Ball engine, the speed of the unit being 300 revolutions per minute. The City Council is much pleased with the outfit, which also operates two street-lighting circuits of 40 50-candlepower, incandescent lamps each. The prominent feature of this plant is that there is not an oil cup on the outfit, and it is almost entirely automatic. The apparatus was furnished by J. Holt Gates & Co. of Chicago.

The Electric Storage Battery company of Philadelphia, manufacturer of the Chloride accumulator, has found it necessary to open a sales office at San Francisco, Cal., to take care of the increasing volume of business in the Pacific coast states and the extreme western territory. This office, which is located in the Nevada block, has been placed in the charge of R. B. Daggett, who has for a long period been connected with the staff of engineers at the Philadelphia office, and his experience gained there will enable him to handle the different problems of modern storage-battery practice arising in this district with skill and promptness.

The Helios-Upton company of Philadelphia has moved its western office, formerly located at its Chicago factory, 222 Fullerton avenue, to a downtown location at 1128 Marquette building. The business of the Chicago factory will be carried on in this office under the supervision of Robert C. Gregg, western manager. Mr. Gregg has had a wide electrical experience extending over a number of years. He was formerly connected with the Marr Construction company of Philadelphia, one of the first construction companies in existence. Afterward he became associated with the Helios Electric company in the manufacture of arc lamps and maintained his connection after the consolidation of the Helios company and the Standard Thermometer and Electric company to form the Helios-Upton company in 1898. In June, 1900, Mr. Gregg came to Chicago to take charge of the western office, succeeding George N. Stout. Associated with Mr. Gregg is William Hood, whose success as a sales agent is well known throughout the West. The Helios-Upton company manufactures arc lamps, both alternating and direct-current for all circuits, as well as steam traps and thermometers. The company has been in the storage-battery field for the last year, being an extensive manufacturer of batteries, both for automobiles and stationary purposes. Most prominent of the many plants installed by the company during the last year are an 800-ampere-hour battery for the Kansas City (Mo.) Electric Light company and a battery for the country residence of H. N. Higinbotham at Joliet, Ill.

BUSINESS.

The Lake Erie Iron company, Cleveland, Ohio, has recently installed an electric-power plant, the engine being a 175-horsepower, self-oiling machine built by the Ball Engine company, Erie, Pa. The Ball Engine company has also sold to the Northern Pacific Railway company a 150-horsepower, self-oiling engine for electrical purposes.

J. Holt Gates & Co., Monadnock building, Chicago, have just installed a 250-horsepower electric-power plant for the Grower building, Chicago, in connection with a Vilter Corliss engine. A number of electrical concerns of Chicago will occupy this building and it will be a representative plant. The Gates firm has been very busy this winter.

The Western Electric company, Chicago, is receiving many favorable reports from the different plants using its series enclosed, alternating arc-lighting system. The economy of operation and ease of management, together with the many special features of excellence, are said to be winning the enthusiastic approval of station managers. Long life, reliability in action and freedom from accidental injury are some of the points which the system affords under all conditions met in practice. Many plants are being installed.

The American Bridge company is furnishing to William Young & Co., Mexico City, Mexico, eight bridges, to be erected over the Sacramento Canal, at Torreon, Mexico. The company will also furnish the steelwork, amounting to 3,000 tons, for the new Astor building, at the corner of Fifty-fifth street and Fifth avenue, New York city, and also about 2,000 tons of the same class of work for the new custom house in New York city. The Gillette-Herzog branch of the American Bridge company has contracted to build a beet-sugar factory at Logan, Utah, for David Eccles; this includes a main building 60 to 75 feet wide and 275 feet long, a boiler-house roof, 42 by 101 feet, a limekiln building, 41 by 84 feet, and a warehouse roof, 52 by 144 feet.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued March 5, 1901.

669,072. Telephone Apparatus. Peter C. Burns, Chicago, Ill. Application filed July 31, 1899.

A local circuit includes a signal-indicating device. A switch operated electromagnetically by the induction coil of the transmitter closes the local circuit.

669,094. Telephone Apparatus. William O. Meissner, Chicago, Ill., assignor to the American Electric Telephone company, Chicago, Ill. Application filed May 2, 1898.

The line circuit has one of its sides provided with a branch which includes an annunciator. A spring-jack is provided with oppositely disposed spring line contacts to which the opposite wires of the line are connected. A sleeve is supported between these line contacts and connected to the annunciator branch. Generator contacts connected to the respective wires of the generator circuit are supported outside of, and normally out of contact with, the line contacts. A plug which can connect the cord circuit with the line circuit by its normal insertion can, by an extended insertion, spread the line contacts and thereby connect them to the generator contacts and also disconnect the line and the cord circuits.

669,100. Physician's Electric Lamp. Purdy M. Randall, New York, N. Y., assignor to the Unique Electric Device company, New York, N. Y. Application filed May 16, 1900.

A separable handle is described, one end of which is adapted to receive a lamp or other translating device. Electric conductors convey current from a battery through the handle, and a case for the battery has insulated compartments for the separated portions of the handle.

669,102. Combined Switch and Rheostat. Henry E. Reeve, Brooklyn, N. Y. Application filed July 2, 1900.

Insulating strips or plates are secured to the top and bottom of a support, with contact plates on one of the insulating strips connected to the rheostat and secured by rivets passing through the support and plates. A switch lever pivoted to the support carries a spring contact which engages with the contact plates. A collecting bar on the other insulating strip is similarly secured by rivets, and a spring contact is carried by the switch lever in constant engagement with it.

669,114. Support for Telephone Receivers. John J. Hartl, Chicago, Ill. Application filed October 26, 1900.

A tilting carrier formed of a bar has at each end a fork and a pivoting ear. A swinging attaching bar having its outer end slotted to receive the ear of the carrier bar is provided with a clamping bolt on which the carrier can be tilted and by which the carrier can be locked in position, and has its inner end rounded to form a journal. A socket receives the journal at the inner end of the attaching bar and is provided with a locking screw engaging the inner end of the bar. A clamping stirrup or loop carries the socket on one of its members and is adapted to be slipped over and clamped to the transmitter arm of the telephone.

669,130. Manufacture of Electrical Heating Appliances. Adolf Vogt, Westminster, England, assignor to the Electric Resistance and Heating company, Limited, London, England. Application filed May 23, 1900.

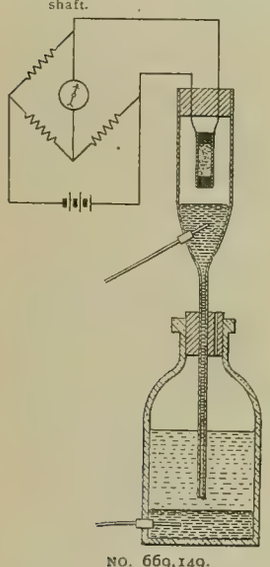
This patent treats of a process which consists in compounding a salt of a conductive metal with a finely divided refractory non-conductive material having the property of becoming slagged, or vitrified, forming a plastic body therewith, reducing the aforesaid salt to a metallic state in an atmosphere of hydrogen, and then subjecting the body to a temperature sufficiently high to vitrify the non-conductive material.

669,149. Capillary Electrometer for Relay Purposes. Albert C. Crehore, Tarrytown, N. Y., and George O. Squier, Washington, D. C., assignors to the Crehore-Squier Intelligence Transmission company, Cleveland, Ohio. Application filed October 20, 1899.

A closed space above the mercury in the capillary tube of the electrometer is filled with a non-compressible fluid. A receptacle in this chamber having flexible walls contains a variable resistance in an electric circuit containing an indicator. (See cut.)

669,151. Electric-lamp Socket. John H. Trumbull and Henry Trumbull, Plainville, Conn. Application filed December 16, 1899.

A sliding shaft is located within the shell with its ends projecting beyond the walls of the base, and contacts project through the walls of this base and engage the sliding shaft.



NO. 669,149.

669,155. Lightning Arrester. Herbert C. Wirt, Schenectady, N. Y., assignor to General Electric company of New York. Application filed April 30, 1897.

Metallic dischargers which are prevented from being heated to an intense degree by lightning discharges are separated by only a comparatively short air-gap. A comparatively low resistance is connected in series with the air-gap.

669,218. Electric Railway. Hugo Hirst, London, England. Application filed January 29, 1901.

This device, designed to prevent collisions by making it impossible for two trains to be on the same section at once, consists of a solenoid operating a cut-out and actuated by the passage of a car, to the end that the section immediately behind the car is rendered dead until the car or train passes on to another section.

669,240. Electrode Plate for Electric Accumulators. Heinrich F. Hobel, Berlin, Germany, assignor to Akkumulatoren and Elektricitätswerke Aktiengesellschaft vorm. W. A. Boese & Co., Berlin S. O., Germany. Application filed October 20, 1900.

The plate comprises a number of bars each of which has two series of leaves projecting from it, the leaves of one set of each bar being arranged in staggered relation with the opposite set and the leaves carried by each bar being arranged in staggered relation with the leaves of the adjacent bar.

669,291. Current Interrupter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed December 26, 1899.

A liquid interrupter is put in circuit with an inductance coil so arranged as to permit adjustment of the current intensity so as to effect circuit interruption within a half-wave. (See cut.)

669,299. Dynamo-electric Machine. Norman C. Bassett, Lynn, Mass., assignor to General Electric company of New York. Application filed December 12, 1899.

A motor is provided with two sets of commutator brushes, one set properly positioned for rotation in a clockwise direction and the other set for rotation in a counter-clockwise direction. Contacts on the controller close the motor circuit through either of the sets of brushes.

669,310. Electric Metering System. Eustace Oxley, Lynn, Mass., assignor to General Electric company of New York. Application filed October 12, 1899.

A consumer's circuit includes a group of constant-current translating devices. A meter motor has one of its operative circuits in series with the translating devices and the other in shunt relation. The same circuit which supplies the translating devices varies the potential at the terminals of the shunt member to change the recording rate of the meter. (See cut.)

669,336. Method of Local Application of Electric Treatment to the Human Body. Herrman Behrendt, Worms, Germany, assignor to Wilhelm Schmidt, Worms, Germany. Application filed September 18, 1900.

The subject of this patent is the electrotherapeutical treatment which consists in subjecting a part of the human body to the action of static electricity while the blood is drawn to the surface, partly producing a vacuum thereon.

669,338. Electric Clock. Sigismund Fischer, New York, N. Y. Application filed June 8, 1900.

The clock is operated by a spring motor which is wound by means of an electromagnet with an oscillating armature.

669,358. Insulated Electric Conductor and Method of Making Same. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric company of New York. Application filed July 30, 1900.

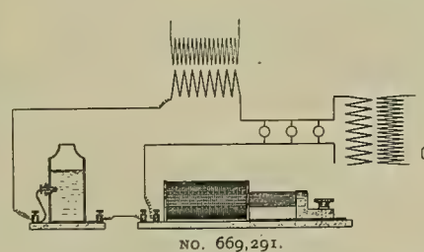
The wire is passed through a solution of cellulose in cupric ammonia, and the cupric ammonia in the resulting coating is then dissolved off with an acid.

669,362. Regulating Device for Electric Currents. Walter Emmott, Halifax, England. Application filed December 28, 1897.

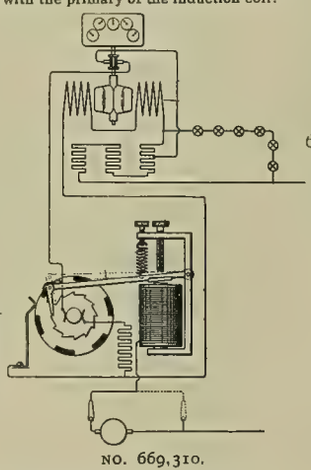
Connections are shown for throwing a variable impedance into circuit with the translating device.

669,366. Telephone System. Clarence Malthaner, Minneapolis, Minn. Application filed March 16, 1900.

This system embraces an instruction circuit comprising a metallic line circuit connecting the switchboards of two exchanges, an operator's set at one of the exchanges comprising an induction coil having its secondary coil connected in series with the line circuit, a condenser and telephone receiver connected in series between the two sections of the secondary, and a telephone transmitter connected in series with the primary of the induction coil.



NO. 669,291.



NO. 669,310.

669,429. Coin-controlled Electric Circuit-closer. William H. Paine, Providence, R. I., assignor to Automatic Tire Inflator company, Providence, R. I. Application filed March 14, 1900.

An open circuit includes a source of energy. Duplex closers are provided for the circuit, and a coin-controlled mechanism engages the primary closer. The operating mechanism actuates the closers successively in opposite directions.

669,438. Magnetic Blow-out Brush Holder. Arthur C. Eastwood, Cleveland, Ohio, assignor to the Electric Controller and Supply company, Cleveland, Ohio. Application filed December 3, 1900.

An inclosure in the holder retains and guides the brush. The brush is insulated from the holder. Magnetic lines of force are caused to pass in a uniform direction through the space in the vicinity of the contact end of the brush.

669,439. Electrolytic Apparatus for Recovering Metals. Hans A. Frasch, Hamilton, Canada. Application filed July 30, 1900.

An electrolytic bath has an anode extending over its bottom and consists of suitable electrical conductors and a body of disintegrated material containing the metal or metals to be extracted. A superposed layer of granular, electrically neutral, permeable material is in immediate contact with the disintegrated material.

669,440. Method of Recovering Metals by Electrolysis. Hans A. Frasch, Hamilton, Canada. Application filed July 30, 1900.

This patent covers a method of producing an electrolyte of metals whose hydroxides are soluble in ammonia, which consists in percolating a solution of a salt of ammonia through an anode composed of disintegrated substance bearing the metal to be extracted, and in presence of a cathode decomposing the salt of ammonia by the action of an electric current, and then circulating the solution successively through the anode and past the cathode.

669,441. Method of Producing Alkali by Electrolysis. Hans A. Frasch, Hamilton, Canada. Application filed August 16, 1900.

This is a process of producing alkali and extracting metals from ores and metal-bearing mineral substances, consisting in electrolyzing a solution of the salt of an alkali in presence of an anode composed of the disintegrated ores or metal-bearing mineral substance containing the metal to be extracted, and of a suitable cathode, conducting a supply of solution of a salt of an alkali both to the anode and the cathode and displacing the metallic solution obtained at the anode and the solution of caustic alkali produced at the cathode.

669,442. Process of Recovering and Separating Metals by Electrolysis. Hans A. Frasch, Hamilton, Canada. Application filed September 15, 1900.

A method of separating metals from their ores is described, which consists in providing an electrolytic bath with a permeable anode composed of the ore bearing the metals to be obtained, circulating successively through a series of such anodes an electrolyte capable of dissolving the metals contained therein, simultaneously depositing a selected metal on suitable cathodes and thereby continuously removing such metal and enriching the contents of the solution with the other metals.

669,459. Electric Railway. Charles E. Fournier, New London, Conn. Application filed June 7, 1900.

The claims describe details of construction of a trolley switch, consisting of a plate to which the two branches are fixed, and a movable piece upon which the trolley wheel passes as it strikes the plate, and which turns so as to direct the wheel toward one or the other of the branches.

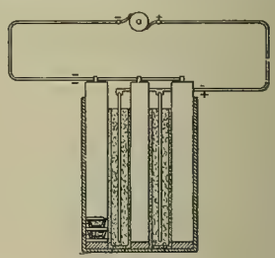
669,471. Telephone Key. Ernest E. Yaxley and Charles C. Cadden, Chicago, Ill., assignors to the Victor Telephone Manufacturing company, Chicago, Ill. Application filed September 22, 1899. Renewed January 5, 1901.

A lever terminates at one end in rollers of insulating material. Contact strips are placed horizontally in groups on opposite sides of the lever, the group on one side consisting of two spring-contact strips having their free ends curved downward and extending in the path of the rollers, the strips arranged above and insulated from but normally in contact with the spring-contact strips, and strips below the spring-contact strips, insulated from and normally out of contact with them, and the group on the opposite side consisting of two spring-contact strips having their free ends curved downward and extending into the path of the rollers, and strips below the last-named spring-contact strips and insulated from them. Turning the lever in one direction actuates one group, causing two contacts to be broken and two to be completed, and turning the lever in the opposite direction causes two contacts to be made.

669,477. Electric Time Switch. Henry J. Cogswell, Hartford, Conn. Application filed July 20, 1899. Renewed August 9, 1900.

A spring drives a time-train, which rotates a time-indicating dial. A trip is adjustable independently of and also rotationally movable with the dial. A spring drives the striking train. Stop mechanism holds the striking train and is periodically moved by the trip to release the striking train. A crank is connected with and rotated by the inner end of the striking-train spring, and stop arms are connected with the crank. A catch temporarily holds the stop arms and is moved by the striking train for releasing the crank and allowing it to be rotated by the striking-train spring. Switch blades are connected to the crank

669,486. Secondary Battery. Henry C. Porter, Chicago, Ill., assignor to Owen H. Fay, Chicago, Ill. Application filed December 27, 1898.



NO. 11,893.

The separator consists of a number of vertical posts provided with notches, and a number of horizontal strips secured in the notches in each of the posts on the opposite sides thereof, the posts and strips being composed of insulating material, and being staggered relatively to each other on opposite sides of the posts.

669,487. Battery Plate or Grid. Henry C. Porter, Chicago, Ill., assignor of one-half to the Owen H. Fay Livery company, Chicago, Ill. Application filed February 5, 1900.

The grid comprises a rectangular frame, with a series of centrally disposed longitudinal bars integrally connecting the end bars of the frame, and a series of transverse bars integrally connecting the side bars of the frame and the longitudinal bars, at opposite sides of the central longitudinal bars, whereby spaces are formed between the inner faces of the transverse bars.

REISSUE.

11,893. Process of Operating Two-liquid Primary Batteries and Regenerating Elements Thereof. Henry K. Hess, Albert J. Shinn and Carl Hering, Philadelphia, Pa., assignors to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed January 24, 1901.

The process described consists in charging the cathode compartment of the battery with a mixture of highly oxidized metallic compound as a depolarizing agent and an acid excitant capable of combining with the product of the reduction of the depolarizer, the acid excitant being in excess of that needed for this purpose, and after exhaustion of the depolarizer transferring the liquid to the anode compartment of the battery to act as an excitant. (See cut.)

DESIGNS.

34,173. Contact Base for Incandescent Lamps. Irving E. Brown, Providence, R. I., assignor to the Providence Gas Burner company, Providence, R. I. Application filed February 7, 1901. Term of patent, 14 years.

34,174. Contact Ring for Incandescent-lamp Bases or Caps. Frederic H. Manchester, Providence, R. I., assignor to the Providence Gas Burner company, Providence, R. I. Application filed February 7, 1901. Term of patent, 14 years.

WESTERN ELECTRICIAN

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Vol. XXVIII. CHICAGO, MARCH 23, 1901. No. 12

The Cuyahoga Telephone Company's Exchange System in Cleveland.

Since the invention of the telephone, telephony has been one of the most progressive of electrical industries, and perhaps no other branch of electrical development has advanced so rapidly. Especially is this true of the period that has elapsed since the fundamental patents expired in 1893, which permitted the Independent telephone companies to enter a hitherto monopolized field. One of the most notable examples of development in this direction is that afforded by the Cuyahoga Telephone company of Cleveland, Ohio, which stands to-day as the most completely equipped and probably the largest Independent telephone exchange in the world.

The Independent movement was begun in Cleveland in 1897 by what was known as the Home Telephone company, which, however, made but slight progress, owing to a lack of finances. In 1898 the present Cuyahoga Telephone company secured control of the property, and immediately laid plans for the present extensive and modern telephone exchange.

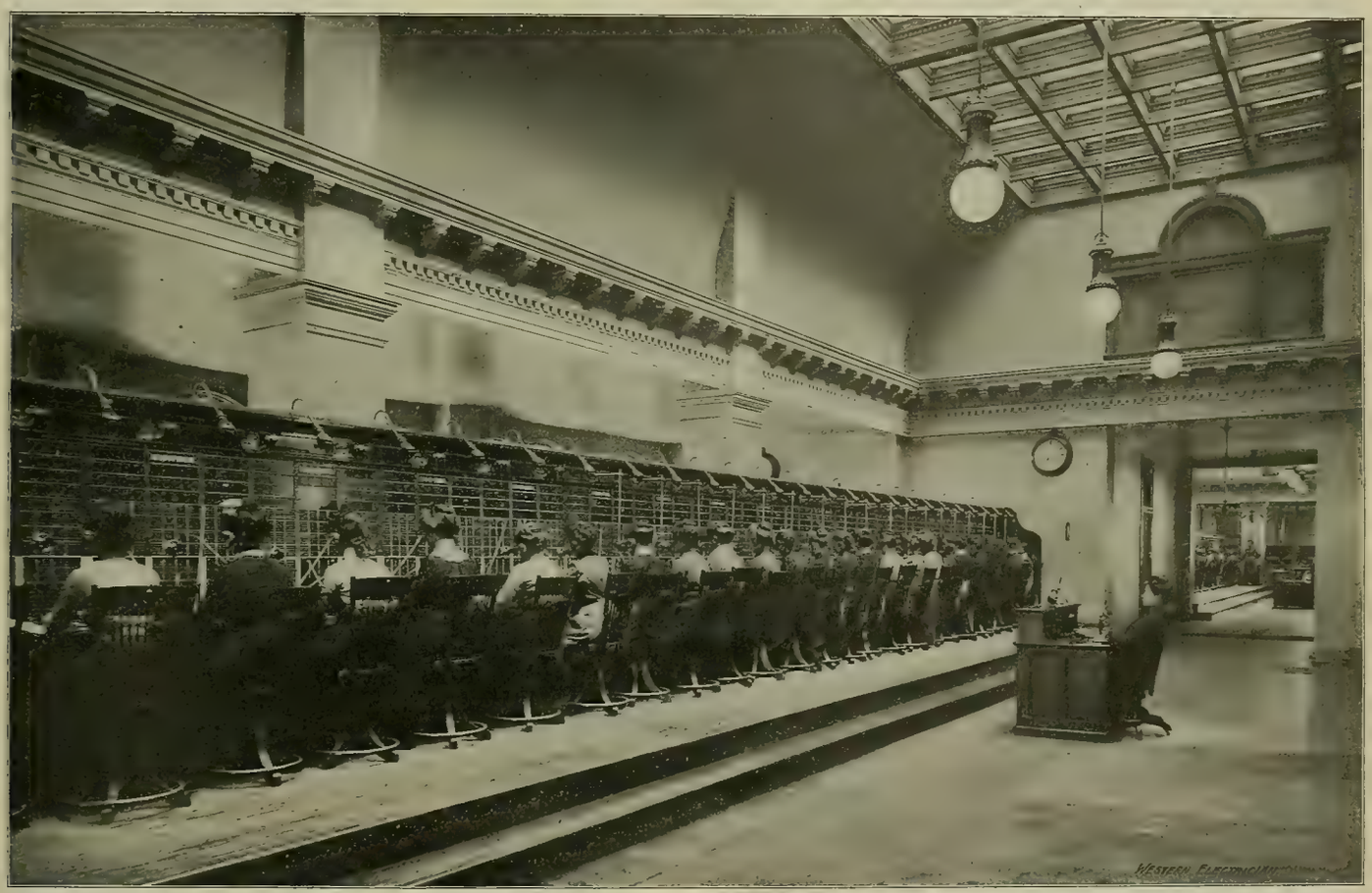
These plans included the construction of a large, modern, nine-story building, known as the Electric building, in the central part of the city, which is recognized as one of the finest office buildings in the state to-day. The three floors at the top of the building are devoted exclusively to telephonic interests. On the eighth floor is situated the switchboard of the Cuyahoga Telephone company and the long-distance toll board of the United States Telephone company. The ninth floor contains some of the offices of the engineering and auditing departments, the storage-battery, power and relay rooms and the operators' locker and lunch rooms. The seventh floor is entirely taken up by the offices of the several allied interests—the Cuyahoga, United States and Federal Telephone companies. The Reserve Construction company, which has charge of all of the construction work of the companies named, has its offices on the sixth floor. In addition to the three floors above mentioned as being devoted exclusively to the telephone interests, a number of offices throughout the building are rented as exhibition or sample rooms to dealers in telephonic supplies. The building is one of the best lighted in the city. Four elevators give rapid communication between the various floors, and are in operation at all hours.

In the outside construction the very best materials have been used and the most modern methods pursued. Subway has been laid in the downtown districts and along the principal streets. The ducts are Camp tile, laid in cement and surrounded with concrete, and in laying subways ample provision has been made for future growth. In the business portion of the city the cables are carried direct from the manholes into the basements of the buildings, where distribution is made from cable boxes; in other parts of the underground district, the distribution is from cable poles. The subway system contains 1,599,919 duct feet; 138,919 feet of trench, 447 manholes and 8,895.7 feet of underground cable have been used in the construction. In the overhead construction a great deal of aerial cable has been used, which is in accordance with the best and most modern telephone construction. This reduces the interference from outside sources to a minimum, and permits the use of shorter poles—and therefore stronger line construction—on account of the decreased number of cross-arms required; in fact, it has been a rule not to use more than five cross-arms on a lead. At certain intervals along the leads, varying in accordance with the number of subscribers in the district, cable boxes are placed, from which distribution is made. The pole-line construction throughout is of a very substantial character. In the outside construction 410,227 feet of aerial cable, 15,811,199 feet of bare copper wire, 19,406 cross-arms and 6,707 poles have been used.

All of the wires are brought into the terminal room, which is located in the basement of the exchange building, through underground cables. These cables terminate in Cook terminal heads, which are equipped with lightning and sneak-current protectors. "Cigarette" fuses, designed to protect cables and property against high-tension currents, are placed in the cable boxes where the line wire enters the cable, and also on buildings where the wire enters. These, together with a combined lightning and sneak-current arrester placed directly above the telephone, afford adequate protection.

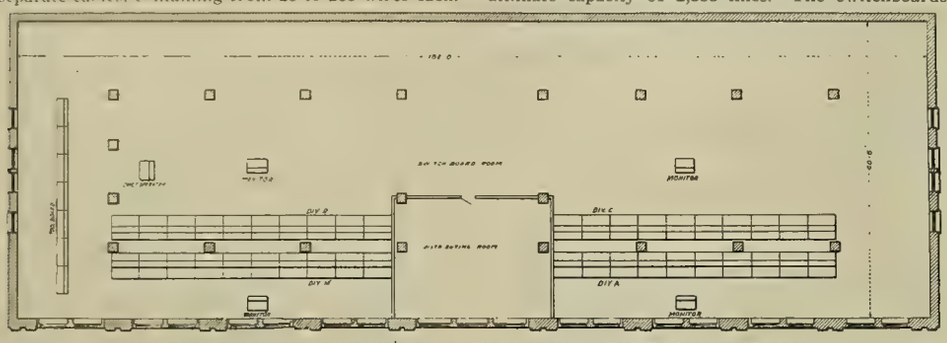
From the terminal room the wires are carried in lead-covered cables of 100 pairs each, through cable shafts, up to the distributing-board room on the eighth floor. From this point they go to the relay room on the ninth, and thence back to the intermediate board on the eighth, where they are distributed to the different sections of the switchboard.

The switchboard, which is the largest in the world, is of the four-division, multiple type, and has an ultimate capacity of 20,000 lines, although it is at present equipped for 10,000 lines. This board was manufactured and installed by the Kellogg Switchboard and Supply company of Chicago. With this design of board (four-division multiple) it is possible to take care of four times as many subscribers as are ordinarily handled on a straight multiple board, which is usually limited to 5,000. Thus it is possible to handle 20,000 lines without difficulty, as one-fourth of the lines are multipled on each of the four divisions. These divisions are designated as the A, C, M and R divisions. Each subscriber's line is equipped with four jacks and polarized drops, one on each division, so that a subscriber can call direct to any other subscriber without having to be transferred through a trunking or transfer system. The calling box at the subscriber's instrument is equipped with four small push-buttons, marked, respectively, A, C, M and R, and a subscriber signals central by pressing a button corresponding to the division of the board on which the called for subscriber is multipled. In the telephone directory the letter of this division is placed before the subscriber's number. The operator answering the call connects the caller directly with the subscriber desired. The subscriber, by replacing his receiver on the hook at the close of conversation, automatically signals the operator to disconnect. This signal is given by the lighting of small incan-



THE CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM IN CLEVELAND.—VIEW SHOWING C AND R DIVISIONS IN OPERATING ROOM.

descent lamps on the operator's keyboard, one of which corresponds to each cord and plug, thus giving double supervision to the operator, and thereby greatly facilitating the rapid handling of calls, which is an essential feature of modern telephone service. In the switchboard there are 40,000 polarized line drops, 136,580 spring-jacks, and more than 16,000 separate cables, containing from 20 to 200 wires each.



CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM —PLAN OF OPERATING ROOM

More than 7,000 miles of wire are used in the switchboard, comprising, approximately, about 1,500,000 separate wires; to connect these to their respective terminals, springs, etc., over 3,000,000 soldered connections are necessary. The total amount of wire used in the entire distributing system, the switchboard and the instruments aggregates over 60,000 miles.

The switchboard is directly connected by a trunking system with the long-distance toll board of the United States Telephone company, which is situated at the east end of the operating room, being separated from the local board by a glass partition. This gives the subscribers direct connection, over 25,000 miles of copper-metallic circuit, with more than 1,300 cities and towns in Ohio and many towns and villages in adjoining states.

The power room, which contains the motor-generators for charging storage batteries and the ringing generators for the local and long-distance boards, is on the ninth floor of the exchange building. In this room is mounted the marble power switchboard, which is equipped with the voltmeters, ammeters, switches, circuit-breakers, etc., necessary for controlling the power service. The current for operating motor-generators is furnished by the company's own plant in the basement, which also furnishes power, light and heat for the entire building. This plant consists of two Ideal engines of 100 horsepower each, direct-connected with two 75-kilowatt generators.

The storage-battery and relay rooms are also on the ninth floor. In the former are located the storage batteries used in operating the line relays and automatic signaling and for furnishing current for the operators' transmitters; the latter contains the subscribers' line relays, by the use of which the operator, in plugging in on the line, automatically cuts out the signaling circuit, and is put in direct connection with the calling subscriber. The wire chief, whose duty it is to see that all trouble is located and cleared, has an office adjoining the terminal room. Here a complete record is kept of every case of trouble that is reported by either the subscriber or the operator.

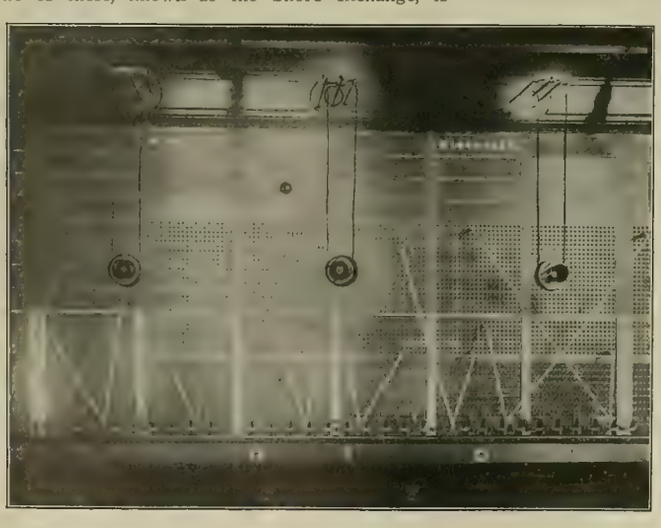
Besides the main switchboard in the central part of the city, the company has four branch exchanges. One of these, known as the Shore exchange, is located at Nottingham, an adjoining town along the lake shore; the remaining three are located, about six miles from the main exchange, in the eastern, southeastern and western suburbs of Cleveland, and are known, respectively, as the Crest, Broad and Cliff exchanges. The Crest and Broad exchanges have been built quite recently, and have each an ultimate capacity of 2,000 lines. The switchboards at these two exchanges were installed by the Kellogg company, and are of that company's latest common-battery, lamp-signal type. They are directly connected, by a trunking system having automatic supervisions, to the main exchange.

The company has 31 private branch exchanges in operation in the offices of some of the largest manufacturing and wholesale establishments of the city, and quite a number of others will be installed soon. These switchboards are equipped for from five to 100 stations, and have direct connection, over one or more trunks, with the main exchange. This class of service is proving very satisfactory to the different concerns which have adopted it.

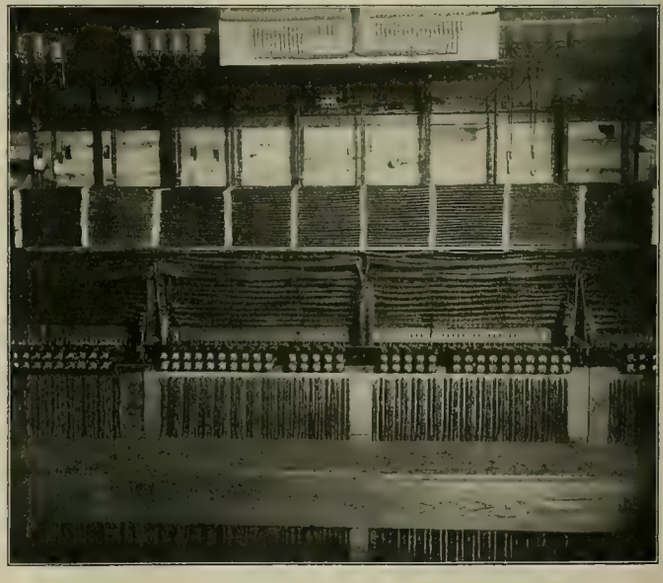
CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—A PORTION OF THE LONG-DISTANCE TOLL BOARD.

The company has made special efforts to secure an efficient operating force, this being a very important feature in furnishing satisfactory service. At present 165 operators are employed, and it is the policy of the company to make every provision for their comfort. Arriving at the building, the girls take the elevator to the ninth floor, where the locker room is located. This room contains combination lockers, in which the operators place their wraps and other belongings while on duty, and each operator has one of these lockers for her exclusive use. At the entrance to the room is a recording clock, by means of which the operators register the time of their arrival and departure. After registering and laying aside their wraps, the operators go to the recreation room adjoining the operating room on

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—DIVISION M OF SWITCHBOARD.



Face of Switchboard.



Rear of Switchboard.

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.

the eighth floor. This room is fitted up with sofas, rockers and other furniture necessary for the operators' comfort, and the latest magazines and periodicals are kept on file. Games of various kinds are also provided for those who prefer this form of recreation. Operators are expected to report for duty in this room five minutes before the schedule time for taking their places at the switchboard. An electric gong, operated from the chief operator's desk in the switchboard room, notifies the operators of the time for commencing their duties, and the following code of signals has been arranged:

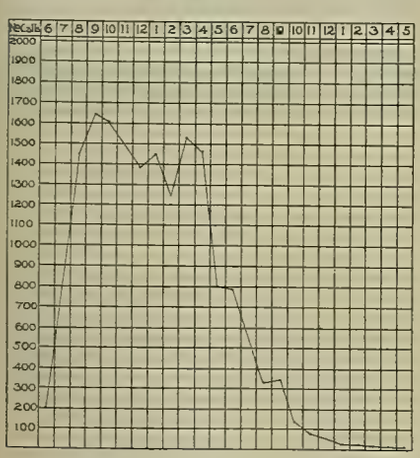
At the first stroke of the bell, the operators form in line and put on their head telephones.

At the second stroke they pass out into the operating room and march in single file, keeping step, to their respective positions at the switchboard, where they stand behind the chairs of the operators whom they are relieving. The operators for the A and C divisions, which are in the western end of the operating room, leave the recreation room through a door to the left, while those for the M and R divisions in the eastern end of the room enter the room from a door to the right.

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—A PRIVATE BRANCH EXCHANGE.

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—STORAGE-BATTERY EQUIPMENT.

At the third stroke the operators who are to be relieved leave their chairs from the left. at the same time withdrawing the plugs of their receiver cords; the relieving operators immediately plug in, while being seated from the right, and assume control of their respective positions.



CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—LOAD CURVE OF C BOARD FROM 6 A. M., DECEMBER 31, 1900, TO 6 A. M., JANUARY 1, 1901.

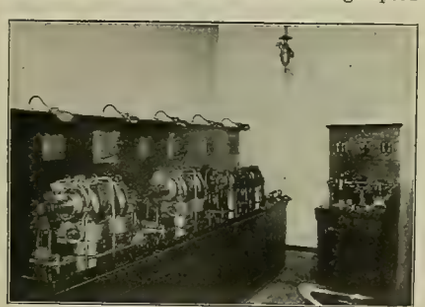
At the fourth stroke of the gong, the relieved operators, who have been standing in line behind their chairs, march in line to the recreation room, leaving the exchange room by the doors through which they entered.

Eight and one-half hours of actual operating constitute a day's work for a regular operator. The operators are allowed one hour for lunch, and are relieved at stated times for 15 minutes in the morning and in the afternoon.

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—DISTRIBUTING-BOARD ROOM.

The operators in each division are presided over by a monitor, whose desk is situated about the center of the division, a short distance from the face of the board. The chief operator has general supervision of the operating room, and from her desk can communicate direct with the monitors, operators or the wire chief. All inquiries in regard to the names, numbers or locations of subscribers are referred to the chief operator and answered by her or her assistant, who has a position at the same desk. A movable card file near the desk contains all information necessary for answering such inquiries. In addition to this, there is an "information bureau" connected with the system, which is designed to answer any question that might be propounded by the most inquisitive or curious subscriber, from an inquiry as to the time of local trains or the address of a city resident to the latest statistics or recipe.

The operating force is very efficient, owing, to a great extent, to the feeling of friendly rivalry existing among the operators in regard to speed in handling calls. By the use of a specially designed automatic apparatus, accurate tests are made several times each month to determine the average speed of the different operators, and the records of such tests are posted in the recreation room at the close of the month. Promotions are made from among the operators having the highest averages. From this record the average speed for the entire exchange is computed. The average time required to answer subscribers' calls for different months, as shown by these tests, has varied from 2.65 seconds to 4.86 seconds. The operators have also been strongly impressed with the importance of courteous treatment of subscribers, and very few complaints in regard to discourteous operators have been received.



CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—POWER ROOM.

One day in each week records are kept of all calls received at the exchange. From these records load curves are made showing the number of calls handled during different hours of the day and night, and the average number of calls handled per day per subscriber is computed; this number at present is 10 and a fraction, and has been gradually increasing since the opening of the exchange in February of last year. A record is also kept of the busiest positions on the switchboard.

Adjoining the reception room is the hospital room, which is equipped with couches, and contains a medicine chest of simple remedies to be used in emergency cases.

On the ninth floor is a neat and attractive dining room for the operators' exclusive use, where pure, wholesome food is served at cost; this room is tastefully decorated with appropriate pictures and paintings. The food served in the dining room is prepared in the kitchen adjoining, which is equipped with gas range, refrigerator and all necessary utensils. Competent help prepare and serve the food under the supervision of a matron, who also has charge of the hospital and recreation room.

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—TERMINAL ROOM.

By means of an improved ventilating system in the basement the air in the switchboard room is kept at an equitable temperature during all seasons of the year. The air is washed and screened and then forced by rotary fans through an air shaft into the operating room. It is heated in winter by passing over steam coils, and cooled in summer by passing over pipes containing ammonia gas from the refrigerating plant. The air when it reaches the switchboard room is practically free from all impurities and dust, which might endanger the health of the operators or injure the delicate mechanism of the switchboard.

The switchboard was originally equipped for 6,000 lines, which it was thought would provide for the growth for some time to come; but, owing to the vigorous policy of the management, all the available space was taken up within the first four months after beginning operation. This phenomenal growth, being so unexpected, made it difficult for the company to take care of new subscribers as rapidly as desired, on account of the delay in securing material, owing to the strong demand for telephone supplies and apparatus. At no time for several months has the number of subscribers on the "waiting list"

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.—OPERATORS MARCHING TO THEIR POSITIONS.

been less than 2,000, and despite the fact that the company, with the increased facilities, is now installing from 25 to 50 telephones a day, the demand for new service is so great that it is not materially lessening this number.

The switchboards of both the Cuyahoga and the United States Telephone companies were installed by Mr. L. W. Stanton, the present superintendent of switchboards of the Federal Telephone company, who was at that time employed by the Kellogg Switchboard and Supply company. All of the construction and engineering work has been under the direct supervision of Mr. Maxime Reber, the present consulting engineer of the company. Mr. Reber is also the consulting engineer and general manager of the Federal Telephone company.

Dining Room. A Corner of the Hospital Room. Lockers. Recreation Room.

CUYAHOGA TELEPHONE COMPANY'S EXCHANGE SYSTEM.

The officers of the company are as follows: President, H. A. Everett; vice-president, E. W. Moore; treasurer, John Sherwin; secretary, F. R. Price; assistant secretary, J. B. Hoge; general manager, Mark Davis; directors, H. A. Everett, E. W. Moore, John Sherwin, H. Clark Ford, F. T. Pomeroy, J. B. Hanna, R. A. Harmon, F. M. Stearns, C. W. Wason, M. H. Davis, Barney Mahler.

Twin City Telephone Company in Minneapolis.

There has lately been formed in Minneapolis a company which has taken over the property of the Mississippi Valley Telephone company, the Independent concern which has for some time been in the hands of a receiver. The new corporation will do business under the name of the Twin City Telephone company, and is backed by Minneapolis, St. Paul and Chicago capital. The plant of the Mississippi Valley company represents an outlay of nearly $1,000,000 in the Twin Cities, and exemplifies the best and most modern ideas in telephone construction, so that Minneapolis will not only have a competing telephone system, second to none in the country, but it will be backed by Minneapolis men who are on the ground, and to whom patrons can turn for remedy for the slightest impairment of their service. This condition has been made possible by the enterprise of a number of progressive men whose efforts to place the affairs of the Mississippi Valley Telephone company on a sound financial basis have been crowned with success.

The reorganization of the Independent company promises results of much importance to that region. Not only are many employes in Minneapolis and St. Paul directly affected, but the officers of the new company have provided for funds to cover contemplated improvements and extensions involving the expenditure of several hundred thousand dollars. These improvements will include telephone buildings and sub-stations in the Twin Cities, as well as many new lines and long-distance connections. The lines of the system are full-metallic circuits, and the management promises a continuance of the former rates, $4 a month for business telephones and $2.50 for residence instruments, all on private wires, with no party lines.

Eber H. Moulton, of the Farmers and Mechanics' Savings Bank, Minneapolis, will be president, and Joseph Lockey, of the National German American Bank, St. Paul, vice-president of the new company. The other officers are: Secretary and treasurer, William M. Kerkhoff of St. Paul; general manager, Edward E. Webster, Minneapolis, and general superintendent, C. H. Judson, Minneapolis. The directors are E. H. Moulton and Edward E. Webster of Minneapolis, Joseph Lockey and William M. Kerkhoff of St. Paul, L. A. Trowbridge of Chicago and J. C. Hubinger of Keokuk, Iowa. Mr. Hubinger is the originator of the Mississippi Valley company, and Edward A. Webster was formerly the receiver in charge of the concern's affairs.

Train Dispatching by Telephone.

The advantages of the telephone in dispatching trains are summarized by the Railroad Gazette as follows:

1. It makes available as an operator every station and train employe who is good at reading and writing.
2. As a corollary to this, it makes it much easier to promptly fill vacancies.
3. A slight saving in time.
4. Perhaps a saving in wages.
5. Enables the dispatcher to make sure that both conductor and engineman have read an order.

To these we may add, if the discipline is of the kind that we have mentioned, a compulsory improvement in discipline.

The only permanent disadvantage is the cost. For long distances the telephone requires a metallic circuit of copper wire. Whether this will be a real disadvantage of any consequence remains to be shown. Someone has said that it is very wearing on the nerves to record telephone messages all day; but, assuming that this is an appreciable drawback, it is safe to say that some way will be found to cure it.

The first adventure speaks for itself; this alone will, we think, be a determining factor in an increasing number of cases. The second includes an added element of strength in dealing with strikers, though it is to be borne in mind that this very fact may bring on strikes of operators. The third advantage is appreciable in the dispatcher's office, but the saving in the time of the trains affected by any particular order is of only occasional value. The fourth item cannot be a very important one (except where a telephone can be made available without establishing a station or office), for the reason that the wages of Morse operators are generally no higher than must be paid for non-operators who are of sufficient years and trustworthiness to handle train orders. It will be a decided backward step if the introduction of the telephone leads to the employment at stations of persons, in any capacity, of lower general intelligence than those now employed. The fifth advantage is based on a single detail, but it is not unimportant. Enginemen have many times smashed their engines by depending on the conductor's reading of an order.

The Cumberland Telephone company of Nashville, Tenn., has applied for a franchise at Leesville, La. This company has purchased the exchange at Harriman, Tenn., and will operate it hereafter.

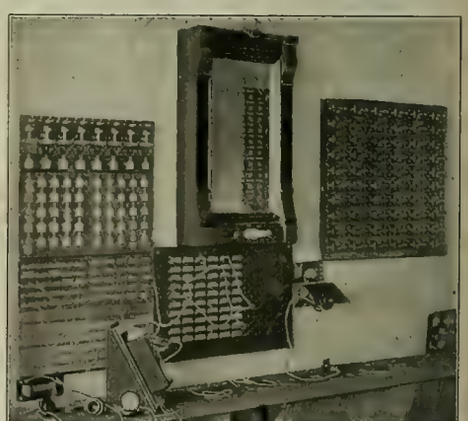
First Telephone Exchange in Indiana.

Evansville, Ind., claims to have had the first public telephone exchange operated in the state of Indiana. The exchange grew out of a telephone system that was installed in April, 1879, for the use of the public schools. The eight school buildings were all connected on one circuit with the superintendent's office in the high school and were operated on a party line, the different buildings being called by one, two, or as many rings as were agreed upon by the superintendent. Edison desk telephones were used, and it is believed that the school-board officers who had the system installed were the first to adopt the telephone, for schools, in the world. This system was installed by N. M. Booth, an old-time telegrapher, assisted by his son, W. P. Booth, and the records of the school board show that Mr. Booth, senior, was paid $417.89 for the telephone plant on May 3, 1879.

Mr. N. M. Booth, who is now 78 years of age and still resides at Evansville, writes that the pupils of the eight school buildings advertised the telephone system by speaking of the "wonderful thing that talked." When H. H. Eldred, the general manager of the telephone department of the Western Union company, went to Evansville the business men were anxious for a public exchange. Mr. Eldred said that if 60 subscribers could be obtained he would secure the outfit that had been ordered for Kansas City. In one day the required number of subscribers was booked and the exchange was installed, it being opened for public service on July 15, 1879.

The calling system of the exchange was based on the telegraph, and relays were used. In the accompanying illustration is shown the exchange equipment. The 60 relays were mounted on a board, seen at the right of the picture. When a subscriber called the central exchange the relay magnet, which was worked by the main battery, closed the local circuit, causing one of the needles of the annunciator board (shown in the center of the illustration) to point to the number of the subscriber. The switching was done as it is now, and the elder Mr. Booth asserts that the time occupied in making connections was no longer than it is in the present-day exchange. The Edison, Gray, Phelps and other telephones were sent to Evansville for trial, but the Edison instrument was adopted, it being regarded as the best of those submitted.

This public exchange, like the school line, was installed by N. M. Booth, who acted in the capacity of manager and was assisted by his son, W. P. Booth, now connected with the Western Telephone Construction company of Chicago. That the service of the system was prompt and satisfactory is attested by a statement signed by many of the business men of Evansville, who were subscribers of the old exchange. One of the uses to which this telephone exchange was put was to connect the residence of one of the subscribers with the pulpit of the Cumberland Presbyterian church, in order that a lady who was not able to attend the church could have the pleasure of hearing the pastor, Rev. W. J. Darby, by telephone. That occasion, it has been suggested, was perhaps the first time that a sermon was transmitted by telephone. Shortly after the exchange was opened a game of chess was contested by telephone between two gentlemen in Evansville and two players in Henderson, Ky., about twelve miles distant. A telephone was sent to Henderson and connected to the telegraph line which was used for the transmission. It is stated that the Evansville team was victorious.



FIRST TELEPHONE EXCHANGE IN INDIANA.

J. L. Hayes of Tallahassee, Fla., has applied for a franchise for an Independent system at Pensacola.

Telephone Service in Chicago.

In the whole field of applied electricity there is no more interesting or significant fact than the phenomenal growth of the telephone business in this country during the last four or five years. During that time the plants and operating facilities of the larger companies have been almost transformed. The old magneto type of telephone with crank generator, local batteries at the subscriber's office, etc., have been replaced with automatic signaling devices, operated by common-battery on metallic circuits. Instruments adapted to the greatest convenience of the subscriber have replaced the older and more clumsy forms. The service has been accelerated and perfected to such an extent that in the larger cities the telephone on the desk of a busy man is almost as indispensable as any other part of his office furnishings.

The development of a system of rates whereby the telephone user pays for just as many messages as he desires, beginning with a small initial number and extending through various gradations of rates to facilities which meet the needs of the heaviest user, is judged to have had much to do with this growth. This system of rates originated in the Buffalo (N. Y.) exchange, but was first given an extended trial in the New York exchange not more than 10 years ago, since which time the number of telephones in that city has increased from less than 8,000 to the large number of 50,000 at the close of the year 1900. The number of telephones operated in Philadelphia and Boston has doubled during that same period, and in Chicago has increased from 7,898, January 1, 1891, to 27,734, January 1, 1901.

The territory of the Chicago Telephone company embraces the city of Chicago and a group of cities and towns in the immediate suburbs and surrounding country within a radius of about 30 miles. In this territory the number of telephones increased in 10 years from 9,043 to 36,414. Increases in the plant of the Chicago company were in proportion. Ten years ago the Chicago Telephone company had exchange offices in 15 towns and toll stations in 63 towns. It now operates 84 exchanges and toll offices in 101 towns and hamlets. The amount of underground wire in Chicago 10 years ago was 8,291 miles. To-day 68,593 miles are in operation, included in a total of 110,605 miles of underground and aerial wire in the city of Chicago. The net increase in the number of telephones and in the plant in a single year now aggregates more than the entire plant 10 years ago. This large growth in the number of telephones has been brought about, it is said, by means of a variety of rates and forms of service adapted to the needs of all classes. Ten years ago there was one uniform rate to all subscribers, and the patron who had but two or three calls in a day paid just as much annually as the one who had 30 or 40 calls. All this has been changed by the introduction of measured-service rates whereby the subscriber pays in proportion to the number of calls he makes. At the present time there are no less than 15 distinct classes of rates for exchange service. Those who desire pay an annual sum for a telephone, operated either on a grounded line or a metallic circuit, and have the privilege of using it to an unlimited extent. More than 500 large users have private branch exchanges, with switchboards located and operated in their own offices, connected by trunk lines with the main exchange. These are provided either for unlimited use or measured service, by which the subscriber pays for just the number of calls he may desire. Many others avail themselves of the measured rates on single or party lines, paying for any desired number of annual calls at an initial rate and for excess calls at a sliding scale of rates as low as three cents per call. The minimum annual rate of this service is $60. Early in 1895 an efficient four-party-line service of private residences was designed by employes of the company and introduced with success. This has become popular throughout the city, and telephones on this plan are in service in nearly 4,000 private residences. For the accommodation of the general public who have not as yet telephones in their own premises, 2,500 public pay stations have been installed and are now in operation in drug stores and public places of every description. The latest innovation of the company has been a service to accommodate the very smallest class of users. This is the nickel-in-the-slot telephone, operated on 10-party lines, introduced late in the year 1900 in the North Office district. Each call is paid for with a nickel at the time it is made. Places of business make a guarantee of 10 cents a day and private residences five cents a day. Twelve hundred of these instruments were installed during the first three months, and their operation is being watched with great care to determine whether such a class of service interferes with the general efficiency of the exchange.

Few people realize that the area covered by the Chicago telephone exchange is greater than any other in this country. From the north to the south limits of the exchange the distance is 18 miles and from the lake to the west limits, eight miles. Underground conduits of the company now extend from Montrose boulevard and Clark street on the north to Sixty-third street and Madison avenue on the south, a distance of 12 miles.

The general conduit plan of the company was laid out in 1893. It provides ultimately for the operation of 22 exchanges in the city and is laid out in relation to these exchange sites, so that all conduit work forms a part of the ultimate plan. Eleven of these exchange offices are now being operated in permanent quarters, the company owning nine of its exchange buildings and leasing two others in the downtown district in modern, fireproof buildings. The company owns the building sites of four additional exchanges, upon which buildings will be erected when the growth of the business requires. The group illustration accompanying this article shows six of the company's buildings completed within the last two years.

In the Main office building there is one of the finest exchange rooms in this country, occupying the entire eighth floor, a room 80 by 90 feet in extent. In this is placed a relay multiple switchboard, sufficient to handle the calls from 7,500 subscribers. In the rooms underneath are located the wire chief's quarters, the distributing frames, battery plant, etc. The operators' quarters occupy almost an entire floor with locker, lunch and retiring rooms, and the remaining space in the building is taken up by the general offices of the company. In the other exchange buildings, the switchboards, terminal rooms, battery plants, operators' quarters, etc., are arranged on the same plan as in the Main office building. The company's buildings are all fireproof and of the best modern construction.

This large extension of its exchange plant in the city of Chicago has provided the company with means whereby it may not only take care of its present service, but may provide for the growth of the present and future years. Extensions made in suburban exchanges have been of a like character. Building lots have been purchased in a number of the larger places, and five new exchange buildings are to be erected this year.

In the Chicago exchange, in spite of the great increase in the number of telephones, it is found that the average distance a message is carried has increased year by year, and in spite of the enormous

Wentworth-Englewood Office. West Office. | Main Office and Exchange. Yards Office. | Lake View Office. North Office.

TELEPHONE SERVICE IN CHICAGO.—SOME OF THE EXCHANGE BUILDINGS.

number of daily messages now handled (which, in the aggregate, is greater than in any other exchange now in operation), the average distance between patrons who are speaking over the lines continues to increase, and is now nearly 3½ miles. It is hardly necessary to say that the operating appliances now used represent the latest developments in the art of telephony. Automatic signaling by electric lights was first introduced in the Chicago exchange and developed by the engineering forces of the company, and is now in extensive use in its offices. It is interesting to note, from the latest reports of the inspection department, that the time required by a subscriber to get the attention of the operator, i. e., from the moment of taking the telephone off the hook until answered by the operator, averages 6.2 seconds. It is doubtful if prompter service than this is given by any other exchange of equal size.

Thomas F. Clark Speaks of Government Ownership of Telegraph Systems.

Thomas F. Clark, vice-president of the Western Union Telegraph company, testified before the Industrial Commission recently, concerning the relations of the telegraph to the public. He said that those who based their advocacy of the system upon its working in Great Britain, Belgium and Switzerland ignored vital differences between the conditions in those countries and in the United States. In this country there are only 67 people to each mile of wire, while there are in Great Britain 130 people to the mile, in Switzerland 220, and in Belgium 321. In the United States there are 1,118,086 miles of wire, and in all Europe 1,583,267 miles.

Mr. Clark said it could not be expected that the owners of telegraph lines would sell them to the government at the mere cost of production. He also argued that the cost of construction of a telegraph system is not confined to the lines throughout the rural districts, but is due largely to city conditions—the construction of buildings and underground conduits and the securing of other terminal facilities. He estimated that there had been spent upon the Western Union system since 1866 not less than $50,000,000 or $60,000,000 entirely outside of construction, and stated that the capitalization of the Western Union company amounts to $703 per mile of poles, or $141 per mile of wire. In Great Britain the capitalization is about twice as great. The chancellor of the exchequer of Great Britain is said to have made the statement that there has been a loss to the government of about $22,000,000 on the telegraph system of that country.

Mr. Clark mentioned the fact that the telegraph lines in the United States cover many sparsely settled sections, saying that while the returns from such sections are comparatively small, the cost of construction and maintenance is greater than in more densely populated sections. In Montana, for instance, with a population of only one person to the square mile of territory, there are 292 telegraph and telephone stations. All told, he said, there are 29,000 places in the United States reached by the telegraph companies, while in Great Britain there are only 10,816 places thus reached. In this country almost 50 per cent. of the postoffices have telegraph connections, while in Great Britain only about one-quarter of them are thus equipped.

While admitting that rates on local messages in Europe are lower than in the United States, Mr. Clark contended that on through messages they are incomparably higher. He pointed out that in Europe addresses and signatures are charged for. As a comparison in long-distance messages an ordinary message covering 10 words of text would cost about $2.41 if sent from London to St. Petersburg, a distance of 1,774 miles, while a message sent from New York to Galveston, about the same distance, would cost only 75 cents.

Referring to the consolidation of the various original lines into the Western Union system, Mr. Clark said it had been necessary in order to secure unification of rates and to facilitate through business. The result also had been a vast reduction in rates of transmission, the present maximum rates being in many cases not more than one-tenth of the rates in 1866. He thought any radical reduction would be followed by disaster to the stockholders, and would result in no benefit to the public at large. There certainly would be a deficit, and in case of government ownership, the burden simply would be shifted from the stockholders to the people.

H. A. DOUGLAS, MANAGER SOUTHERN STANDARD TELEPHONE CONSTRUCTION COMPANY, ATLANTA.

The net earnings of the Western Union company for last year amounted to $6,165,364. The expenses for the year amounted to $18,593,205. There were about 35,000 people employed by the Western Union. The wages are higher than in Europe, and Mr. Clark thought they were generally satisfactory. In carrying the government business between the United States and Cuba, the International company, which is under the control of the Western Union and which carries government business free of charge, has carried more messages for the United States in one year than it had carried for Spain in 30 years.

Mr. Clark closed with another reference to government ownership, saying that he thought that no reduction could be made in rates without a serious deficit unless a permanent civil service could be established, and he believed that no benefit would be derived from the change.

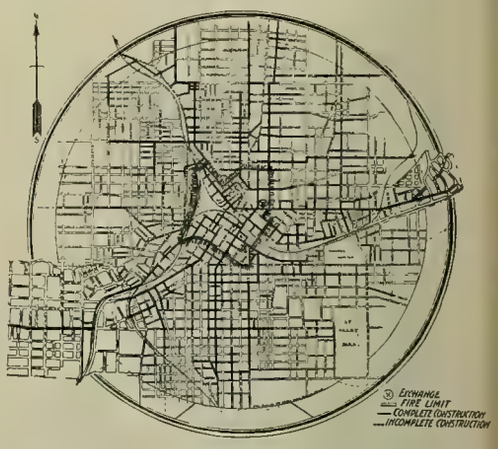
FIG. 2. TELEPHONE LINE CONSTRUCTION IN ATLANTA.—ERECTION OF DISTRIBUTING POLE.

The Augusta Railway and Electric company of Augusta, Ga., has fitted up a gymnasium with lockers, baths and reading rooms for the Augusta Railway Athletic and Benefit association, a mutual-benefit organization of its employes. The hall will be opened on April 9th.

Telephone Line Construction in Atlanta.

The great activity in the Independent telephone field in the North and West has almost caused the important developments in the southeastern states to be lost sight of, although, as a matter of fact, some of the most important Independent exchanges have been organized and are operating in this section. Atlanta, Ga., with a population of nearly 125,000, has as complete and up-to-date an exchange as can be found in any city of its size in the country.

Work on the underground system of the exchange began about two years ago, and in its finished state the underground work covers the entire fire limits of the city, and in one direction extends for nearly a mile outside, this extension being necessitated by city ordinance. The underground district is rather irregular in shape and is clearly shown in the accompanying map, which gives the extent and arrangement of the entire conduit system. The shaded lines enclose the fire district, the black lines within this boundary representing the conduits. There is a total of 193,000 feet of duct. The McRoy conduit is used, the sections being in lengths of six feet and of four and six ducts each. The conduits are laid on a bed of concrete six inches thick and are surrounded by walls of concrete three inches thick. (See Fig. 1.) Each section is fitted absolutely to its mate and is held in place by steel dowel pins one-half inch thick. The joints are wrapped with strips of burlap four inches wide, saturated in hot asphaltum, making them almost moisture-proof. The whole is then covered with a layer of concrete.



MAP OF ATLANTA, SHOWING TELEPHONE CONSTRUCTION

There are 87 manholes located at the intersection of the streets and at such other points as to facilitate the drawing-in of the cable. As a general rule, the manholes are not more than 300 feet apart. Great care was taken in their location and building, and in only one or two cases do gas or water pipes pass through them. The manholes are built of brick laid in cement mortar and are capped with heavy granite stone. Supported by bars of railway iron, they are provided with double iron covers, the inside one being fastened in place with a bar and fitted with rubber gaskets to keep out the surface water. The system being almost entirely free from gas, no special method of ventilation was found to be necessary other than that afforded by the three-inch wrought-iron cable ducts running up the distributing poles. The underground system was laid out to accomodate nearly 5,000 lines, 40 ducts leaving the central office.

The underground cables were manufactured and installed by the John A. Roebling's Sons company, and at present consist of 26 120-pair double-wrapped, paper-insulated cables, built under Conference specifications. There is now installed a total of 99,360 feet, including the pole taps. The entire cable distribution is made on the Boston multiple plan and is therefore very flexible, and has proven satisfactory in all respects. At proper points within the fire districts tall distributing poles (see Figs. 2 and 3) are placed and so arranged that all subscribers' stations can be reached without the use of pole lines, which are prohibited by law within the underground district. The distributing poles are of black locust, procured in the mountains of North Georgia. Many of them are over 75 feet high. These poles have the advantage of standing over 50 years without showing any signs of decay. They become very hard in time, making it necessary to frame them for the full complement of cross-arms and to bore for steps and fit the cable platform before erecting. Each cable pole is equipped with iron cable platform or balcony to facilitate work in the cable boxes. The cables pass up the poles through three-

inch wrought-iron pipes which rise to a distance of 12 feet above the ground. They are then covered with a casing of wood, for their protection, enter the boxes and are distributed to lightning arresters. The pot-head terminal is used almost entirely throughout the system. Cut-in wires are brought down into the cable box, through chutes placed on the pole above the box, by arm wires made into forms and laced into place. Subscribers' lines are distributed from cross-arms, as shown by Fig. 3. The use of bare wire being prohibited within the fire limits, twisted-pair, rubber-covered and braided copper wire is used for all cut-ins. No roof fixtures are permitted, and the cut-in wires are carried on drop blocks fastened to the buildings.

Underground distribution to all of the large office buildings and hotels is provided for.

From the ends of the underground system heavy aerial leads are built, carrying the open wires and 30 and 60 aerial cables to distributing poles, from which open wires extend in both directions to obviate the necessity for more than five cross-arms on any pole. This method of distribution materially lightens the construction, reduces the strain on the pole line and adds to the appearance of the routes. In almost all cases copper is used for the open lines. All circuits are full-metallic. The map shows in full black lines all of the routes which have been completed; the dotted lines show those that have been laid out and are under construction. Fig. 4 represents a 120-pair terminal box on pole.

The central office (Fig. 5) is located in a three-

FIG. 1. TELEPHONE LINE CONSTRUCTION IN ATLANTA.—UNDERGROUND WORK IN EDGEWOOD AVENUE.

story-and-basement brick building on Edgewood avenue, which was remodeled to fit it for exchange purposes. It is heated by steam and lighted by electricity. The operating room occupies the entire third floor, and is lighted and ventilated by means of a large skylight. This room is 35 by 65 feet. The present equipment provides for 3,000 subscribers, and there is room for additional switchboard to bring the capacity up to 4,000. The apparatus was manufactured and installed by George F. Payne & Co. of Philadelphia. It is proposed to make extensive additions and alterations in the system, and particularly in the power plant, in the near future.

The entire outside plant was laid out and built under the direct supervision of Mr. H. A. Douglas, as manager for the Southern Standard Telephone Construction company. Mr. Douglas has had wide experience in the telephone field. He began as an operator with the Chicago Telephone company some 15 years ago, and at the time of severing his connection with that company he held the position of assistant superintendent of the operating department, which place he had held for several years. Mr. Douglas entered the Independent field with the Citizens' Telephone company at Grand Rapids, Mich., and remained with that company for two years. He then accepted a position as superintendent of equipment with the American Electric Telephone company of Chicago, leaving to accept the management of the Southern Standard Telephone Construction company at Atlanta.

Proposed Competitive Lighting Plant in Chicago.

A number of Chicago merchants, doing business on East North avenue, are backing a project to establish an independent co-operative lighting plant, to be operated by the A. J. Sidder company, to furnish light for their own stores. A. J. Sidder, who is the leader in the movement, asserts that the Chicago

FIG 3. TELEPHONE LINE CONSTRUCTION IN ATLANTA — 75-FOOT CABLE DISTRIBUTING POLE.

Edison company makes a practice of discriminating in rates between customers, who use power under similar conditions. Mr. Sidder's charges were followed by the shutting off of his current supply, and he immediately began mandamus proceedings to compel the company to show cause why his lights were discontinued. The Edison company stated, through its counsel, that no unjust discrimination had been made; that Mr. Sidder's service was discontinued because of an unpaid account; that the cost of supplying power during the daytime is greater than after dark, because the demand is not so heavy, and that rates should always be so graded as to favor customers who used power at the time of day when the company could supply it most economically. In the meantime Mr. Sidder's service was resumed, and the corporation counsel gave an opinion that unless that gentleman could produce evidence that unjust

FIG. 4. TELEPHONE LINE CONSTRUCTION IN ATLANTA.—120-PAIR TERMINAL BOX.

discrimination in rates had been made there would be no ground for action against the Edison company.

An ordinance was introduced in the Chicago council granting the A. J. Sidder company a franchise to operate a lighting plant and to lay mains under the sidewalks on East North avenue, the company offering a $10,000 bond to protect the city from damage. The ordinance was referred to the committee on gas, oil and electric lights, and was placed on file at the council meeting of March 11th, at the committee's recommendation, the objection being made that the company was not incorporated. On March 13th the A. J. Sidder company filed incorporation papers at Springfield. The capital stock was placed at $50,000, and the object of the corporation, as stated, is to operate electric-light, heating and power plants. The incorporators are Abraham J. Sidder, Richard H. Luth and Simon Sinsheimer. At the council meeting on March 18th an effort was made to take the ordinance from the committee on gas, oil and electric lights, but although the objection formerly made to its passage had been removed, sufficient votes could not be obtained and the move was defeated. This is regarded as practically the defeat of the measure unless there should be unforeseen developments.

Wireless Telegraphy for the Weather Bureau.

The work of the Weather Bureau in its experiments with wireless telegraphy is being pushed with businesslike energy. At present the experiments are being confined to stations along the coasts of Virginia and North Carolina. Mr. Willis L. Moore, chief of the Weather Bureau, finds from his experiments up to this time that the greatest efficiency in long-distance transmission is obtained from wire cylinders. Each of the new coast stations is being equipped with cylinders of 16 wires, each wire being 140 feet in length. At present stations are in operation at Hatteras and Roanoke Island, in Pamlico

FIG. 5. TELEPHONE LINE CONSTRUCTION IN ATLANTA.—TELEPHONE BUILDING.

Sound, North Carolina. When the third station now building at Cape Henry is completed, the distance between the most widely separated stations will be a little more than 125 miles. The two completed stations and the one building are now connected by an ordinary telegraph line, which will be abandoned on the completion of the third station. This will result in a saving to the government, as the present repair stations for its telegraph line can be discontinued.

Marconi's American Plans.

Marconi arrived in New York on March 14th, and during the month which he expects to spend in America intends to visit New England and Nova Scotia to find sites for the establishment of receiving stations. He says that he has equipped 28 British, four Belgian and three German warships with signaling and receiving plants, and that a vessel fitted with his apparatus can signal 200 miles. Several steamship companies have adopted the system, but are unable to use it in many places owing to the absence of receiving stations, and it is on this account that the inventor has come to this country. The North German Lloyd will be the first transatlantic line to make use of the Marconi system; the steamer Kaiser Wilhelm der Grosse is equipped with wireless-telegraph instruments, and the big new steamer Kronprinz Wilhelm, which will make her maiden voyage to New York in September, is being fitted with a special telegraph room.

Mr. Marconi says that little is said about wireless telegraphy in England, as it is in use there to a much greater extent than in this country and is recognized as an established art.

Filipino Electrical Machinery.

By R. G. Mayse.

There has been quite an advance made in the manufacturing of electrical machinery in the Philippine shops during the year 1900. When I arrived on the islands, in 1899, there were practically no electrical machine shops. At the present time there are several machine shops in and about such places as Manila, Iloilo, etc., in which one may get electrical machinery of various descriptions made to order. The Filipino electrical machinists are very ingenious, even though they may lack many of the qualifications that go to make a thoroughly com-

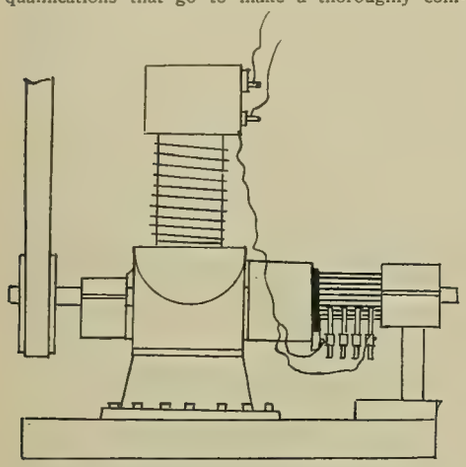


FIG. 1. FILIPINO ELECTRICAL MACHINERY.—DIRECT-CURRENT DYNAMO.

petent electrical machinist. I examined some of the work turned out by them, and found that in most cases they managed to produce electrical machinery which would answer all practical purposes, even though the finish was imperfect. There is a shortage of the necessary machinery and tools for turning out some of the finer and more complicated parts of the machines, and one can notice the deficiency.

In Fig. 1 is a form of dynamo made at one of

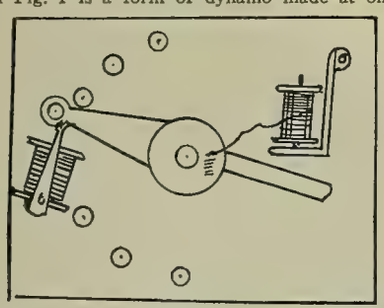


FIG. 2. FILIPINO ELECTRICAL MACHINERY.—RHEOSTAT.

the Filipino shops at Manila. The field magnet is made of two columns of iron, wrapped with the coils of insulated wire. The armature consists of coils of insulated wire wound around a core of iron. The commutator is formed with segments of copper bars, adjusted side by side. There are two sets of brushes fixed upon a type of rocker yoke, ingeniously arranged. Cables conveying the main currents are attached to the positive and negative

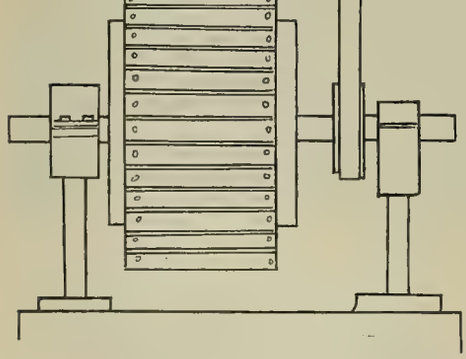


FIG. 3. FILIPINO ELECTRICAL MACHINERY.—ALTERNATING-CURRENT DYNAMO.

brushes. The speed of the machine is not so great as that of the American types, nor does it run so steadily. There appeared to be jarring and groaning in all of the journals, due to improper fitting of the parts. However, these machines do the work, and that is all that can be expected.

A form of rheostat made in the works of the native shops is presented in Fig. 2. I saw a number of patterns of these devices for regulating or adjusting a circuit, in some of which the resistance coils were arranged in quite novel forms. The Filipino machinists lack the necessary outfit of tools to make a good job on parts of electrical fittings of this description, and the indications of bungling work are plain.

In Fig. 3 is the sort of alternating-current dynamo which is made in the electrical shops of the country. These dynamos are not very popular, judging by the number made, for I saw only a very few. There is need of foundries in the islands in which the required parts of machinery can be cast. I saw that in some places the natives were shaping journals from solid pieces of metal, using the file and chipping tools to work out the parts for the receiving of the sleeves. This is very tedious work and consumes much time. But time does not appear to count for much with the Filipino machinist. He is content to work at a thing for hours and days to complete it, when, if the proper methods were employed, the part could be finished up in a few hours. I have seen machinists work for a long time truing a sprung shaft, using a hammer and anvil, and relying upon the eye. They never seem to think of putting the shaft betwen two revolving centers and truing in that way.

In Fig. 4 is shown a form of electric motor made in the Philippines. There is quite a demand for these motors with which to run elevators, electrical fans and general machinery. It would pay builders of motors in the United States to send some of their modern types of machinery here, for the present kinds are nearly all out of date. I saw

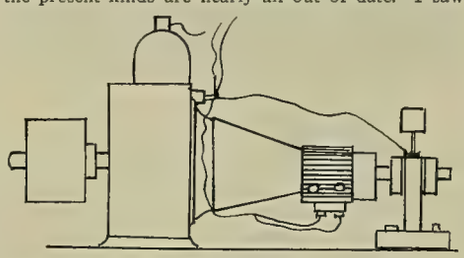


FIG. 4. FILIPINO ELECTRICAL MACHINERY.—DIRECT-CURRENT MOTOR.

some from German shops which were defective in that they were too large and cumbersome for the work required of them. Then, again, expert German machinists did not come with the machines and no one knew how to set them up and run them.

Fig. 5 represents the usual pattern of brushes constructed in the works of the native shop. The brushes are set directly against the commutator. I observed that imperfect alignment of the copper segments at (B) and (A) caused trouble. The native machinists are rather careless about these little matters and have a tendency to let a thing

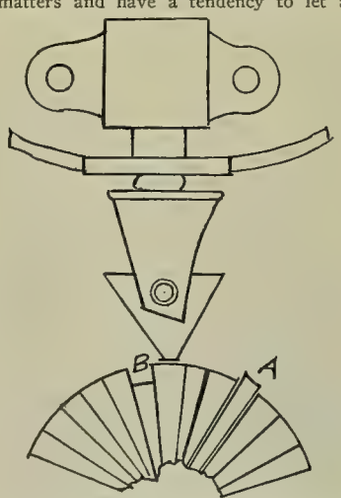


FIG. 5. FILIPINO ELECTRICAL MACHINERY.—BRUSH.

run poorly and under adverse circumstances for a long time. I noticed some of the parts of the machines were tied up with wires and strings.

The increased consumption of copper by the electrical trades makes any new copper finds of interest. Those of the Philippines will evidently prove of value before long, for the reason that some American and Canadian capitalists have lately arrived with the idea of buying up copper lands and working the mines. There are also some syndicates in operation. There is a great need of proper mining machinery and tools, and for the lack of both the mining of copper is greatly retarded. But with new machines and tools constantly arriving, it will not be long before the copper mines are run on a practical basis.

The motor shown in Fig. 6 is series-wound, and has one pole connected with two binding posts of reversing switches, while the other pole connects with the handle. There are not very many of this pattern made in the Filipino shops, but I saw several of them. The demand for electrical machinery is far in excess of the machines supplied by the native

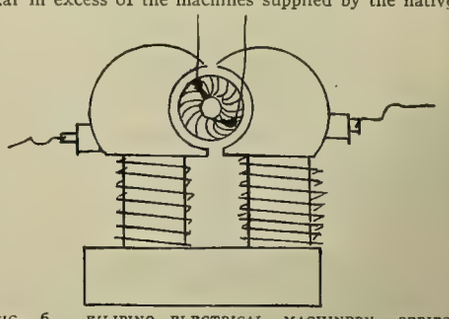


FIG. 6. FILIPINO ELECTRICAL MACHINERY.—SERIES-WOUND MOTOR.

builders. Many do not care to purchase the home-made machines, preferring to wait four or five months while the machines are ordered from America. There are a few places where some of the leading makes of electrical machinery are kept in stock, and this is a great convenience to the users of electrical power.

Electrical Exhibitors at Pan-American Exposition.

Following is a list, complete and corrected up to March 15th, of the exhibitors in the electrical section of the Pan-American Exposition at Buffalo. This includes all in the electrical section, as well as those who are placing their apparatus about the grounds in the service of the exposition. Additions may be expected until the middle of April.

American Electric Telephone company.....Chicago, Ill.
American Vitrified Conduit company....New York, N. Y.
Arnold, B. J. .....Chicago, Ill.
Bettini Phonograph company.....New York, N. Y.
Bernard company, E. G.....Troy, N. Y.
Bossert Electrical Construction company.....Utica, N. Y.
Bullock Electric Manufacturing company.....
.....Cincinnati, Ohio
Camp company, H. B. .....Akron, Ohio
Clark Automatic Telephone Switchboard company..
.....Providence, R. I.
Crocker-Wheeler company .....Ampere, N. J.
Cutler-Hammer Manufacturing company.Milwaukee, Wis.
D'Olier Engineering company.....Philadelphia, Pa.
Edison Manufacturing company.....Orange, N. J.
Electric Storage Battery company.....Philadelphia, Pa.
Eureka Electric company .....Chicago, Ill.
General Electric company .....Schenectady, N. Y.
Gould Storage Battery company.....Depew, N. Y.
Hanfeld, B. & E. .....New York, N. Y.
Holland, C. C. .....New York, N. Y.
Incandescent Electric Light Manipulator company..
.....Boston, Mass.
Jandus Electric company .....Cleveland, Ohio
Kellogg Switchboard and Supply company...Chicago, Ill.
Keystone Electric company.....Erie, Pa.
Lee Manufacturing company.....Elwood, Ind.
Mason Monogram company .....New York, N. Y.
Miller Signal company .....Chicago, Ill.
Morris Electric company.....New York, N. Y.
National Automatic Telephone company.....Chicago, Ill.
National Carbon company .....Cleveland, Ohio
National Gramophone company .....New York, N. Y.
Northern Electrical Manufacturing company.....
.....Madison, Wis.
Onondaga Dynamo company.....Syracuse, N. Y.
Peru Electric and Manufacturing company....Peru, Ind.
Phelps company .....Elmwood, Ill.
Power Installation company.....Buffalo, N. Y.
Rowell, C. B. .....Buffalo, N. Y.
Safety Insulated Wire company.....New York, N. Y.
Stanley Electric Manufacturing company.....
.....Pittsfield, Mass.
Stanley Instrument company ....Great Barrington, Mass.
Stromberg-Carlson Telephone Manufacturing company .....Chicago, Ill.
Syracuse Electric Fuse company.....Syracuse, N. Y.
Toerring, C. J. .....Philadelphia, Pa.
Wagner & Co., R. W. .....Chicago, Ill.
Waite & Bartlett Manufacturing company.....
.....New York, N. Y.
Westinghouse Electric and Manufacturing company
.....Pittsburg, Pa.
White company, O. C. .....Worcester, Mass.

Canadian Telegraphs.

The beginning of the Canadian telegraph system was made 54 years ago, when a line was established between Quebec and Toronto. The mileage of Canadian telegraphs to-day is something over 35,057 miles, 18,286 miles of this being controlled by the Great Northwestern Telegraph company, 8,886 by the Canadian Pacific Railway company, 4,973 by the Dominion government and 2,912 by the Western Union Telegraph company. It is calculated that this represents some 86,000 miles of wire and more than 2,700 offices. With the exception of the Yukon telegraphs and the extension on the north shore of the St. Lawrence, toward Belle Isle, the lines included in the Canadian government telegraph service were almost all established and equipped between the year 1880 and 1882. Three years ago contracts were given for the supply of poles and for construction of the land line to connect with the proposed cable to Belle Isle, off the Labrador coast. But for the loss of the government cable steamer, last fall, this cable would have been laid. When completed, it will practically reduce navigation between Canada and Europe to three days, the oceanic distance being reckoned from land to land where passengers can be placed in communication with the world. This will be effected when steamships can receive and send telegraphic messages at Belle Isle.

Independent Exchange at Kokomo, Ind.

Among the large number of Independent telephone exchanges that have been established in the central states, the plant recently opened by the Citizens' Telephone company, Kokomo, Ind., has been one of the most successful. About a year ago the company was organized and the franchise procured by W. N. Turner of North Vernon, Ind., who has had considerable experience in successfully organizing Independent companies. The officers of the company are: President, C. E. Nordyke; vice-president, A. H. Nordyke; secretary, S. Tudor, and treasurer and manager, W. N. Turner. The Nordykes are Indianapolis men; the others hail from Kokomo.

FIG. 1. INDEPENDENT EXCHANGE AT KOKOMO.—MULTIPLE SWITCHBOARD.

The construction work and the entire building of the plant was done under the supervision and specifications of M. H. Bentley, superintendent of the New Telephone company of Indianapolis. The Citizens' company had about 200 subscribers contracted for when the construction work was begun on May 1, 1900. The material and equipment, however, were ordered for the immediate equipment of 500 subcribers, with an ultimate capacity of 1,800. Before the exchange had been entirely completed, the subscription list had been raised to 600, and the exchange equipment was increased to accommodate 1,000 lines. The exchange has now been in operation for several months, and at the present time the patronage has increased to 850 subscribers, and at present indications, the exchange will require at least 1,200 lines in the near future. The rates charged are $2 a month for business and $1.25 a month for residence telephones. The former rates of the Central Union Telephone company at Kokomo were $3 and $2 a month, respectively.

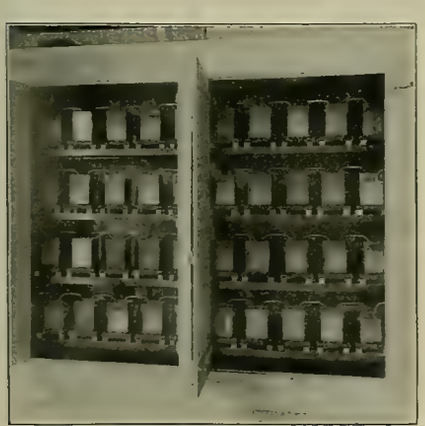


FIG. 2. INDEPENDENT EXCHANGE AT KOKOMO.—STORAGE BATTERY IN CABINET.

The second floor of the new and handsome Kennedy block was secured for the exchange, the rooms running the entire length of the building. Fronting on Main street is located a commodious operating room, part of which is given up to the reception room and general office. This room contains an improved central-energy multiple switchboard (Fig. 1), having an ultimate capacity for 1,800 subscribers. The first position of the board is equipped for toll lines and country lines, in which are centered long-distance toll-line connections and the county farmer lines. This position is equipped with the proper multiple jacks, so that the operator in the first position can answer any of the calls and make direct connection with any of the subscribers in the main exchange, and any of the operators on the main board can make direct connection from the subscriber's line to the toll lines and party lines.

The visual line signals are placed at the upper side of the board, directly in front of the operator, and behind ground-glass plates. When any subscriber takes the receiver from its hook, the corresponding signal rises automatically into view; when the operator inserts a plug into the corresponding jack, the visual signal is automatically restored and the connection is made in the usual manner. When the subscriber replaces his receiver, a miniature-lamp, clearing-out signal is shown directly in front of the cord with which the users are connected, which is automatically extinguished when the disconnection is made. Each operator's position is provided with a pilot lamp in the center of the frame, immediately underneath the answering jacks, which is lighted at the same time the signal indicates, giving two signals to the operator that a call has been made.

FIG. 3 INDEPENDENT EXCHANGE AT KOKOMO —POWER GENERATORS AND SWITCHBOARD.

In the rear part of the building are located the power plant and auxiliary apparatus. Here are placed the line-fuse and protector cabinet and the distributing board. This latter is of a heavy iron framework of such cross-section and so braced as to be strong and rigid. Fig. 2 shows the storage-battery case, with two sets, of 20 cells each, of American storage batteries. Each one of these sets is of ample capacity for supplying the energy to all the telephones in the exchange, as well as the switchboard, for a period of over 24 hours without recharging. In this system no batteries are required locally at the telephones.

In Fig. 3 are shown the power switchboard, charging machine and ringing generator. The power switchboard is fully provided with the necessary flush measuring instruments, switches for properly controlling the machines, batteries, etc., and also necessary starting boxes. The charging machine consists of a 2½-horsepower Roth motor-generator.

The construction, both for the exchange and lines, is excellent. So far some 16,000 feet of aerial cable has been put up and from 6,000 to 8,000 feet additional will probably be placed soon. Full-metallic circuits are used throughout. Starting from the office with 100 and 130-pair cables, the cables are so put in that 25 pairs can be taken out at any cable box and at any distance along the line. The poles used in the construction vary from 60 foot for the main leads to 30 foot, with other sizes between to meet the varying conditions. The cable boxes are of the Sterling Electric company's make. Fig. 4 gives a view of the rear of the exchange building and also one of the main leads of aerial lines.

The entire telephone equipment, from the switchboard to the subscriber, was installed by the Stromberg-Carlson Telephone Manufacturing company of Chicago. The Kokomo plant is considered a model exchange, and the fact that the number of subscribers is daily increasing proves that the citizens are well satisfied with the operation of the plant and the service.

FIG. 4. INDEPENDENT EXCHANGE AT KOKOMO.—AERIAL LEAD FROM TELEPHONE BUILDING.

The London Traction Field.

Recent London reports seem to indicate that Charles T. Yerkes is trying to secure control of the Metropolitan district railway, although it has been stated that his visit to London is solely in the interest of the Charing Cross and Hempstead road. Mr. Yerkes believes that London offers exceptional inducements for the establishment of a modern traction system, and it is probable that the development will follow the most advanced American practice in street railways, and will involve the discontinuance of compartment cars and graded fares. A seven-mile trolley line may be built as an extension to the Charing Cross and Hempstead road.

The reports connecting Mr. Yerkes with the Metropolitan District railway seem to be based on the fact that Robert W. Perks, Mr. Yerkes' solicitor, who is said to be the largest shareholder in the road, is reported to have been buying Metropolitan stock quietly, but in large quantities, for several months. The New York Sun, under a London date of March 13th, is authority for the statement that the Metropolitan directors have formally decided to adopt the Ganz high-tension system, with alternating-current motors, in combination with the Sprague multiple-unit system of control. This decision would indicate that the American holders of shares were not in control, as the understanding has been that the acquirement of this road was merely a step toward the consolidation of all the London transportation systems, and as no mention has been made of the adoption of the Ganz system on the other roads, the reported consolidation would be seriously hindered by the dissimilarity of equipment.

Willis L. Russell is leading an organization which has for its purpose the establishment of a lighting and power plant at Kenosha, Wis., to compete with the Kenosha Gas and Electric company.

Searchlight Displays at Niagara.

By Orrin E. Dunlap.

Prospects are exceedingly good that the searchlight display in and about the Niagara locality during the summer will surpass anything of the kind ever witnessed. Last summer the searchlight illumination of the Whirlpool Rapids was a great success, hundreds going down the gorge nightly to witness the remarkable and weird effects produced by the powerful light upon the tossing, fascinating waters that plunge through the narrow gorge in such tremendous haste. This feature of entertainment will be improved upon during the coming summer, so that it will be more attractive than ever.

On top of the electric tower of the Pan-American Exposition two great searchlights of the 30-inch type will be operated, and down at Niagara Falls, way up on the observation tower that stands on Riverway opposite Prospect Park, not far distant from the Falls, there will be still another 30-inch projector, casting its beam here and there, to the delight of all. Between the electric tower on the Pan-American grounds in Buffalo and the observation tower at Niagara Falls the distance approaches 22 miles, and from tower to tower the powerful searchlights will flash signals, night after night, during the summer. Messages will be transmitted from the Falls to Buffalo, and then, at other times, the brilliant lights will be concentrated on some city or town many miles away. Both of the towers are over 300 feet high, and it is the expressed opinions of experts that it will be possible from this height to throw the searchlight beams 50 miles across country very effectively. This will bring a large amount of territory within the influence of the lights, and the people will come to welcome their appearance each night.

The above outlines a searchlight display that would make an attractive feature in any locality so admirably situated as Niagara, but to this is to be added a still grander feature, which will be the illumination of the Falls of Niagara by searchlights.

Some 15 or more years ago, when the lands about the Falls were in the hands of private corporations, and when the arc lamp was in its comparative infancy, a plant was installed and some of the lamps operated by it had their light thrown upon the lace-like, falling waters of the Falls. Even with this insufficient lighting, the spectacle gave pleasure, and thousands traveled to Niagara to see it. Since that time there has been a wonderful improvement in electric lighting, and especially in searchlight apparatus, and now humanity is to be given an opportunity to view the greatest waterfall on earth under the beams of powerful searchlights.

On Tuesday, March 12th, experiments were made to ascertain the value of a searchlight illumination of the Falls, and they were so successful that it was given out that the cataract will be nightly illuminated throughout the summer. These experiments were conducted by the Michigan Central Railroad company. The officers of this company have long had in view an effort to make a night spectacle of the Falls. The company has a station on the Canadian side known as Falls View, at which all trains passing east and west stop for 10 minutes or more in order that the passengers may enjoy the Falls. On the date referred to General Passenger Agent O. W. Ruggles of Chicago, Frank J. Bramhall and son of Chicago, W. H. Underwood, general eastern passenger agent of Buffalo, Superintendent Morford of St. Thomas, Ont., and others assembled at the Falls for the experiments. A Michigan Central car had been provided with the necessary apparatus, including a generator and a small engine, a 30-inch searchlight, etc. This car was drawn to Falls View by a locomotive, and connection was made between the locomotive and the engine on the car to provide a steam supply for the operation of the generator, the full steam pressure of the locomotive being reduced about half by a valve.

When in operation the searchlight beam was thrown about the Horseshoe Fall and upper rapids, with great success, and it was observed that the color values in the water were well maintained. At points where the water breaks over the rocks and reefs, the whitecapped crest caught the light with glorious effect. Extending from Falls View the Michigan Central tracks skirt Victoria Park to the rear, and when Murray's Ravine was reached the light was projected down through the ravine across the gorge upon the American Fall. It fell full upon its face, presenting an entrancing spectacle. All were delighted with the results.

When the searchlight for regular summer work is installed, it probably will be placed in the neighborhood of Falls View or farther down the river, the current to be taken from the power station on the Canadian side. A 36-inch projector may be used in order that the diverged beam may fall full across the Horseshoe. Niagara Falls people are highly elated over the enterprise of the Michigan Central in trying to develop a new source of pleasure at that resort.

Automatic Telephone Exchange in New Bedford, Mass.

The telephone exchange recently opened by the Automatic Telephone company of New Bedford is the first automatic exchange in New England, as well as the largest automatic system ever constructed, and it has novel features that have attracted wide attention. The company has a paid-in capital of $100,000, under Massachusetts laws. Its officers and stockholders are prominent business men of New Bedford. Francis T. Aiken is president and Frederic Taber is treasurer. The exchange has been constructed under the supervision of Frank R. Marsh, an experienced telephone engineer, formerly employed by various Bell telephone companies. It is built for an ultimate capacity of 4,000 subscribers, all on private lines. The present equipment consists of cable capacity for 1,000 private lines and 600 telephones. The switchboard is of the type called the 10,000-capacity system, but is wired up for an ultimate use of 4,000. While the present installation of switchboards is for the accommodation of about 1,000 subscribers, additional sections or boards may be connected from time to time, as the expansion of the exchange necessitates, without any interruption in the existing service. The company will extend its lines to the adjoining towns of Fairhaven, Acushnet and Dartmouth and will connect with the Fall River Automatic Telephone company, which is now constructing a similar exchange, to be opened in the spring.

The telephones and switchboards were made by the Strowger Automatic Telephone exchange of Chicago, but the New Bedford company operates under a license from the Eastern Automatic Telephone company of Boston.

The Automatic telephone building (Fig. 1) is a handsome three-story, brick and brown-stone structure at William and South Second streets, which was built and fitted up by the Citizens' National Bank at a cost of $60,000. The company occupies (what was formerly) the banking room on the first floor, and rents the second and third floors. The expensive bank fittings, including the carved San Domingo mahogany rail and wainscot, the brass grills and tessellated floor, are well adapted for the purpose and make a fine exchange room, as may be judged from Fig. 2. Even the private coupon rooms are utilized as telephone booths.

From this building, situated in the geographical center of the city, radiate the five miles of underground conduits and the cable system. In the central part of the city there are no poles except for distribution purposes, and these are located in the alleys and back yards. The pole-line construction in the outlying districts is of the most substantial character, the wire being of hard-drawn copper. There are two miles of overhead cable and 10 miles of open line construction. Two wires only connect each telephone with the exchange.

FIG. 1. AUTOMATIC TELEPHONE EXCHANGE IN NEW BEDFORD, MASS.

The conduits were built of creosoted-wood duct, which was carefully inspected by the company's expert, who remained at the factory of the Williamsport Wooden Pipe company during the time of its preparation. The cables were furnished by the Standard Underground Cable company. The cable terminals and fuses and the pole-top terminals were made by the Sterling Electric company. Two one-third-horsepower motor-generators, made by the Holtzer-Cabot Electric company, are used alternately. The storage battery is also in double capacity for alternate use, one set being of 80-ampere-hour capacity and the other of 20-ampere-hour capacity, each composed of 50 cells, made by the American Battery company of Chicago. The terminal and power room is shown in Fig. 3.

The most prominent feature of this system, which distinguishes it from manual exchanges, is that each subscriber instantaneously connects his telephone automatically with the telephone of any other subscriber in the exchange and can talk in absolute secrecy, with no possibility of being interrupted or cut off. The automatic switchboards, made up of small individual switches, as shown in Fig. 4, connect a subscriber automatically with any desired telephone in the system. If the desired instrument happens to be in use, the subscriber calling is instantly informed of that fact by a buzzing in the receiver; he can, however, continue calling

FIG. 2. AUTOMATIC TELEPHONE EXCHANGE IN NEW BEDFORD, MASS.—OFFICE AND EXCHANGE ROOM.

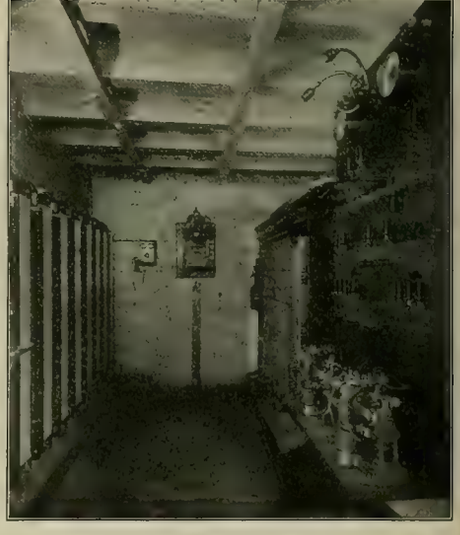


FIG. 3. AUTOMATIC TELEPHONE EXCHANGE IN NEW BEDFORD, MASS.—TERMINAL AND POWER ROOM.

as often as he may wish, and will secure the desired telephone the instant it becomes disengaged. Hanging up the receiver makes instant disconnection. The calling device on each telephone is operated by a simple, revolving dial with 10 finger slots on one side, numbered from 1 to 0, which, used in combination, will call any number desired. The operation of calling is quick and simple. The figures of the number required are separately pulled down to the stop; by this action connection is made; the signal button is then pressed, ringing the bell of the desired subscriber.

The exchange began giving service in November to a portion of its subscribers, and the Western Electrician is informed that it has steadily gained in popular favor, with new customers constantly on the list waiting for connection. The city of New Bedford is using 56 Automatic telephones, and the service has been found so satisfactory, it is said, that, with two or three exceptions, no more contracts for the renewal of Bell telephones are to be made for city offices.

FIG. 4. AUTOMATIC TELEPHONE EXCHANGE IN NEW BEDFORD, MASS.—SECTION OF SWITCHBOARD SHOWING FIRST SELECTORS.

There is but one attendant employed in the exchange room to look after the switchboards and the entire electrical apparatus, and even he is absent part of the time. There are but five regular employes of the company. The service is maintained all night, Sundays and holidays, with no other attendant than the janitor of the building, who has familiarized himself with the working of the system.

The automatic switchboards, being simply an aggregation of the individual switches before mentioned, may be increased indefinitely, without any complication, when the added volume of business demands. The fundamental feature of each individual switch is a vertical rod about the size of a lead pencil, which is lifted vertically by a ratchet or step-by-step movement, produced by a magnet, and is then rotated around on its axis by another step-by-step movement, produced by a second magnet. A short contact arm extends out radially and horizontally and is made to come in contact with any one of a bank of 100 contact points, arranged in rows of 10 each. The rod and contact arm thereon is lifted up, step by step, until it comes opposite any one of the 10 rows of the contact points, and the rod is then rotated, while the contact arm sweeps over the 10 points comprised in the row and stops at the one desired. Thus, to connect with contact point 56, it is lifted five steps and then rotated six steps. For trunk-line work the rotary movement is performed automatically after the arm has been raised to the desired row of contact points and the automatic rotary movement is continued until the contact arm finds itself in connection with an unoccupied trunk line, and then stops; the instrument is then said to act as a selector, since it is selecting a trunk line leading to the desired group of subscribers.

Every contact which opens and closes the electric circuit, excepting the relay contact, is in the form of a wiping or rubbing contact made with split springs bearing on opposite sides of a fixed and solid contact point; there is thus a constant rubbing of the double-contact surfaces, and as the parts are very light, there is no strain on them.

The two lines running to each subscriber's station are normally connected together and disconnected from the ground, one being known as the "units" line and the other as the "tens." At the central station these lines are normally closed on the main battery. The subscriber, in calling, first opens and closes the "tens" line a definite number of times (by one movement of his dial), which lifts up the contact arm of the switch a corresponding number of times to the desired number of trunk lines, when it is simultaneously rotated until it finds a trunk line in that group of "tens" that is not in use and stops. Whereupon the second movement of the dial by the subscriber serves in like manner to pick up the next trunk line. The subscriber is then connected with the connector switch to which the person desired is connected, and the last two movements serve to lift and rotate the contact arm of the connector switch to the required contact point of the desired line. The different movements require only from two to four seconds of time.

If another subscriber attempts to secure connection with the same line, he is automatically shut off and connected with a buzzer, which indicates to him that the desired line is busy.

In the operation of the switches at the central station, the assertion is made that they are found to be in just as good or better condition if frequently used, and it has been demonstrated, it is said, that the most severe use does not show any appreciable wear and tear.

It is easy to locate trouble in this exchange, since each subscriber's instrument and connecting wire are systematically defined and located, and therefore are easily repaired. It should be noted that, in the event of one section of the switchboard being burned out, the rest of the exchange remains operative.

The exchange is protected against accidents from lightning and connection with electric-light and railway wires in the same manner as the manual exchanges, and also by special protectors, which have been devised in the development of the system. In the case of a line fuse being blown, an annunciator shows its location and a bell rings to attract the attention of the attendant. In case of a switch fuse being blown, an electric light indicates the precise location of the trouble, and a bell rings to attract the attention of the attendant, if he should be in another part of the building.

Public Telephone Service.

An Associated Press dispatch from New Haven, Conn., announces that public telephones will soon be placed on street corners of that city, after the plan of fire-alarm boxes. The telephones will be encased in aluminum boxes, the height and shape of fire or police-alarm boxes. On each of the four sides of each telephone will be a blue bell, the Bell companies' sign of the public telephone. The boxes will be ordinarily locked. They can be opened by dropping into a slot a coin, which is recoverable when the door is opened.

When the door has been so opened the process of obtaining a telephone connection will be precisely the same as at any public pay station, a directory being hung inside each box. The door of the box will be so arranged that it will shut automatically when the receiver is hung up after use. C. B. Doolittle, the superintendent of public telephone stations of New Haven, is the inventor.

"The New Haven idea would not be possible in a large city like Chicago," said General Manager Hibbard of the Chicago Telephone company in an interview in the Daily News. "Chicago is supplied with nearly 3,000 public telephones, and there is no necessity for any such innovation as suggested by the New Haven dispatch. The mechanism of such a system would necessarily be very complicated, and complicated mechanism is always dangerous to successful operation. We are putting in public telephones as fast as we find locations, and within a few months we hope to have telephones convenient in every locality of the city. Our rates are being reduced and our service is becoming better every day, and Chicago is receiving the best telephone service of any city in the world to-day."

Mr. Latta Resigns as President of the T. T. C. Company.

William J. Latta has resigned from the office of president of the Telephone, Telegraph and Cable company of America. A circular letter has been sent to the stockholders stating the fact of the resignation, and calling a special meeting, to be held in Jersey City on March 26th, at which it is proposed to make some changes in the plan of the organization. The stock consists of 600,000 shares, which, at a par value of $50 a share, represents a total capitalization of $30,000,000. The stockholders have already paid $15 a share in assessments, making the paid-up capitalization $9,000,000, and it is proposed to terminate the assessments here and thus reduce the authorized capital to the latter figure. The circular letter states that the office of president is left vacant for the present. It is signed by Henry R. Wilson as vice-president. Mr. Latta remains as a director and member of the executive committee of the company. No reasons are announced for his resignation, but it is suggested that it was due to friction over the deal by which the company for a time had possession of the Erie Telephone system. It is said that this transaction tied up all the working capital of the company, leaving nothing for the development of other properties, and resulted finally in the Erie system being let go at a loss.

The Detroit, Ypsilanti and Ann Arbor road will be extended to Jackson, Mich., this spring, at a cost of $1,500,000. The Detroit, Rochester, Romeo and Lake Orion will be extended to Flint, and the Toledo and Monroe line, which is nearly ready for operation, has secured a right-of-way to Detroit, which will soon be built upon. This latter road is included in the plan for a Buffalo-Detroit through line.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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Telephone communication on large ships is destined to be greatly extended, adding to the convenience of the transatlantic voyager and increasing the efficiency of naval vessels. We note that in four British battleships launched this month (the Drake, Montagu, Albemarle and Kent) complete telephone outfits for all parts of the ships have been installed. This use of the telephone is capable of great extensions on merchant ships as well as on men-of-war.

While automatic telephone exchanges now appear to be giving useful service in small cities, it is, of course, premature to say that "the 'hello girl' has been superseded," as many of the daily newspapers declare. The Atlanta (Ga.) News, however, takes a novel and rather interesting view of the new development: "When the hello girl is no more there will be no one to blame if the exchange doesn't work. We fear that plan would not give satisfaction." This is not a technical objection, but neither is it altogether a mere pleasantry, although probably intended as such. The lack of human intelligence in performing the connections at an automatic telephone exchange must certainly be considered.

There are some municipal-ownership advocates who admit that there is such a thing as depreciation in machinery and apparatus constantly in use. R. N. Ellis, the superintendent of the electric-light plant of Jacksonville, Fla., is one of them. In Jacksonville the municipal plant supplies current for commercial use as well as for street lighting, and it is figured that the plant is operated at a profit. But listen to Mr. Ellis: "Instead of turning over to the city all of the surplus revenue to pay interest on the bonded debt, there should be at least eight per cent. on the cost of the works set aside each year to provide for depreciation." It is refreshing to encounter the statement of a man engaged in municipal electric lighting who recognizes the existence of depreciation and who has the candor to admit that provision must be made for it.

In exports of electrical machinery the reports of the Treasury Department continue to show a satisfactory increase. For the period of seven months ended January 31, 1901, the total valuation of such exports was $3,211,179, against a value of $2,141,234 for the corresponding period of 1899-1900. The exports of instruments and apparatus for scientific purposes, including telegraph, telephone and other electrical instruments, showed a similar gain, the figures being $4,425,289 and $3,700,485, respectively. Since the comparatively sudden "spurt" in the foreign business of American electrical manufacturers some three years ago the increase in this trade has been steady and gratifying. The electrical machinery builders of the continent of Europe—notably those of Germany, Switzerland and Hungary—are wide awake, however, and those of England are waking up. If the American electrical manufacturers are to retain the markets they have found and extend them, they must not be content with present-day success, but, with the most scientific methods of designing, manufacturing and merchandizing, must reach out for a large share of that great demand for electrical apparatus of all sorts which the twentieth century is offering and will certainly continue to offer.

A remarkable statement in relation to electric-railway construction in England has been made by Alderman Brownsword, chairman of the electric tramways committee of the City Council of Nottingham. Addressing a meeting of taxpayers, this gentleman gave some interesting information in reference to the progress of the electric-railway work now in progress in that city. Speaking of a recent accident at Liverpool, he said that an accident like that could not occur in Nottingham, where the arrangements were much better than in Liverpool. "In the latter city large bunches of wires cross and recross each other, and the only protection the trolley wire had was provided by a piece of wood glued on to the top of the wire. In wet weather the glue gave way, and the wood slipped underneath the wire. In Nottingham the trolley wire was guarded by wires above, and if a telephone wire fell across, there was little probability of it touching the trolley wire." Truly, the wood-and-glue arrangement would be rather primitive and cumbersome for the backwoods of America, even if it were workable; but in the jealously guarded and altogether beautiful streets of a great English city—no; it is inconceivable. We prefer to believe that somebody has been having fun with the worthy alderman who told the story.

The present telephone number of the Western Electrician well illustrates the practice of the year 1901. Large exchanges, such as those in Chicago and Cleveland, up-to-date line construction in that most enterprising of southern cities, Atlanta, a typical modern equipment for a town of 12,000 inhabitants—Kokomo, Ind.—and the new automatic exchange in that old Massachusetts city, New Bedford, are described in illustrated articles. A number of other articles of interest to telephone men are features of this week's issue. Two are in reminiscent vein and show the changes that a period not longer than 20 years has made in this truly wonderful telephone industry. They are in sharp contrast with the descriptions of the exchange operations and methods of to-day. The shorter articles describing new types of apparatus contained in this number also show the great advance that is making in the art. Telephone lamps, hotel telephones to take the place of annunciators, automatic exchanges for small towns were talked of rather than used five or six years ago. To-day they are commercial articles. In the improvement of the various types of switchboards, signaling apparatus and line construction the advancement has been no less marked. In all departments the telephone industry of the United States is in a most vigorous and flourishing condition. Judge Brown's decision in the Berliner case has removed the last lingering doubt of patent interference, and the future is bright with the promise of a great extension of the business in all sections of the country. No apology is needed, therefore, for the large proportion of this issue of the Western Electrician which is devoted to telephone subjects, although the amount of reading matter is considerably increased, so that other subjects of current electrical interest may not be neglected.

Questions relating to street railways and electric lighting are debated with great heat in the mayoralty campaign now waging in Chicago. One political party has adopted this plank as a part of its platform: "We affirm the business of supplying light for commercial purposes to be a legitimate function of municipal government, and we demand such an amendment of our city charter as will enable Chicago to supply its citizens with gas and electric current." This party points with pride to its administration of the city-owned electric street-lighting plant and says that municipal ownership is a great boon that is to be eagerly sought. It warns the voters against the wicked traction companies, and says that now the people must rise in their might, as all the principal street-railway franchises expire in 1903 and must not be renewed except on terms much more favorable to the city than those that now obtain, and then for a period of 20 years only. The other party—the "outs" in this case—is violently opposed to everything the "ins" advocate. Owing to the imminence of the franchise question, it is rather guarded in expressing itself on street-railway problems, but it is perfectly convinced that the loud protestations of the existing administration are entirely fraudulent and merely put forth for campaign purposes, as it is well aware that the "ins" are in reality hand-in-glove with the traction interests. There is much sound and fury. "Clean the streets!" shouts the party out of power. "The streets may be dirty, but they belong to the people," retort those who rely on the street-railway-franchise issue. Neither are the traction companies' opponents agreed among themselves. Some are for "ample compensation" for the privilege of using the streets, others advocate a reduction in fares; some want "municipal control," or a leasing of the rights-of-way in the streets, with private operation, while others insist on straight-out municipal ownership. Both parties assert that the street-railway companies have contributed to the campaign fund of the other. And so it goes, much like the memorable election as Eatanswill, as reported by the chronicler of the Pickwick Club.

Undoubtely, questions of great importance are involved in the present city campaign in Chicago, but they are so involved in the misrepresentations of partisan politics that the true civic patriot has a task of great difficulty in addressing himself to their solution.

The Telephone of Other Days.

By O. M. H.

The babyhood days of any great enterprise are easily forgotten when time shows a marked difference between its now and its then. This is especially true where such prodigious results have been accomplished as in the last quarter of the dead century in telephony.

The first attempts at telephonic enterprise were so puerile, when compared with the present system and service, as to be almost incredible to-day.

I remember hearing, from those superior to me, a mere messenger in the first exchange, how the first two telephones, sent out by Bell himself, were experimented with and came near being turned down as mere scientific toys. The two boxes, in which were the receivers—there was no transmitter or microphone—were connected together, and one of these carried into the safe of an office on La Salle street, while the other was taken into a second room, and the doors of the room and safe closed. Conversation was carried on between the man in the safe and the rest of the committee in the second room. If I remember aright, there were five of these committeemen. Two of the committee could see no outcome to the telephone business, one was undecided and two were confident of a fair future for the instrument.

In due course of time the American District company, by which I was employed, concluded to open an exchange in connection with its messenger and watch service. We messenger boys were made operators.

The first exchange was composed of 11, or about that number, patrons, all of whom were in one class of business—bankers—and who were fairly forced to become members of the exchange. There was no multiple switchboard, and for that limited number none was needed. A call would come in on the A. D. T. instrument, the call box of which, at the patron's office, was arranged to give any one of several signals—messenger, police, fire, telephone, etc. On receiving the telephone signal a ticket with the subscriber's number was made and handed to the switchman, who called him up on his telephone wire and gave him a connection with the person required.

In due course of time the telephone began to make headway, and subscribers were gradually obtained, until it was found that the half dozen boys of us were not able to do the work, and our quarters were too cramped. We were moved up to the third floor, which then seemed large enough for all time to come. But another difficulty presented itself. It was impossible with a single board to work more than two of us at a time, and the more subscribers we had the worse the conditions.

To aid in the transferring of the calls, speaking tubes were put in from the A. D. T. instruments to the operators, through which to convey the numbers calling and called for.

Then came an attempt at duplicating the switching board. An operator was placed at the second board to plug in a duplicate dummy connection, so that we could more readily distinguish which lines were busy. Tickets piled up; the same person, getting impatient, would call three, or even more, times before getting a connection, and when his second, third or fourth ticket came to its turn he would be notified that he could have the number he had called for and finished with a half hour before. There was a positive rule that no improper language should be used; but how could we prevent it under such circumstances? There were many who, as it is to-day, I presume, when told the line wanted was busy, said mentally, if not orally, "That boy is a liar, and I know it."

The duplicate board was not a brilliant success. Plugs were omitted, plugs were neglected, so that, between not putting them in and not taking them out, the whole was a case of confusion worse confounded.

What was wanted was a board that would permit of a test at any time, to show if a line was busy, without disturbing the persons talking, and thus allow of two or more boards being worked without interference. The problem was well advertised, for exchanges, by this time, were incapable of rendering efficient service with a single board.

Electricians, our manager told us, all over the country pronounced this impossible, and sundry schemes were proposed to solve the problem. Among other things, a "railroad" board was inaugurated, to which all that class of lines were carried. Other classes were aggregated similarly, but this was not perfect relief. Finally, the multiple switchboard, invented by Haskins and Wilson, materialized, and instantly nearly every exchange manager in the country became enamored of what they had believed impossible.

With the rapid increase of patrons, the "busy" notification was, of course, more frequent. A railroad or commission man or a lumber dealer would occupy one operator (there were several "hello girls" now) with his various calls until he had transacted all his morning's telephone business, without ever losing his hold, and in the meantime other subscribers were making remarks—forcible remarks—on the lying operators at central.

The nice little candy gifts the operators occasionally received showed that their aid was appreciated, and we who were good to the girls occasionally sampled the box.

There was one doubting Thomas on the West Side who had repeatedly denied the statement that his correspondent was busy, and he set a trap to catch the operator. Leaving his clerk with positive instructions not to allow anyone to use the telephone until he called him up, he made a bee-line for the central office, and asked the manager to give him his store. He was told the line was "busy." Then he did break out! His rage apparently knew no bounds. When he had cooled somewhat the manager plugged in a second connection, and gave him a receiver. He heard his own clerk's voice and that of a customer, buying goods. His store had been called up in his absence, and he was as subdued and sincerely repentant as the fox in the fable, caught with the hen in his mouth.

Whenever anything of that sort occurred it was public property at once, for all the employes, from the superintendent of construction down, and, of course, proved a salve to our wounded feelings in the operating room.

There was, at one time, a grand avalanche of complaints of being cut off in the midst of conversation, and letters containing threats of dire vengeance were found in every mail, clothed in language not weak nor elegant, for which there appeared to be no remedy, until it was discovered that the plugs, when placed firmly in the switchboard by the left hand of the operator, unscrewed the connection on the plug, while those placed by the right hand were tightened by the act of twisting them in firmly. A couple of hours by the handy man with a soldering-iron stopped that cry of "cut off," and the next few days brought an abundance of complimentary epistles and more than one postscript hoping that, now we had caught the young devil, the management would hang him, or drown, or cremate the youth. How much boyhood is held responsible for!

I happened to be in the manager's office on detailed duty one day, when a gentleman with a disappointed air entered and spoke in a subdued voice, making a request to have his telephone removed. Now, when a request of that kind was made, it was strongly suspected that the enemy (the Bell company was in the field with a very active solicitor) had been making advances to one of our customers. The manager asked his reasons.

"I can't hear anything over the telephone, and I have to give it up."

"Let us see," said the manager, at the same time calling up his place, and giving him the receiver.

Patron (listening)—"No; I can't hear anything distinctly."

Manager (to me)—"Go to Ed Kelly, and tell him to send me a left-handed telephone."

I was thunderstruck, but I obeyed, and Kelly, who was something of a wag, poked over a lot of receivers, and finally handed me one, with "Tell the manager we have but one more left-handed receiver, and he must get a new lot."

I delivered the message, with the receiver, and the manager proceeded very gravely to make a memorandum of the need, being careful to let the gentleman see it. Removing the receiver, which he assumed was a right-hand instrument, he replaced it with the left-hand receiver, and asked the gentleman to listen with the other ear. The trick was a success. The man was deaf on the right side.

Competition by this time was running so high that strategic movements alone could win. The foreman of construction of our company was called up one morning by the manager, who asked him if he could run a line to a given street number by 6 p. m. "The boss" continued: "Mr. X. has promised that if I can get a line working in his office by that time he will take it, otherwise he will take the Bell." After a moment's hesitation the answer came, "Sure, and no mistake." The line was promised, and run, and in working order by 4:30 p. m. The contract was signed, and everything satisfactory, except that Mr. Z., whose office was in the same building, telephoned the next morning over Mr. X.'s line that his own line was not working. "No wonder," said the foreman; "I used his wire for the other fellow!"

Of course, while the enterprise was new, there were plenty of people who were anxious to have a telephone, provided it cost nothing; and again there were others who would not have one under any circumstances. The belief (founded on as firm facts as those relative to the baneful influences of the Drainage Canal, when it was first opened) that to have a wire attached to one's premises was a sure way of inviting God's wrath in the shape of a thunderbolt was not infrequently stumbled upon by the solicitor, and this risk was sometimes advanced by those who considered it a fair equivalent for a free telephone service. A very common answer to the agent who was endeavoring to swell the list of subscribers was: "Why, I've got a horse and buggy, and I like to see the man, face to face, with whom I am talking;" and it took hard work, and a deal of it, to convince a lumber dealer, for instance, that he could transact many times as much by telephone as by horse and buggy, and with more comfort, in the same time.

The excuse above referred to—that a wire was a menace to the safety of a building—was a serious drawback to the construction gangs, and it was not an uncommon occurrence for a gang to string one or more wires, if necessary, while the proprietor or agent was asleep.

An interesting little episode occurred one night on the West Side when a gang of men on a roof was suddenly alarmed and sought safety in flight. One of their number, Billy ———, who was unfamiliar with the roof—which, by the way, covered several apartments—was lost from his companions, and mistook the scuttle. Descending the ladder, the distance from the lower round to the floor was greater than he anticipated, and he fell with considerable force against a door, which he found was locked. Before he could recover, and climb back up the ladder, the door was unlocked, and there, confronting him, was a man with scanty raiment, a cocked revolver, and a dog which seemed only too ready to sample his flesh. The lineman surrendered unconditionally, and, while the dog snuffed uncomfortably at his heels, submitted to a search which revealed no burglar's kit, and he was eventually believed innocent. The dog was called off, the revolver was pointed the other way, and Billy was politely shown the way down the stairs. The story was too good to keep, and the victim told the tale on himself.

The foreman, of whom I spoke before, required a line between two points which necessitated a wire being run from one building where dire threats had been made against any and all telephone men attempting to string a line. About dusk one evening the foreman called one of his men aside, and showed him where he wanted the line run before morning. "Take Jim and Dan with you," he said, "and run me a wire from there"—indicating—"to there, and don't get caught at it, either."

"But," said the lineman, "they won't let me into the building."

"You didn't understand me," said the foreman. "I want a line from there to there by to-morrow morning."

"But how'll I get it there?" asked the man; and the foreman, straightening himself to his full attitude—six feet two—and waving his arms like the wings of a Dutch windmill, replied, excitedly:

"Fly! —— —— it; fly!"

The wire was in place next morning.

It was the rule, rather than the exception, for everyone to yell into the telephone, as if the racket must be in direct proportion to the distance of the listener. The talker seemed to think that it required three or four times as much effort to talk to the stockyards as to speak to a man half a dozen streets away.

We had on the force a bright little red-headed Irishman, whose wit was ever ready, and who seemed always primed for a joke. One day a gentleman asked the use of the telephone to talk to somebody near the south end of town. He fairly screamed into the instrument, and set all the boys giggling. In the midst of the tumult Mike got off his bench, and while the captain of the messengers was not looking, opened the window its full height. He explained, when asked what he had done that for, "So the feller down in Fiftieth street c'd hear betther, sor."

The peculiar faculty the lines have for getting mixed occasionally, so that the wrong person turns up when you call, is nothing nowadays to what it was in the olden time. We had some very amusing instances occasionally, as well as many exasperating ones. On one occasion a patron asked a connection with Fuller & Fuller. The wrong man answered with "Hello," as usual.

"Who are you?" asked the girl, not recognizing the voice; "I'm trying to get Fuller & Fuller." The answer came back, punctuated with hiccoughs: "Well,

I'm (hic) pretty full, but I (hic) ain't getting fuller and fuller;" and he rang off.

It was the usual method in those days of telephonic juvenility to call for the person wanted by name, and, of course, mistakes were not rare. There were two doctors whose names were nearly alike telephonically. The initials of the one, a physician, were A. J. The other, H. A., was a veterinary surgeon. One night the physician was called to a case quite a distance from his home, and found, on his arrival, that the invalid was a pet cow, and the veterinary surgeon was wanted. The similarity of the two sets of initials, when spoken carelessly, had been responsible for the error.

Yet with all its imperfections and faults, the telephone of those days was highly appreciated by many, and especially in hands where it was clearly a luxury for the most part; and what caused some astonishment among the earlier users was the facility with which it adapted itself to the various spoken languages. A gentleman of considerable polite, as well as business, education had an instrument put in his office and one in his residence. When these were ready for use, the agent instructed him how to call up his house, and made the necessary arrangements that he might converse with his wife.

The conversation was conducted in no less than three languages, much to the amusement of the gentleman, who closed the interview with a French sentence, which the agent did not understand. Correcting himself, he said: "Excuse me, my friend; I didn't know but you were like the telephone, and talked everything. I am much pleased to know that the instrument has no memory. Send in your bill."

The telephone expert of to-day will smile at the simple-minded folk who were the pioneers in telephony, but they have among them, even now, some who, like the writer, can recall most, if not all, the incidents and trials I have related.

New Electrical Building in Chicago.

A number of electrical concerns have established themselves in the new electrical building at Jackson boulevard and Desplaines street, Chicago. As shown in the accompanying illustration, the building is eight stories high and well built. Prominent among the tenants is the Farr Telephone and Construction

NEW ELECTRICAL BUILDING IN CHICAGO.

Supply company, which, established in 1895 at 357 Dearborn street, has entirely outgrown the old quarters and is about to move to the Electrical building, where it will have about 3,000 square feet of floor space. This increase of space will enable the company to fill its orders more promptly than ever. The general offices and salesroom of the Farr company will be located on the ground floor at Nos. 118 and 120 West Jackson boulevard. The Farr company has had a remarkable success in telephone business, its customers being in every state of the Union, and not a few in Canada. This company guarantees its telephones to give satisfaction or the money will be refunded. A small book of diagrams and instructions will be sent free to anyone upon application.

Other concerns which will be located in the new building are the New York Insulated Wire company, H. T. Paiste company, John W. Brooks company, American Circular Loom company, Dearborn Electric company, Pass & Seymour company, Haines & Noyes company, George S. Searing (Hart & Hegeman), Peru Electric Manufacturing company, W. R. Garton company, McDermid Manufacturing company, Anchor Electric company and Western Tool company.

Independent Telephone Practice in Duluth and West Superior.

By J. C. Crowley, Jr.

A telephone-exchange system of considerable magnitude that is worthy of mention is that of the People's Telephone company of West Superior, Wis., which operates at the head of the Great Lakes nearly 3,000 telephones. The system is divided as follows: The Duluth (Minn.) office is equipped with a 3,600-capacity switchboard. West Superior, Wis., five miles across St. Louis Bay from Duluth, is equipped with an 1,800-capacity switchboard. The Duluth office, on the Minnesota side, has two branch, or sub-exchanges, known as the West Duluth and Lake Side offices. Each of these branch offices has one 100-drop switchboard. The West Superior office also has a sub-exchange at Old Superior with a 100-drop switchboard. From Duluth the trunking system is divided as follows: From Duluth to West Duluth, there are 10 pairs of trunk lines; from Duluth to Lake Side, five pairs of trunk lines; from Duluth to West Superior, 15 outgoing trunk lines; from Duluth to Old Superior, two outgoing trunk lines. The trunking system from West Superior is as follows: West Superior to Duluth, 15 outgoing trunk lines; West Superior to Old Superior, 10 outgoing trunks; West Superior to West Duluth office, two outgoing trunks.

The cables carrying the wires into the exchanges consist of 100-pair, paper insulation, No. 20 B. & S. gauge cables, running down a shaft constructed from the second floor to the basement, and thence into subways. They are carried to points of distribution in underground conduit at the fire limits. There they are taken aerially to their respective points on pole lines, dividing into 25-pair cables, as they are needed at different points.

In the main offices are the large 100-pair, fusible terminal heads made by the Moon Manufacturing company of Chicago. The terminal heads at the points of distribution are protected by one-ampere fuses, and at the main office by one-half-ampere fuses. In addition to the line and cable protection, there is also a Maxstadt fuse block at each subscriber's station, protected by half-ampere mica fuses, manufactured by the American Electric Fuse company of Chicago, Ill.

The conduit used is that made by the J. T. McRoy company. It is laid in trenches six feet deep, on a bed of concrete four inches thick. It is then covered on both sides by a thickness of two inches and on top by four inches of concrete, thus securing a rigid and substantial foundation, as well as a protection against outside disturbances. The manholes are all constructed from the best fire-burnt brick. Each manhole is six by six feet square and eight feet deep and is provided with sewer connections and trap and a well-ventilated cover, thus securing proper ventilation and draining at all times.

White cedar poles were used throughout for the line construction of these exchanges, as the cedar is plentiful in the immediate vicinity. The cross-arms are all of yellow pine from the southern states. One-and-one-fourth-inch oak pins are placed on all straight pole lines, locust pins being used at all junctions, as well as corner poles. The cross-arm braces are 18 inches long and 1¼ by one-fourth inch in cross-section and are heavily japanned. The cable platforms are all of local manufacture and are made from selected oak and thoroughly braced. All corner, junction and cable poles are securely anchored by three-eighths-inch and five-eighths-inch signal strand wire, fastened to three-fourths-inch, one-inch and 1½-inch galvanized-iron guy rods, set at the proper depth, in accordance to the strain. The cables are suspended on three-eighths-inch and one-half-inch messenger wire by Boston cable clips. The line wire used throughout is No. 14 B. & S. gauge, full-metallic lines running from the cable distribution points to the poles in rear of the subscribers' places of business. There the lines are separated to the end of each cross-arm on double-grooved insulators, thus giving a good distance between wires from house to pole and avoiding the old trouble of crossed wires. The cable poles are all "jumpered" with heavy cotton-braided, rubber-covered, No. 18 B. & S. gauge wire. The interior wiring at subscribers' residences and places of business is done throughout with twin cotton rubber-covered wire to the fuse blocks, whence two single No. 18 B. & S. gauge, rubber-covered, cotton-braided wires are carried to the line connection.

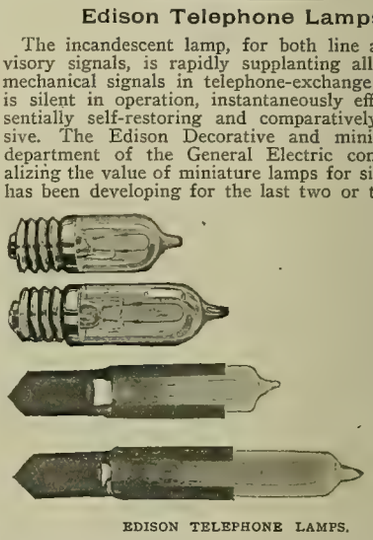
The cables used are those manufactured by the John A. Roebling's Sons company of Trenton, N. J. A fact worthy of mention at this point is that the 50-pair cable, which runs from Duluth to the West Superior office, is, approximately, 27,000 feet long, thus giving a cable a fraction over five miles in length. This cable gives excellent service to all the subscribers, it being used for trunk lines exclusively between the different exchanges.

The apparatus is that manufactured by the Stromberg-Carlson Telephone Manufacturing company of Chicago, and is of its latest improved central-energy system throughout. Duluth is furnished as follows: One 3,600-capacity switchboard, 40 cells of storage battery (American company's type), two Crocker-Wheeler charging machines in duplicate, Weston ammeters, voltmeters, etc. The West Superior equipment comprises one 1,800-capacity switchboard, 40 cells of storage battery (150-ampere-hour American), one Wagner single-phase motor, one Roth Brothers 50-volt, direct-current dynamo, with necessary Weston ammeters, voltmeters, etc.

The personnel of the People's Telephone company is as follows: President, W. M. Pattison; vice-president, W. M. Hubbard; secretary, C. C. Kritzer; treasurer, R. C. Ogelvie; manager, H. H. Stewart; general superintendent and engineer, J. C. Crowley; directors, R. C. Ogelvie, E. L. Bradley, W. M. Pattison, E. H. Stafford, E. S. Upham, W. M. Hubbard, L. S. Loeb, William Harrison and C. F. Leland.

Edison Telephone Lamps.

The incandescent lamp, for both line and supervisory signals, is rapidly supplanting all forms of mechanical signals in telephone-exchange work. It is silent in operation, instantaneously effective, essentially self-restoring and comparatively inexpensive. The Edison Decorative and miniature-lamp department of the General Electric company, realizing the value of miniature lamps for signal work, has been developing for the last two or three years



EDISON TELEPHONE LAMPS.

a special type of incandescent lamp known as the telephone lamp. By its thorough methods and careful processes, it says, the only fault such a signaling device is believed to have—liability to burn out—has been minimized now to an almost negligible degree. The Edison telephone lamp is asserted to have the following-named special features: Certainty of service of each individual lamp, due to the elimination of all faulty lamps; extreme length of life; strong and durable mechanical construction; thorough uniformity of all lamps, insuring certainty of contact in sockets and freedom from misfits; maximum of maintained light for a minimum of power consumption.

By reason of these characteristics, which have been verified by extended service, and also by reason of its ability to fill orders promptly and properly for any quantity, the Edison decorative and miniature-lamp department finds that its business in these lamps has grown to very large proportions, many exchanges using nothing else. The accompanying illustrations show the several styles of telephone lamps.

Waterpower Development of Great Falls on the Potomac.

The development of the waterpower of the Potomac River at Great Falls, 18 miles from Washington city, has been agitated for many years, but the accomplishment of the plan has been delayed by numerous legal complications. It now seems probable that a compromise between the litigants has been effected, and the work of "harnessing" the falls and transmitting the power to Washington will be taken up shortly and pushed with vigor.

Several prominent stockholders in the syndicate which has acquired 11 of the street railways and the two electric-light companies in Washington are interested in the movement, since they have acquired a majority of the Great Falls company. The plan, so far as can be learned, is for the company developing the power to transmit the power to Washington and sell it to the Washington Electric and Traction company. If this plan is pursued by the closely related companies, the necessity of enlarging the central power station will be removed. It was recently announced that the central plant was to be greatly enlarged, and the plans of the contemplated enlargement were made public.

It is rumored that the General Electric company is about to invest extensively in copper-mining property in Arizona, with a view to obtaining and refining all the copper necessary in its manufacturing business.

Ericsson Hotel Telephone Equipments.

In the model hotel or apartment house of to-day telephones are quite as necessary as the elevators and mail chutes. After many unfavorable experiences, architects, engineers and contractors have gradually discarded the cheap and inefficient telephone apparatus and are choosing instruments more for quality and durability than price. An example of a modern installation is that placed in the new Hotel Essex, at Fifty-sixth street and Madison avenue, New York city. This hotel is equipped with genuine Ericsson telephones and switchboard, which give quick communication from every suite and hall to the office, and place the management within easy reach of every patron.

The room telephones are all of the hand microtelephone pattern, as shown in Fig. 1, and instead of being a disfigurement to the wall, they serve as an ornament to the finely finished suites. Each of these instruments is fitted with a flexible cord of sufficient length to enable the patron to call the office, or to answer a call, if desired, without rising from the couch or bed. When through using, the releasing of a lever in the handle makes and breaks all necessary connections, and it is not necessary to replace on a hook, as in ordinary telephones. When first introduced, the hand microtelephone was considered a curiosity, but its manufacturer says that its utility and compactness have made it a great favorite, and that it bids fair soon to take the place of the popular nickel desk set and in many cases to replace the wall instrument as well.

In operation the office is called by simply pressing the contact in the handle of the hand microtelephone, which act throws the drop at the switchboard. The operator connects in the usual manner, answering the call, and, if desired, calls some other suite and enables the two to converse. The call to the suite is made by a small musical gong, placed near the ceiling, which, while loud enough to call a person, is not harsh enough to disturb one.

As shown in Fig. 2, the wall telephone for use in the halls is neat, compact, and takes small space. It is fitted with the standard Ericsson receiver and transmitter. In operation it is used in the usual way, the act of taking the receiver from the hook sending the call for the operator in the office. With both instruments, when the line is released, the operator is at once notified and quickly disconnects.

The switchboard is shown in Fig. 3, and besides being positive and rapid in operation, it is said to be of the finest mechanical construction. It is handsomely finished and, while occupying very little space compared to its capacity, is of a peculiar design which distinguishes it from ordinary boards. The system is operated by centralized batteries and is so arranged that, when desired, a motor-generator can be thrown into circuit for calling. In addition to this system, the Ericsson Telephone company, 296 Broadway, New York, makes a number of different telephone systems and instruments of special design and finish for special uses, including intercommunicating patterns and those for exchange use.

Fig. 1. Hand Microphone.

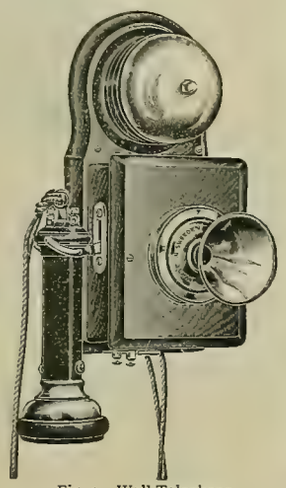


Fig. 2. Wall Telephone.

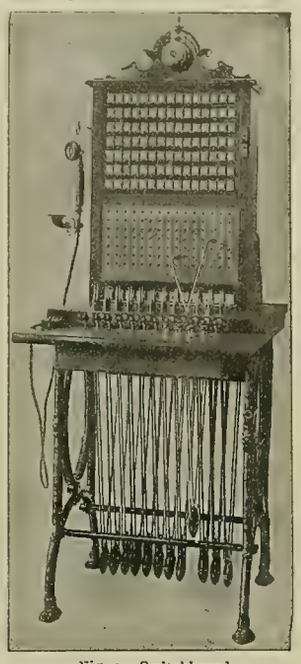


Fig. 3. Switchboard.

ERICSSON HOTEL TELEPHONE EQUIPMENTS.

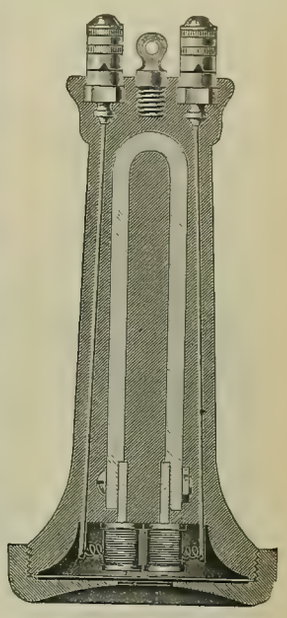
Swedish Sure-grip Climber.

The Smith & Hemenway company of 296 Broadway, New York, importer and manufacturer of a line of Swedish flyers for linemen, is putting on the market what it calls its Swedish sure-grip climber. The accompanying picture illustrates one of the climbers. The spur, in addition to being welded to the upright, is also riveted, thereby insuring a solid connection. It is said that in a number of tests recently made it was demonstrated beyond question that the spur is there to stay, and that it is practically impossible to knock it out. The company has been experimenting some time in the manufacture of climbers, and has now struck a standard. It will hereafter warrant each climber, and should the spur loosen or come out, the company will either refund the money to the purchaser or replace the climber by a new pair.

SWEDISH SURE-GRIP CLIMBER.

Murdock "Solid" Receiver.

The sectional illustration shows a telephone receiver made by William J. Murdock & Co. of Chelsea, Mass. This receiver is known as the "Solid." The distinctive feature is that the magnet, the pole-pieces, the binding posts, the wires connecting with the binding posts and extending through the case and the supporting rings, are covered with the insulating material which forms the shell and are solidly molded therein, making the case and all these parts practically one piece. This gives the magnet a permanent position, and keeps the pole-pieces always in the same relative position with respect to the diaphragm seat. The binding posts are made hexagonal in shape and grooved, this shape preventing their turning; the grooves insure them against pulling out of the molded shell. The manufacturers assert that the adjustment of their receivers being exact at the outset, this construction makes it permanently so. Watch-case receivers are also made on this principle.



MURDOCK "SOLID" RECEIVER.

Eavesdropper Betrayed by a Clock.

A press dispatch from Dresden, Ohio, states that Farmer William G. Gehrung has been fined $25 by his neighbors for eavesdropping over the Independent party-line telephone. Some time ago the farmers organized a telephone company. When the telephones were put in the party-line principle was employed, and half a dozen telephones were put on the same line. This arrangement is such that when one telephone bell rings all ring. For weeks the subscribers have been trying to find out who was listening when they talked. Farmer Green and Farmer Brown were engaged in conversation over the line when they heard another subscriber take down his telephone. Then they heard the clear tones of a clock striking. Farmers Green and Brown knew the clock, from its peculiar tone, and that it belonged to Farmer Gehrung.

"Central" Transmitter.

The accompanying illustrations show the twentieth-century long-distance transmitter of the Central Telephone and Electric company of St. Louis, Mo. This transmitter is the result of long experience and exhaustive tests and is placed on the market with the statement that nothing better can be made. Genuine imported granular carbon is used, and no expense has been spared in any part. Perfect talking results and unlimited lasting qualities are claimed. Referring to the illustrations, Fig. 1 shows the transmitter complete; Fig. 2, the heavy cast front of case, with protected mouthpiece; Fig. 3, the metal back of case, showing double cord connections, and re-enforced fastenings; Fig. 4, metal diaphragm, with electrode attached; Fig. 5, special transmitter cup with carbon back.

Fig. 1.

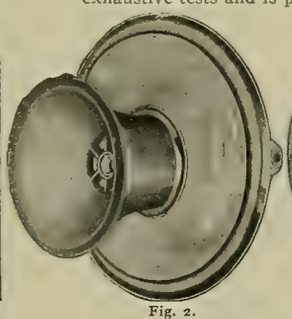


Fig. 2.

Fig. 3.

Fig. 4.

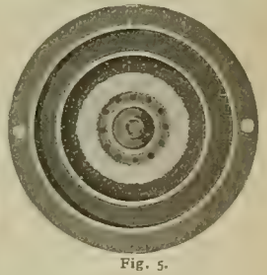


Fig. 5.

"CENTRAL" TRANSMITTER.

Chicago Automobile Show.

The automobile show at the Chicago Coliseum presents many points of interest, not only to lovers of the sport, but also to those who are interested in the vehicles from technical and commercial viewpoints. The list of exhibitors is a long one, and includes most of the prominent manufacturers of this country, as well as some of the European makers. Among the former may be mentioned the National Automobile and Electric company, Indianapolis; Mobile Company of America, New York; Woods Motor Vehicle company, Chicago; Milwaukee Automobile company, Milwaukee; Woods, Waring & Co., Chicago; Hewitt-Lindstrom Motor Vehicle company, Chicago; Electric Vehicle company, Hartford, Conn.; Automobile and Cycle Parts company, Cleveland; New York Belting and Packing company, New York; Crest Manufacturing company, Cambridgeport, Mass.; Eastman Automobile company, Cleveland; Sipe & Sigler, Cleveland, and A. B. Holson, Chicago. The list several days ago included 24 exhibitors of automobiles and motor cycles, besides a large number of exhibitors of parts and accessories.

The exhibit of motor cycles is of especial interest. There is a widespread idea among cyclists that motor bicycles are too clumsy and unreliable to be either safe or desirable for general use, and the manufacturers will endeavor to correct this idea by showing a number of the machines in service on the track which has been provided for the purpose.

The large steam truck which was built in Milwaukee for the exhibition, and is said to be the largest of its kind in the country, was driven to Chicago by road to bear witness to its practicability. One exhibitor of steam vehicles has announced his inten-

tion of running steam carriages between the Coliseum and his downtown showroom for the use of his friends and customers.

Another feature which will prove of interest is the provision which has been made for the exhibition of racing machines on the track. Racing automobiles are not familiar sights to most Chicagoans, and arrangements have been made for speed trials every afternoon and evening during the show. The exhibition will be open for one week, closing on March 30th.

Olds Electric Carriage.

There have been placed upon the market many devices for controlling the speeds of electric vehicles which have given considerable trouble in the matter of the contacts becoming fused. Frequently when a heavy load is suddenly thrown upon the vehicle, a change from one speed to another must be made while a current of 50 or 60 amperes is passing. It will thus be seen that in order to prevent fusing at the contacts, the making and breaking of the contact must be positive and instantaneous. The controller built by the Olds Motor Works of Detroit is claimed to be positive in action and to be a perfect snap switch in both directions. The construction work upon all parts of the vehicle made by this concern is asserted to be of a superior character. Slate and porcelain are extensively used as insulation, and the greatest care has been taken, so that all parts are constructed strictly in accord-

OLDS ELECTRIC CARRIAGE.

ance with the most approved electrical practice. The Olds Works manufacture all of their own switches. The running switch is a neatly constructed snap switch, mounted upon slate. The handle to this switch is detachable, and is made in the form of a lock. The handle proper is of buckhorn, mounted with sterling silver.

The gear mounting of the Olds electric vehicles is very neat and simple. It consists of a cast-steel gear case covering the large driving gear and a greater portion of the rear axle. This gear case supports the motor and also the springs. It is graceful in form and takes a beautiful finish. The wrenches consist of a pair of tubes so attached to the motor and pivoted at the front axle as to form a solid frame in the form of a triangle in the vertical plane.

One of the interesting things manufactured by the Olds Works is the switchboard to use in connection with its carriages. It is a thoroughly modern board in every detail. One thing which attracts the eye is a novel and neatly constructed safety switch of the firm's own design and manufacture. The Detroit factory of the works is, or was, before the recent fire, situated upon the Detroit River. It will be rebuilt promptly on the present site, near the bridge which leads to the renowned Belle Isle Park, where 20 miles of beautiful drives furnish a show-ground for vehicles which is unequaled. It was on one of these drives that the electric vehicle shown in the accompanying illustration was photographed.

McIntire Wire Connector.

The patent wire connectors, terminals and specialties manufactured by the C. McIntire company of Newark, N. J., have brought that company into prominence. Mr. McIntire's new single-tube sleeve connector for hard-drawn copper wire for all the standard sizes is shown in Fig. 1 of the accompanying illustrations. This connector is used exclusively by large telephone companies in all parts of the country, and is guaranteed, when properly made with splicing clamps, to be absolutely airtight, and to form one solid mass of metal at the joint without heat or solder. The connectors are also guaranteed to hold the wire under any pull or strain whatsoever. The manufacturer says that the cost of these connectors is as reasonable as good workmanship will allow. While Fig. 1 shows the connector ready for use, Fig. 2 represents it after the wires are inserted and the connector is complete on the line. It is asserted that 3½ complete turns or twists will make the McIntire connector practically a solid mass of copper and perfectly airtight.

Fig 1. Connector Ready for Use.

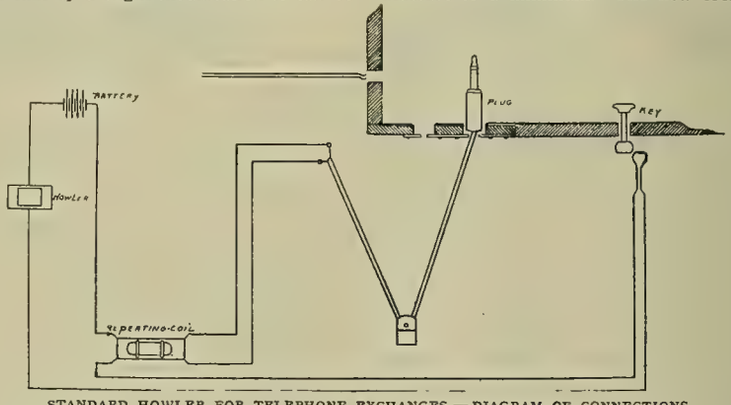
Fig. 2. Connector on the Line.

M'INTIRE WIRE CONNECTOR.

Standard Howler for Telephone Exchanges.

The device commonly known as a "howler" has for its purpose the signaling of a subscriber when he has left his receiver off its hook. A howler invented by W. G. Peacock of Chicago and now manufactured by the Standard Construction company, 72 to 80 Market street, Chicago, has some points of special merit. The apparatus can be placed anywhere in an exchange, and is adapted to common-battery or magneto boards. It can be operated by the main battery or by 25 or 30 cells of standard batteries.

In the accompanying diagram are shown the connections for the operation of the Standard howler. In order to illustrate the induction, an ordinary repeating coil is shown outside of the howler box. The apparatus is entirely enclosed in a solid-oak box, occupying a space of 15 by 16 inches, all wiring being on the inside and brought to terminals on the side of the case, making it a very simple matter to connect. It can be put in circuit with a key and plug on the chief operator's desk or any position on the board. By simply placing the plug in the jack of the negligent subscriber and pressing the key, a howling sound is produced in the subscriber's receiver which can be heard at a distance of 100 feet. By using an induced current the vibrations of the diaphragm are so slight as to be hardly noticeable and there is said to be no tendency to injure the receiver in any way. An important feature of this instrument is that by a slight modification it can be used as a busy-back signaling device. The Standard Construction company also manufactures switchboards and telephone supplies, and has recently brought out a common-battery telephone system which is said to possess simplicity and other valuable features.



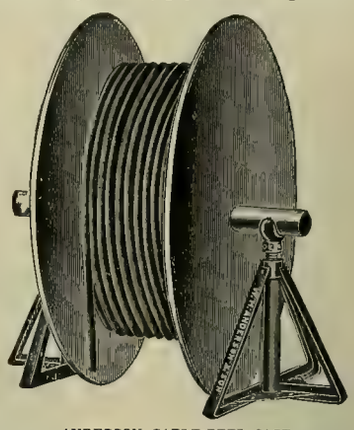
STANDARD HOWLER FOR TELEPHONE EXCHANGES.—DIAGRAM OF CONNECTIONS.

Anderson & Sons' Linemen's Products.

The accompanying illustration shows a cable-reel jack which W. H. Anderson & Sons of Detroit, Mich., brought out about a year ago. The device is of a new design, and the firm has had large sales of the reel jack to companies doing aerial and underground-cable work. The jacks are made entirely of steel and are of such size that they can support any of the cable reels now generally used. It is asserted that they do not take up half the space of the old-style blocks.

W. H. Anderson & Sons began doing business in April, 1871. Early in the history of the telephone industry they commenced to manufacture many tools used in outside construction, such as digging bars, tamps, linemen's screw-drivers, lag wrenches, payout and takeup reels, etc., and have constantly been adding new devices to keep abreast of the constantly changing methods of outside construction work.

The firm has recently purchased a new factory site 130 feet by 160 feet in size, and new buildings, particularly adapted to its requirements, are now being erected and will be ready for occupancy about May 15th. With a railroad siding the entire length of its factory, the firm will have unsurpassed facilities for making quick shipments of the various articles manufactured by it, which embrace cross-arm braces, distributing pole tops, angle-iron cross-arms for aerial cables, guy rods, guy-wire clamps and hooks,



ANDERSON CABLE-REEL JACK.

and all other articles used in telephone construction.

Anderson & Sons have a large business in supplying railroads and also contractors who make a specialty of suburban-railway construction with everything used in track-laying, grading, pole-setting, etc. The new factory will be equipped with many new machines especially designed and manufactured by the firm itself for producing large quantities of special iron and steel work, such as pole bands, truss rods, clips, eyebolts and specially formed, punched or threaded articles, which will reduce the cost of manufacture to a minimum. The new location will be the northwest corner of Guoin and St. Aubin avenues, the present factory and offices now being located at 14 and 16 Macomb street.

BOOK TABLE.

THE UNIVERSAL ELECTRICAL DIRECTORY (J. A. Berly's). 1901. London: H. Alabaster, Gatehouse & Co. Pp., 1,328 (6 by 9½ inches). Prices, $2.25 in United States, 7s. 6d. in Great Britain.

This electrical directory, now in its twentieth year, comprises the names and addresses of many of the members of the electrical and allied industries throughout the world. Besides being the oldest, it is also, it is said, the largest, electrical directory in the world, and the amount of work entailed in the compilation of this volume has again considerably increased. The book has been thoroughly revised and now contains a total of 28,586 names, approximately, 2,189 names of individuals and firms more than were contained in the 1900 edition. For simplicity and facility of reference, the names are divided into four groups, as follows: British, 10,656 names; Continental, 9,240; American, 6,160; Colonial, 2,530. These divisions are again subdivided into alphabetical and classified sections, in the case of the British list, a geographical section being given. In addition to the new names incorporated in the present issue, much financial information is given and the telegraphic addresses and local telephone numbers are included. The pages added to the work are 57 in number, as compared with that of 1900, making in all about 1,250 pages of purely directory matter. To American electrical men the principal value of the book consists in the European names and addresses, for, as might be expected, the American portion of the work is insufficient.

E. C. De Long, manager of the Ice, Light and Water company, Lexington, Miss., invites bids for the complete equipment of a lighting plant, the immediate equipment to be of 60 kilowatts' capacity, with provision for extension.

Proposed Telephone Competition in Chicago.

In the latter part of December, 1900, an ordinance was introduced in the Chicago Council, granting a franchise to the United Telegraph, Telephone and Electric company to operate an Independent system in the city to compete with the Chicago Telephone company. The principal provisions of the ordinance, together with a brief outline of the company's plans, were published in the Western Electrician at that time. The ordinance was referred to the council committee on gas, oil and electric lights, and after giving hearings to V. H. Surghnor and Willard T. Block, who are backing the project, the ordinance was amended and finally recommended for passage at the council meeting of March 11th. The ordinance, as passed by the committee and agreed to by the promoters of the company, provides for large reductions in service rates, as well as terms exceptionally favorable to the city in the matter of compensation for the privileges granted.

The United Telegraph, Telephone and Electric company at present operates about 600 telephones in what was formerly Hyde Park, now a part of Chicago. The new ordinance provides that all conductors shall be placed in approved underground conduits in the territory bounded by Fullerton avenue, Western avenue, Twenty-second street, Halsted street, Thirty-ninth street and Lake Michigan, and that no poles shall be erected in any street that has been improved with a permanent form of paving. The right to use the top cross-arm of each pole and one duct in each conduit is given free of charge to the city. The maximum rate for business telephones is fixed at $85, and for residence instruments at $50 a year. Public telephones may be installed at a rate of not more than $125 a year. The company agrees to have 2,000 telephones installed and in operation within five years from the passage of the ordinance or forfeit its franchise and plant to the city. In the business district no more than two instruments may be placed on one trunk line, and outside of the territory bounded by the river, Twelfth street and Lake Michigan, not more than five telephones may be connected on one line. The ordinance becomes void and the plant is declared forfeited in case of an attempted transfer of the privileges granted, whether by sale or lease. The company is to pay to the city as compensation during the first five years of the franchise three per cent. of its gross receipts, during the next 10 years five per cent. and during the remaining ten years seven per cent., the life of the franchise being 25 years. The ordinance provides for the free installation, maintenance and operation of at least 35 telephones in the City Hall which shall have the same service privileges as any other instrument in the system, for the rental at $1 a year of as many telephones as the city may need for fire-alarm and police service, and for the rental of instruments in fire and police stations to be connected with the company's exchanges at a rate of $10 a year. All lines are required to be full copper metallic circuits. The company is required to file a bond of $50,000 for the performance of the requirements of the ordinance.

The United company is at work developing the Hyde Park business under its old franchise, obtained from the town of Hyde Park, and will continue to do so, whether the ordinance permitting extensions north of Thirty-ninth street passes or not. It has its main office at Forty-seventh street and Cottage Grove avenue. The passage of the ordinance will not be urged for several weeks, as the promoters desire that its provisions be thoroughly understood before it comes up to be voted upon. Should the desired franchise be granted, the United company will run about 50 metallic circuits from Hammond, Ind., which is to be the long-distance station, to an exchange in the center of the business district of Chicago, according to the present plans. The backers of the organization have had many requests from Independent long-distance companies for entrance into Chicago over the lines of the United company, as well as from outlying Illinois towns, and expect the long-distance business to be an important factor in securing subscribers for building up their city system.

At the time of the first introduction of the ordinance there was a report published to the effect that negotiations were pending for the absorption of the United Telegraph, Telephone and Electric company by the Illinois Telephone and Telegraph company. The report was denied at the time by officials of the former company, and it is stated now that the reverse was true—that the Illinois company offered to sell out to the new organization—but that, owing to the expensive character of the tunnel work done by the Illinois company and the probable high cost of maintenance, the United company preferred to lay its own conduits.

The men back of the United company say that they have plenty of money to begin work and carry out the obligations of the company, and have offered to deposit the company's stock with the city as a guarantee of good faith.

Globe Automatic Telephone System.

The Globe Automatic Telephone company of Chicago is coming to the front with a new automatic system which gives promise of success. The originators are not new in the business, having had several years of experience, and now claim to have a system so perfect that it will almost maintain itself. The inventors say that they have entirely reversed the ideas of former systems of this class. Instead of making the mechanisms sensitive and accurately adjusted, they can, by their method, make the parts roughly and of substantial material, so that the chances of wear and the possibilities of getting out of order are remote, at the same time making the apparatus exceedingly simple. The switching device (Fig. 1) consists principally of steel bars on which are mounted the terminals. The circuit-closers are operated by stored energy, controlled by electromagnets, requiring but a very light current and making the connections positive. The energy required may be stored without cost. The appliances will last indefinitely, it is said.

The telephones are built much on the same principle as ordinary telephones, except that each instrument is equipped with a keyboard with one or more keys or indicators. For each key is a keyway, on the side of which are placed the numerals from 0 to 9. Each key is moved downward in its respective keyway to a figure to constitute a desired number. For instance, if 465 is wanted, the key to the left-hand side is brought down to 4, the next to 6 and the next to 5. The receiver is then removed from the hook and the ringing is done in the ordinary way. The keyboard is placed on the front of the telephone as shown in the illustration (Fig. 3), and, in fact, can be attached to any ordinary telephone. It is a substantial device and cannot be put out of order, it is said, by manipulating or rough usage, or by persons inexperienced. In fact, no experience whatever is necessary. Among the many advantages that are claimed for this system may be mentioned the satisfaction of ringing the person wanted directly, without asking any operator to "please try them again," etc. If the line wanted should be busy, the calling subscriber is at once aware of it, as the bell on his instrument will not ring. The switching device will not connect to a busy line, so, on discovering this condition, the restoration is made instantly by replacing the receiver on the hook. Thus the telephone is ready for immediate use to call other numbers. Inasmuch as it is automatic, the system is entirely secret. No one can overhear the conversation. The service is always uniform, day and night.

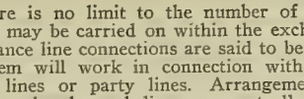


Fig 1. Switching Device.

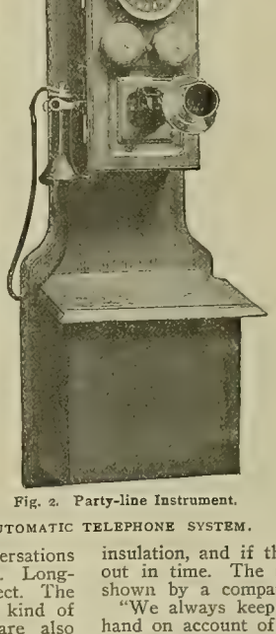


Fig. 2. Party-line Instrument.

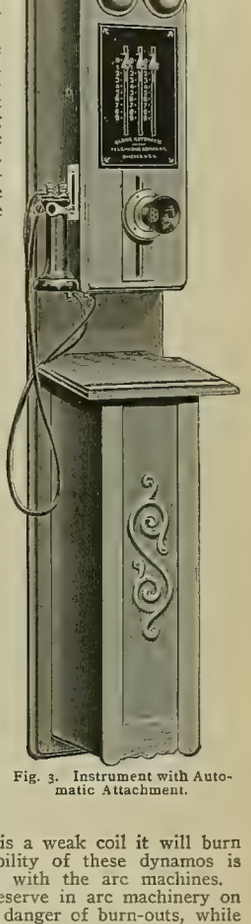


Fig. 3. Instrument with Automatic Attachment.

GLOBE AUTOMATIC TELEPHONE SYSTEM.

There is no limit to the number of conversations that may be carried on within the exchange. Long-distance line connections are said to be perfect. The system will work in connection with any kind of toll lines or party lines. Arrangements are also made whereby such lines are controlled from a certain point, thus doing away with the necessity of the many outlying town operators, and, at the same time, giving all such smaller places access to any point at any time.

Another interesting feature is the selective party-line telephone, whereby as many instruments may be placed on each line as may be considered practicable. Each telephone is equipped with a selecting device, as shown in the illustration (Fig. 2), by which a person at either end of the line may select and ring any desired telephone without ringing any other but the one wanted, thus making the line entirely separable from the other instruments on the line; or any two on a line may be connected together, to the exclusion of all others. For exchanges where party-line service is furnished, this, it seems, should be an excellent arrangement, as well as for regular toll-line service.

The patents for this automatic system are controlled by the Globe Automatic Telephone company, whose offices are located at 59 Dearborn street, with factory at 31-45 West Randolph street, Chicago. The officers of the company are: President, J. E. Norling; vice-president and electrical engineer, J. K. Norstrom; secretary and treasurer, P. O. Norling; manager, F. A. Lundquist; superintendent, J. J. Brownrigg.

Resignation of Patent Commissioner Duell.

Charles H. Duell, the commissioner of patents, has handed in his resignation, to take effect upon the appointment of his successor. The resignation is said to be due to Mr. Duell's desire to resume the practice of law, and is not altogether a surprise. Walter H. Chamberlain of Illinois, the present assistant commissioner of patents, is an applicant for the position, but it is stated as probable that Senators Platt and Depew of New York will be permitted to name Mr. Duell's successor, in recognition of their concession in connection with the appointment of Colonel Sanger as assistant secretary of war.

Municipal Electrical Engineering in Detroit.

A Detroit electrical engineer well versed in the ins and outs of the municipal-lighting situation in that city calls the attention of the Western Electrician to a "unique electrical report—not a joke, but a bona fide public document." The report and some explanatory matter appear in the Detroit Evening News:

Assistant General Superintendent Hatch made a report to the public-lighting commission in December as to why the armature on No. 1 of the three Westinghouse alternators had been burnt out so often. He first claims that it has burnt out less frequently under his superintendence than formerly, and then says:

"As regards the cause of these burn-outs, I submit the ammeter records for the week previous to the last burn-out, which show the shifting of the load from one dynamo to another. This proves that the engines are carrying a load too large to enable them to govern well. This shifting of the current makes a severe electrical strain on the insulation, and if there is a weak coil it will burn out in time. The reliability of these dynamos is shown by a comparison with the arc machines.

"We always keep a reserve in arc machinery on hand on account of the danger of burn-outs, while in incandescent machinery we are running an overload of 15 per cent. The reason that No. 1 has burned out more times than Nos. 2 and 3 together is not entirely due to a difference in the governing of the engine, but structural properties in the iron of the dynamo undoubtedly produce electrical stresses in the machine that have a tendency to break down the insulation."

This apparently did not satisfy the commissioners, for recently Mr. Hatch has made another report on the same subject, and this time the explanation of the burning out of armatures takes him into the subject of "harmonics," "resonance," "induction," "wattless currents," "cosine formula," "auxiliary fields" and other highly technical subjects which must be very enlightening to good John Erhard and other lighting commissioners. It is as follows:

"According to the resolution of the previous meeting requesting a report on the cause of the burn-out of armature in No. 1 alternator, since my previous report was not satisfactory, I wish to submit the following:

"There are 56 coils in the armature, overlapping one another six coils; the current is taken off every 14 coils, but on September 27, 1899, this armature was entirely rewound and one tap was connected one coil out. This made 14 coils in two machines in multiple with 13 and 15, respectively, causing a variable action in one phase.

"We have the following data of two of these machines:

Symbol.	No. 1.	No. 2.
L	.00099	.00104
E	1,654	1,654
I	35.3	35.?
R (hot)	.621	.654
Stored energy, watts	.626	.638
Self-induction, watts	773.83	814.94

L is determined from an average set of readings varying from 22 degrees 20 minutes to 26 degrees 37 minutes, an average of 24 degrees 29 minutes.

R is determined by direct measurement to ascertain the rise in temperature from the formula $R = r(1 + .004t)$.

"There are three classes of electrical phenomena which affect the life of apparatus: Heating, harmonics and resonance. Harmonics can have no effect, as complex harmonics neutralize, and by applying the cosine formula the simple harmonic above the third is reduced to zero. Resonance is dependent on self-induction and capacity, so under our present condition this cannot exceed 1,759 volts, which will cause no injury unless there should be a sudden opening of the inductive circuit. This would puncture in a weak place like a lightning discharge.

"On February 9th we had such a discharge on Nos. 1 and 3. We repaired No. 3 that night, but did not get No. 1 finished until the 11th. It was caused by the auxiliary field opening and making the static discharge as described above. This is a puncture and not a burn-out, which is caused by the heating of the dynamo, and although the self-induction is a wattless current so far as the load is concerned, still it produces heat, and this heating, added to the load current, gives the total heat produced in the dynamo.

"In my former report I mentioned the fact that the load is too large to allow the engine to govern well, and thus cause a pumping of current between machines. In the above table we see that the resistance of No. 1 is the lowest, consequently the most of this surging current passes into this machine, causing it to run the hottest."

The engineer above referred to further elucidates the situation thus: "The common sort of electricians in Detroit, who would not know a cosine formula if they met it on Woodward avenue, say that the 55-kilowatt Westinghouse two-phase alternators have been burned out because the engine governors let one machine pull too much of the load. They say also that at times one machine has not only pulled the load, but has run the other machine as a motor. Over and above all this, these common electricians are wicked enough to intimate that the general superintendent, who is supposed to be the mechanical head of the municipal plant, does not know enough to adjust these governors. Seeing that he never had charge of a lighting plant until his political friends put him in office here, it is just possible that the statement may be true. The alternators have pulled pretty heavy overloads in the past, and they have even lost a coil ocasionally. They were entitled to do so after some five years of good, hard work, during which they managed to divide the load among themselves as well-behaved alternators ought to. During these five years the staff also attended to its business. That was before the practical politicians took things in charge a year ago. Since then neither the alternators nor the men can agree about anything."

Ohio Telephone Notes.

John Kilgour, who has for a long time served as president of the Cincinnati Street Railway company, recently leased to the Cincinnati Traction company, has been chosen president and general manager of the City and Suburban Telegraph association at Cincinnati, to succeed Captain George N. Stone, whose death occurred a few days ago. W. A. Blanchard succeeds Captain Stone as director and also takes Mr. Kilgour's place as treasurer. Mr. Kilgour has been a director in this company for a number of years and is well acquainted with the business and the methods of the company. It is therefore probably the best selection that could have been made. It is not anticipated that there will be any changes in the manner of conducting the business or in the employes about the office. Mr. Kilgour will retain his position as president of the railroad company.

New material is arriving at Zanesville for the Central Union Telephone company, and it is proposed to put the plant into first-class condition by July 1st, in order to be in position to compete with the Independent company. The subscribers will all be furnished with new and modern boxes and the office will be equipped with new furniture throughout. It is said the company will make this one of the best exchanges in the state.

The Zanesville Telephone and Telegraph company is going right on with preparations to build its exchange. A plat of the plant has been filed with the Probate Court for approval and a bond of $10,000 has been filed guaranteeing the city against any damage. The company apparently does not ask anything that the city would have any objection to. A request has been made that it be allowed to connect up some of the factories at once.

The Village Council of Johnstown has granted Judge B. M. Critchfield authority to construct a telephone plant in that town. He already has quite a number of subscribers, and there are others ready to subscribe, now that the matter has been arranged. Judge Critchfield has arranged with the Independent company at Newark for connections by which his subscribers will be enabled to reach Columbus, Cleveland and other points, as well as a large number of small places in Licking County.

The Mansfield Telephone company has purchased all the lines of the Star Telephone company of Ashland, in Richland County, and they reach almost every small village and postoffice, there being about 149 miles of pole line carrying about 400 miles of wire. The Mansfield company announces that it will at once begin the construction of a plant in Mansfield that will be equipped with all the latest appliances and long-distance boxes. A portion of the lines will be placed underground in the business district and the remainder will be upon poles of the regulation height. Arrangements have been completed by which the company will have long-distance connection with the United States Telephone company, which, it is understood, is largely interested in the company. The Independent companies have had rather a hard time to gain a foothold in Mansfield, but it now appears that a plant will be built at once. S. N. Ford is president of the company and John L. Baxter, secretary.

The Star Telephone company of Ashland will expend the money secured for its Richland County lines in rebuilding its exchange at home. A complete new outfit will be purchased and installed at the earliest possible date, and the exchange will be in much better condition that it ever has been before.

The commissioners of Richland County have granted the People's Telephone company of Shelby a franchise to extend its lines all over the county along the public roads. The company agrees not to do anything that will interfere with travel or the drainage of the land. G. M. Skiles is the president of the company, and Edwin Mansfield, secretary.

The Home Telephone company of New Carlisle has become active and will probably build an exchange within the next few months. B. H. Rannels, an attorney, is at the head of the new company.

The real estate in Canton purchased by the Stark County Telephone company some time ago has been transferred to it, and the work of erecting a building will now proceed. This company has leased a portion of the Review building at Alliance for its office in that place and it has been granted a franchise by the Village Council of Malvern, where a plant will be installed to be connected with the home office. The company is now in position to push matters and bids fair to become one of the important Independent concerns of the state. The new office in Canton will be a handsome affair, especially designed for the purpose.

The lines of the Columbiana County Telephone company at Salem were damaged by the storm which passed over that section of the country last week.

The Delta Home Telephone company of Delta has filed notice with the secretary of state of an increase in capital stock from $10,000 to $20,000. O. M. C.

Telephone News from the Northwest.

A bill is before the Minnesota Legislature providing for the municipal ownership of underground conduits in towns of 10,000 to 50,000 population.

Andrew Kvien has taken possession of the Fosston (Minn.) telephone system.

The Badger Telephone company of Baraboo, Wis., plans to extend toll lines from La Crosse, Wis., to Minneapolis. This will give connection between the Twin Cities and La Crosse over the Bell wires and also over the Independent wires.

The Northfield (Minn.) Telephone company has been incorporated, with $15,000 capital stock.

The La Crosse (Wis.) Telephone company will build an addition to its present quarters on Main street.

A. B. Kerlin of Park Rapids, Minn., has been at Hibbing, Minn., in the interests of the Northern Minnesota Telephone company, and is working for a local and long-distance connection.

The Little Wolf River Telephone company of Fond du Lac, Wis., is preparing to install party-line service for residences, using the selective system.

The Citizens' Telephone company of Mankato, Minn., has been granted a franchise for a local system at Mapleton, Minn.

D. N. Tallman of Willmar, Minn., and Charles Webster of Waucoma, Iowa, have secured the entire stock of the Minnesota Central Telephone company, having headquarters at Willmar, Minn. The auditing department of the company, which has hitherto been located at Waucoma, Iowa, is now removed to Willmar.

The People's Telephone company of Winthrop, Minn., has been incorporated, with $10,000 capital stock.

Clarence Malthaner, an employe of the Mississippi Valley Telephone company, in Minneapolis, has secured a patent on a new invention, a trunking circuit, which is said to facilitate long-distance service. The device consists of two condensers, instead of repeating coils such as are used in the Bell system. The effectiveness of the Malthaner trunking circuit has been proved by extensive tests. A. E. Gregory, the superintendent of construction for the same company, has patented a mold for connecting joints of conduit with concrete, which facilitates construction and insures protection from moisture.

Telephone wires have been strung across the Missouri River at Wheeler, S. D. Great towers have been constructed on both banks, in order to elevate the wires to clear boats on the stream. According to a local authority, the wires will be without supports for over a mile.

A telephone line is projected from Lakota to Aneta, N. D.

The city of Appleton, Wis., has found a practicable way of managing telephone companies which does not yield any of the city's rights. It consists in permitting telephone companies applying for admission to enter the city, always complying with certain conditions laid down, but without granting any franchise. So long as the company adheres to the rules laid down, it will not be interfered with. But the city thus keeps all power within its own hands, and does not, by a franchise, give the company a weapon with which to dispute the city's rights. The Wisconsin Telephone company and the Fox River Valley Telephone company are both in the city under these conditions.

The Central Telephone company has asked a franchise for local exchanges in Rockwell City and Lohrville, Iowa.

The Ottumwa (Iowa) Telephone company plans to extend a line to Batavia, where arrangements will be made to connect with the Jefferson County Telephone company, and thence on to Burlington.

The Dakota Central Telephone company of Aberdeen, S. D., will expend $20,000 the coming season in the extension of its lines. Work will be begun as early as possible in the spring, and connections will be made with St. Paul, Minneapolis, Sioux City, Sioux Falls and other cities.

The Billings (Mont.) Telephone company is reorganizing.

The Interior Telephone company of Cedar Rapids, Iowa, has been incorporated, with $10,000 capital stock.

The Iowa Telephone company proposes to go extensively into the rural-telephone business, using party-line service.

The Columbus Junction (Iowa) Telephone company has been incorporated, with $8,000 capital stock.

The Northern Telephone company plans to establish an exchange at Aurelia, Iowa, Alta, Iowa, will vote on granting the company a franchise.

John A. Anderson, Jr., has applied for a local franchise at Red Oak, Iowa. He already has a complete exchange at Corning, Iowa.

Newton, Iowa, will vote March 25th on granting a franchise to the Newton & Kellogg Telephone company.

A company has been formed to build a telephone line from Medford to Indianola, Iowa.

Independent telephone companies owning toll lines into Des Moines, Iowa, seek to secure a controlling interest in the Mutual Telephone company of that city.

A new line is about completed which connects Villisca, Bethesda, Clarinda, Yorktown, Essex and Stanton, Iowa.

The Automatic Telephone company of Seattle, Wash., announces that its exchange will be installed by May 15th.

The state auditor of Iowa will require the telephone companies of the state to furnish detailed reports in making their annual statements for assessment purposes.

C. C. Nelson of New Sweden, Minn., will construct a local exchange for Bernadotte, Minn.

R.

Iowa Telephone Association.

The fifth annual meeting of the Iowa Telephone association was held at the Savery Hotel in Des Moines on March 12th and 13th. There were present representatives of telephone companies in the following-named Iowa towns: Madrid, Chariton, Russell, Rockwell City, Sigourney, Des Moines, Corning, Grinnell, Newton, Marshalltown, Washington, Brighton, Ainsworth, Waterloo, Bloomfield, Bedford, Clearfield, Onawa, Knoxville, Boone, Perry, Ottumwa, Iowa City, Sharon City, Thurman, State Center, Fort Dodge, Union, Villisca, Atlantic, Fairfield and Nevada. Marysville, Mo., was also represented.

The president's annual address was delivered by President J. S. Bellamy, and was followed by an address by A. T. Presson of Iowa City on "Our Greatest Need—Through Copper Lines." On the second day papers were read as follows: "Farmers' Lines and Our Experience with Them," C. L. Dobie, Sigourney; "Future of the Farm Line Movement," George N. Bandy, Perry; "The Telephone Business Looked at as an Investment," U. S. Alderman, Nevada; "Government Ownership of Telephone Lines," H. C. Raney, Fairfield; "A Clearing House for Monthly Reports and Settlement of Toll Business," C. F. Bennett, Waterloo; "Underground Construction," O. H. Gray, Des Moines; "Central Energy," C. W. Stiger, Chicago.

The following-named officers were elected to hold office for one year: President, H. C. Raney, Fairfield; vice-president, A. T. Presson, Iowa City; secretary-treasurer, C. C. Deering, Boone; executive committee, H. C. Raney of Fairfield, Charles Kirk of Thurman, George N. Bandy of Perry, J. S. Bellamy of Knoxville and U. S. Alderman of Nevada.

Great interest was manifested in the subjects relating to farmers' lines. The leading manufacturers were represented and exhibited apparatus, and the attendance was good, although many were kept away by the severe storms.

Combination Conduit to Be Tried in Chicago.

An experimental combination conduit, such as has been designed by City Electrician Edward B. Ellicott and which was described in the last issue of the Western Electrician, is to be laid in Chicago. This decision was reached at a meeting last week of representatives of the Chicago Telephone company, the Chicago Edison company, the Western Union Telegraph company, the Postal Telegraph-cable company and the city of Chicago. The conduit

proposed as a trial will be laid on Archer avenue for a distance of three-fourths of a mile from the junction with State street, and will accommodate all the wires of the five corporations, which in this locality are 160 in number. The city will control the conduit, but the other corporations will have rights of occupation equal to the city, and will share in the expense of construction. If the Archer avenue experiment is a success, the combination conduit will undoubtedly be built in many of the streets as overhead wires are taken down.

Present Condition of Wireless Telegraphy.[1]

By George W. Roosevelt.

The experiments in wireless telegraphy now being made in this city [Brussels, Belgium] show the many difficulties inventors encounter in putting into practice the results of their researches.

Mr. Emile Guarini, the inventor of the automatic repeater, the value of which is soon to be tested at Malines, says his experiments have cost him more than 50,000 francs ($9,650). Patents, independent of descriptions, plans, etc., necessary to render his invention comprehensible, have cost him more than 20,000 francs ($3,860).

I have recently received from Mr. Guarini some very interesting data regarding wireless telegraphy, and give the substance below:

Present Condition of Wirbless Telegraphy.

"More or less erroneous accounts of wonderful results obtained by wireless telegraphy have appeared in many of the daily papers. Readers have accepted these accounts as journalistic canards, which, in view of the style of some of them, is excusable. Others more credulous were startled by the results obtained, which appeared almost like witchcraft. In the turmoil of business and progress in which we live, "savants" have made wonderful research during the last century, in the silence of their laboratories, in the science of optics, elasticity and electricity, and have, through ardent and laborious study, erected one of the most admirable monuments of human genius, 'the elecromagnetic theory of light,' owing its origin to three great men—Fresnel, Maxwell and Hertz. No later than four years ago, this theory seemed bound to remain the prerogative of a few philosophers; but now practice has mastered the essential results of these high conceptions and has made an instrument capable of a great number of applications.

"The trials of wireless telegraphy are not new. Mr. Preece, the chief engineer of the English telegraph office, made experiments in 1892 and 1894 in wireless telegraphy, utilizing what electricians call 'induction effects.' There is also some reason to believe that the first experiments of wireless telegraphy date from 1876. The system at present most popular employs electromagnetic oscillations of ether. This invisible medium, according to scientists, penetrates all bodies, the oscillations being only distinguished from luminous rays as quantitative, the electric rays being in reality many millions of times longer than the luminous rays. As the luminous rays streaming from a candle or from an electric lamp are equally divided in space, electric invisible rays spring from one electric spark, spreading into space in all directions. Technicists have proved that the discharge of an electric spark, such as lightning, is effected in oscillating movements—as the string of a violin which has just been strummed on vibrates successively until in complete repose. And as the string transmits to the surrounding air oscillating vibratory movements which we find in sound, the ether is transformed in undulating movements by the electric spark. We cannot perceive these movements, but that which human organs cannot perceive is what a very simple little apparatus called 'coherer' or 'radioconductor' can do. This small apparatus is in general not formed of anything but a little glass tube containing metallic powder and terminating on each side in a good conducting electric wire. This coherer opposes a considerable resistance to the electric current. In other terms, the space between the two conductors occupied by the file dust must be considered as an interrupter. But this resistance is reduced to a minimum as soon as an electromagnetic ray, spreading from an electric spark producer, reaches the tube; in other terms, the electric contact is established. Thus, without going farther, the possibility of regular telegraphy is admitted; for, as soon as the electric resistance of the coherer is lessened under the influence of electric rays, a local electric current—viz., galvanic—may run through the coherer, become sensitive and cause a Morse apparatus to play. By very light blows on the coherer, a strong primitive resistance is established.

"Here it is interesting to remark that there is no sort of connection between the energy put into liberty by the electric spark and the one that causes the Morse apparatus to play. The energy emitted by the spark and that influences the tube of file dust only serves as projector; it fills the same role as the mechanic's hand that opens a tap and puts a powerful machine into motion. And for the same reason that it is not the mechanic who furnished the necessary power to put the machine into motion, so it is true that the Morse apparatus is not put into action by the transmitted ray of the spark producer, but by the current of a galvanic local battery.

"This remark is indispensable. If one day the problem of wireless telephony is solved and the transmission of wireless electric motor power, heat and lighting attained, it cannot be said that it had as basis or principle the present system of telegraphy. Truly the idea would be that the electric ray acts from a distance without the help of any local battery and without coherer or the Morse apparatus. But, unfortunately, we have not yet advanced so far; certainly if that could be, the apparatuses would be greatly simplified, and wireless telegraphy would enter a new stage. Mr. Calzecchi Onesti, an Italian, discovered in 1885 the value of metallic filings, but it was a Frenchman—Mr. Branly, professor of the Catholic Institute at Paris—who constructed in 1890 the first powerful tube of file dust which he called 'radioconductor.' Dr. Lodge, an Englishman, was the first to explain the advantages to be drawn from the tubes of file dust as indicators of electric rays. The contrivance of Dr. Lodge was employed by the author to repeat the experiments of Hertz. The first practical application was realized by Mr. Popoff, professor at the naval college at Cronstadt.

"The idea of utilizing the power of electric rays for the transmission of signals seems to belong to the English scientist, Dr. Lodge, who, in a conference which took place in 1894, expressed the idea that the presence of electric rays might be discovered by means of the Branly tube up to a distance of half a mile from their starting point. But no experiments were made to verify the fact. In 1895 and 1896, Mr. Popoff used his contrivance in trials of communications by wireless telegraphy. About the same time, another Russian—Mr. Nasckevitch Iodko—made independently of Mr. Popoff analogous experiments. In 1896 Mr. Marconi undertook, in his turn, essays on telegraphic communication by Hertzian ray. The measures he took at that time, analogous to the course adopted by Popoff, are actually the same as those now employed. But important improvements in details have been steadily made in the Popoff contrivance by the young Italian. Some of these are but imperfectly known, but it is certain that these have allowed the inventor to obtain results far superior to those already obtained by all other experimenters. He has been assisted in this by a very important English company—'Wireless Telegraph company'—the owner of his patents.

"In France the Ducretet measure is applied by M. Tissot. In America, the Navy Department is studying a special type of apparatus, so as not to accept the caudine forks of the English company. In Austria, experiments are made under the Schaeffer system, and it appears that the Lloyd company has established a station for wireless-telegraph communication between Bremerhaven, a lighthouse situated at Borkum, and a lightship. In Russia the Popoff system is used. In Germany the system officially adopted by the imperial navy is the Slaby-Arco constructed by the Allgemeine Electricitäts Gesellschaft.

"Of the foregoing systems, the most perfected, complete, and, at the same time, the most complicated and costly, is without doubt the Marconi system. The English Admiralty has decided to adopt it, and will pay about 38,000 francs ($7,334) per apparatus—that is, 2,500 francs ($482.50) per year per apparatus for a period of 15 years.

"The transmitting and receiving machines that Mr. Guarini will use at the Antwerp station and in Brussels are in principle analogous to the above-mentioned ones, but Mr. Guarini has made numerous improvements in detail.

"From the beginning of experiments made with the wireless telegraph, it was discovered that a transmitter could work several receivers at the same time, and it was further remarked that if a receiver was worked by several transmitters, issuing different signals, these signals were quite unreadable and impossible to make out. Many experimenters, to obviate this, have had recourse to a contrivance called 'accord' or 'syntonization.'

"In acoustics there exists a phenomena called resonance. Let us suppose three diapasons, two of which, in vibrating, produce 800 vibrations per second and the other only 500. The duration of oscillation, otherwise called the period of the first two diapasons, is one eight-hundredth of a second and that of the third one five-hundredth of a second. What is termed the length of a ray is obtained by dividing the speed of sound in the air—342 meters—by the number of vibrations per second. For the first two diapasons the length of a ray is $342 \div 800 = 0.42$ meter and for the third the length of ray is $342 \div 500 = 0.68$ meter. If the three diapasons are placed at a suitable distance, and if the third diapason is made to vibrate, the other two do not answer; they would be at variance—that is, they would have different periods of vibration. If the first diapason vibrates, the second will vibrate without being touched, because it is in sympathy with the first—that is, it has the same period of vibration as the first. The third diapason will not vibrate, for the reasons already explained.

"With the apparatus of wireless telegraphs, similar phenomena can be observed. Let us state at once that the length of an electric ray, and therefore what is termed period of oscillation, depends on three coefficients—the capacity, resistance and self-induction of the electric circuit from which the spark is produced, called 'discharge' by specialists. When two apparatuses are put in accord, the coefficients may be varied. Each experimenter obtains the effect desired—that is, according to his own style. Thus we have the Marconi, Slaby-Arco Blondel, Tommasi Jegon systems, without naming others. Mr. Guarini will also use the syntonization system. This is necessary if great distances of transmission are to be reached.

"The contrivance above mentioned was experimented with by Marconi in 1899, and has given almost conclusive results. However, for the accord to be efficacious, each station must be at least 2,500 meters distant from the other. Supposing there are three double stations (transmitter, receiver), one at Brussels, one at Antwerp and the other at Liege. The distance between Brussels and Antwerp, Brussels and Liege, Antwerp and Liege—that is, between three of these stations and the two others—is more than 2,500 meters (8,202 feet). The Brussels station is in accord with the Antwerp one; Brussels transmits, Antwerp replies, that is, receives the signals; Liege remains dumb. Vice versa, Antwerp transmits, Brussels replies; Liege, as previously, does not reply. It is possible, owing to what is termed variable accord, to use the same apparatuses to make Brussels communicate with Liege without any reply from Antwerp; Brussels with Antwerp without any reply from Liege; Liege with Antwerp without any reply from Brussels. It is possible by varying in each station the three coefficients, capacity, resistance and self-induction (this last term to be understood as the inertness of a body starting into movement), or one of these three factors, to obtain from one moment to another a different accord, such as to be able to correspond with the three stations, Brussels, Antwerp and Liege.

"In practice this can be obtained by disposing the three contacts, each being able to include in the circuit a capacity, a self-induction and a resistance, larger or smaller, according to the case. For the three stations, three different accords correspond to the contacts; the accord 1 is the same at Brussels, Antwerp and at Liege, also the accord 2 and 3. The normal period of the Brussels station is the accord 1, Antwerp 2, and Liege 3. The three stations, being at variance, cannot be in communication. When Brussels wishes to communicate with Antwerp, the contact 2 is shut, and consequently it passes on to the 2 period. Brussels is then in accord with Antwerp, which receives the signals, while Liege, which has the period of 3, does not answer. When the communication is finished, the Brussels station returns to the normal accord 1, or passes on to the 3 contact, in which case Antwerp does not reply. To prevent Liege upsetting the Brussels-Antwerp communication by passing from the period 2 to the period 1 (Brussels), Brussels, before transmitting to Antwerp (2), passes to the Liege period, so as to give notice it is engaged. At the end of the communication, Brussels warns Liege again (3), and everything returns to its normal state.

"In case of war—and let us hasten to state that in time of war wireless telegraphy presents enormous advantages—the enemy could succeed by tampering with the accord of the two apparatuses, and at the same time it would be quite possible for him to upset the correspondence or to intercept a message. By making use of the variable accord and by varying the accord of the two corresponding apparatuses in a conventional way, it would be impossible for the enemy to arrive at the same result as the preceding, because from the moment he succeeded in according his apparatus the accord would change, and he would have to begin again.

"Let us consider now if one wished to transmit from Brussels at the same time to Antwerp and Liege and receive from Namur and Ostend. It would then be necessary to have in Brussels two transmitting apparatuses and two receiving apparatuses. Referring to what has been previously said, the two transmitting and receiving apparatuses must be placed at a distance of 2,500 meters—that is to say, the transmitters at St. Gilles and the receivers at Kockelberg. If it were otherwise, the two transmitters of Brussels would act on the two receivers of the same locality. All this easily explains how Marconi has been able to realize the duplex communication in one sense. It has sufficed for him to place two transmitters of different periods at Poole and two receivers at St. Catherine in accord and working with the two transmitters above stated. This would not have happened had he placed a transmitter and a receiver of different caliber at Poole and a receiver and a transmitter suited to the previous apparatuses at St. Catherine.

"The system which Mr. Guarini employs to attain the same end is based on a very different principle. He surrounds his transmitting and receiving 'antenna' by a metallic sheath having a longitudinal slit. The slits of these sheaths correspond with one another in the two stations. In the same way that a light shut in a room only throws out its rays where it finds issue and has its rays stopped by walls, the transmitting antenna, surrounded by its sheath, only allows its rays to filter through where there are longitudinal slits. A system can thus be conceived that limits the space where the electric radiations are sent, and even concentrates them. The receiving feeler only receives rays from the side where the slit is opened; radiations coming from other directions reach the sheath and furrow into the ground. This system is simple and much more certain than the problematic one of syntonization, but it is impractical, or nearly so, for motive power or com-

1. Report of the United States consul at Brussels, dated January 25-28, 1901. Mr. Guarini's article is written for the lay reader, but nevertheless it contains facts of technical importance.

munication, as, per example, between ships and coast ships. If it is desired to communicate from Brussels simultaneously with Antwerp and Liege, it would be sufficient to lay at Brussels two transmitters with antennæ and sheaths. The slit in the sheath of each transmitter must be respectively turned toward Antwerp and Liege. The space through which the radiations are sent being very limited, it would be almost impossible to intercept the message. On the other side, each transmitter sends radiations exclusively to the station to which they are destined, and thus each transmitter would send the telegram to its destination, as ordinary telegraph wire sends telegrams to the station to which they are destined.

"By sea, the maximum of transmission obtained by Marconi was 52 kilometers (32 miles) in 1899. It appears that in recent trials 136 kilometers (84 miles) have been obtained at sea, and, if Marconi's hopes are realized, this distance can still be increased by sea and on level land. In fact, on land, except by the use of captive balloons or kites, not more than 15 kilometers' (nine miles) distance has been obtained at Berlin with the Slaby-Arco system. We must not, however, allow our imagination a too-free rein, as it is quite certain that nature will offer an impassable limit. However great, in fact, may be the power brought to bear at the transmission station, inevitable loss of strength occurs on the run of the Hertzian rays, which reach the receiver considerably weakened. These losses are notably the production of heat on the rays' passage through more or less resisting bodies, in their successive deviations and reflections on metallic substances, etc. The rays themselves are a notable cause of weakness in the power. The height of the atennae, increased by the distance to be cleared—also the practical question of construction and financial interest—will soon oppose any increase of distance. As sequel to the losses above mentioned, the Hertzian rays fade away at a certain distance from the production station. Then, the world is round, and the rays spread in a straight line. The skein of concentrated rays must be bent at the curving of the earth by deviations or successive reflections, and thus the losing game will begin again.

"It is thus necessary to have recourse to other means to solve the problem of wireless telegraphy at all distances. The ordinary electric telegraphy, even primitive electric telegraphy of former times, gives us the principle of it in relays or translators. The translator or repeater must be able to receive the electric radiations coming from a station or relay post, to give fresh impulse to these radiations and to propel them to an extreme station or another relay post.

"Admitting that 500 kilometers (310 miles) can be attained by direct transmission, to compel a telegram to make the world's circuit, 80 intermediary posts would be necessary, the world's circumference being about 40,000 kilometers (24,854 miles). It is indispensable to have in the intermediary stations a unique apparatus that can repeat the telegram at the same time that it receives it; this repetition must be made automatically so as to economize time and personnel. Every automatic repeater must be essentially composed of a receiver and a transmitter. Then, our telegram, to go around the world, will not require more than two hours' time, the only requisite delay proceeding from the inertia of the different apparatuses."

Although Mr. Guarini had expressed doubts as to the possibility of transmitting messages direct from Brussels to Antwerp, a distance of 41 kilometers (25 miles), by wireless telegraphy, he nevertheless made an attempt to do so on the 21st instant, and successfully demonstrated the impossibility of sending wireless messages direct between the two cities, owing to the great distance. As above stated, he had predicted his failure, adding that, up to the present, it has been impossible to operate wireless telegraphy without captive balloons or simple masts (the only utilizable means) not only between Brussels and Antwerp, but also between Malines and Antwerp (22 kilometers = 13 miles).

As will be observed, Mr. Guarini's invention is explained in the foregoing report. He has recently installed a relay on the tower of St. Rombant, at Malines, a city midway between Brussels and Antwerp, and hopes thus to prove the efficiency of wireless telegraphy by relays, after having established the impossibility of direct communication between the two cities.

SUPPLEMENTARY REPORT.

After transmitting my report on "Present Condition of Wireless Telegraphy," dated January 25, 1901, I learn that the experiment of transmission of electric rays by relays was completely successful. Mr. Guarini made his experiments over a much more limited distance Friday afternoon (January 25, 1901). He telegraphed between Brussels (column of congress) and Malines (tower of St. Rombant Church), and his experiments were crowned with success. Numerous messages were transmitted and received with great distinctness, and two messages were received at a time when communication of the transmitter with the ground had been interrupted.

It is the first time that messages have been exchanged between two large cities with the antennæ placed on high monuments, without help of captive balloons or kites. The rays to arrive at Malines traversed several towns—Schaarbeek, Haren, Vilvorde, Eppeghem, and a large part of Malines—over chimneys, monuments, woods, etc., which constitute obstacles which stop or weaken the electric radiations.

GENERAL TELEPHONE NEWS.

The De Kalb County Telephone company of Sycamore, Ill., has increased its capital stock from $15,000 to $50,000.

The Cambridge Mutual Telephone company of Cambridge, Ill., has been incorporated for $2,500, by Theodore, Ernestine and Victor Boltenstein.

The Hudson River Telephone company of Albany, N. Y., has increased its capital from $3,000,000 to $4,000,000 for extensions in its lines and betterment of its property.

The Citizens' Telephone company of Bath, N. Y., has been incorporated, with capital amounting to $10,000, by B. G. Hubbell, C. B. Stowe and J. H. Fuller of Cleveland, Ohio.

It is reported that the Southern Bell Telephone company, in order to head off competition in Virginia, Georgia, Florida and Alabama, is contemplating extensive developments during the present year.

The Cumberland Telephone company has purchased the telephone exchange at Ducktown, Tenn., and this exchange will be connected with Knoxville. It is said this company is negotiating for several other exchanges in East Tennessee.

This year, as in previous years, an attempt has been made to put the telephone companies doing business in Massachusetts under the supervision of the gas and electric-light commission. At hearings given by the committee on mercantile affairs, before which the matter has been placed in the Legislature, there was less public interest expressed this year than heretofore, and less urging of the project has been noted in the newspapers. Popular demand for the measure, which was fostered principally by a few of the newspapers last year, seems to have subsided.

The Northville Independent Telephone company of Northville, Mich., has secured the right to string wires on the Detroit and Northwestern Electric Railway company's poles to Farmington and Pontiac, and on the Detroit, Plymouth and Northville Railway company's poles to Plymouth, and from there the Plymouth Independent company continues on to Wayne, where connection will be made with the Independent line running to New Boston, Romulus, Willow, Waltz, Carleton, Flat Rock and Rockwood. The Northville exchange has over 100 subscribers, Plymouth 98, Farmington and Wayne about a dozen, and this, with the Pontiac exchange, will give connections with about 1,000 subscribers. Work on the extension of these lines will begin early in the spring, and in that the poles and arms are already up, the job will be a short one.

THE TELEPHONE TRADE.

It is reported that the American Electric Telephone company of Chicago is about to erect an eastern branch factory at York, Pa.

R. H. Leavitt of Capron, Ill., manufacturer of telephone cross-arms, pins and brackets, has issued a new catalogue. He carries a large stock of his specialties.

The Garton-Daniels company, manufacturer of electrical specialties at Keokuk, Iowa, announces a great demand from telephone exchanges for its extension circuit ringers. It says that these ringers have met with immediate approval, especially among exchanges operating party lines, as these devices reproduce on a vibrating battery-bell circuit the exact ringing of the telephone magneto.

The Haines & Noyes company of Chicago reports a continual growth of business. Through its intercommunicating department it has closed some large contracts with the Anchor Line Steamship company, the Hahnemann Hospital, the Chicago branch of the Pabst Brewery company and several other large contracts. In St. Louis, through the H. E. Lindsey Electrical Supply company, the company has closed a large contract for a private telephone plant for a large chemical establishment. The Board of Education, city of Chicago, has awarded to the Haines & Noyes company a contract for a private telephone plant, to be installed in the R. A. Waller High School.

The Acme Electric company, 231 South Canal street, Chicago, of which O. W. Meissner is president, offers to the telephone trade a large assortment of magneto bells and other telephone parts of its own manufacture. The bells made by this company are the result of many years of experience with the needs of the business, and are said to contain many new and desirable features, not the least in importance being that of low price when quality is considered. Mr. Meissner, the moving spirit of the Acme company, is well known to telephone and other electrical men of the West. He has been connected with the Independent telephone industry since its inception in 1893, and was closely associated with the electrical business for a long time before that. He promises the very highest grade of goods that money and skill can produce.

Power to Enforce Payment for Telephone Tolls.

A rule of a telephone company that all moneys due it or its toll-line connections are payable at the office of the secretary on or before the fifth day of the month succeeding the maturity of such indebtedness, with the proviso that if the bill is not paid on or before that date the service of the delinquent shall be disconnected until the indebtedness is paid, the Appellate Court of Indiana holds to be a reasonable one, and one which the company has the right to enforce. Such a rule, the court goes on to say, on the appeal of the Rushville Co-operative Telephone company against Irvin (a case which has been mentioned in the Western Electrician heretofore) may be enforced for the reason that such a company is charged with a public duty, and may enforce such reasonable rules as are necessary to enable it to give the public efficient service. It is a quasi-public corporation, and must extend its service to those who apply and who offer to pay the charges. It may be compelled by mandate to render its service, and prevented by injunction from disconnecting such service. It cannot render efficient service to the public unless it can enforce prompt payment of tolls, and this fact is recognized by the courts when they hold that, for non-compliance with a reasonable rule, service may be refused. So here it holds that the company had the right to refuse the service demanded as long as the subscriber refused to pay the bill for the preceding month. He, however, did not refuse to pay the bill because he did not owe for services for the preceding month, but because he claimed the company was owing him. The question was thus presented whether the company had the right to discontinue the service because of the refusal to pay the preceding month's rental, regardless of the fact that the subscriber claimed the company was indebted to him.

The court does not consider this the same as trying to enforce the collection of an old bill, and says that it cannot be denied that a rule of the company requiring these monthly payments to be made in advance would have been a reasonable rule, and that, upon refusal to so pay, service could be denied. The company must protect its plant and keep up its efficiency, and may enforce a rule that insures a reasonable revenue and its prompt receipt. It can maintain an efficient service only through prompt payment of its dues and tolls, and because of that fact it may use the summary remedy of denying service for non-payment. It cannot be said that it may be denied the benefit of this rule because a patron claims the company is indebted to him. It cannot be required to stop and adjudicate claims held against it. The law compels it to furnish service. A patron may take service or not, as he chooses. It must furnish efficient service to all alike who are alike situated, and must not discriminate in favor of or against anyone. The law holds the company to these requirements strictly. For failure the extraordinary remedies of mandamus and injunction may be successfully invoked. It may be said that the courts are open to the company to collect its claim, but as to this the company and the patron are on an equal footing. The fact that the patron is solvent aids nothing in determining a rule which must apply to solvent and insolvent patrons alike. Nor does the court consider that the fact that other subscribers may have been in arrears for the preceding month was equivalent to saying that they had refused to pay when payment was demanded, so that not denying them service showed discrimination. For all of which reasons, and keeping in view the nature of the company's duties and the services it may be compelled to render, the court declares that it must be held that the company may enforce the payment of its current dues and tolls by the summary remedy of denying service, regardless of the fact that the subscriber claims that the company is indebted to him.

Public Use of an Invention.

The Court of Appeals in Washington has recently given a decision which sets forth, with some degree of definition, what constitutes public, as distinguished from experimental, use of an invention. On November 22, 1898, a patent on a design of an attachment plug for electrical circuits was granted to A. P. Seymour. Eight days afterward a man named Tournier filed an application for a patent on a design for a similar article, and this application was put in interference. The interference proceeding was brought to a determination, and priority of invention was found in favor of Tournier, but in the direct proceeding on the claim for a patent, in view of evidence that had been produced and filed in the interference, the patent was refused, upon the ground that the attachment plug, which was claimed by Tournier to be his invention and design, was in public use as a complete article in the shops of the General Electric company for more than two years prior to the date of the filing of the application for patent. This opinion was concurred in by all three tribunals of the Patent Office, and the question for the consideration by the Court of Appeals was really that of public use for more than two years.

It was claimed by Tournier that in order to obtain a patent under the law it was necessary to demonstrate the utility of the invention, and that to do this he had made experimental use of the plug with no other end in view. From the evidence of the patentee, and of others examined, however, it was evident that the attaching plug under considera-

tion was invented and produced as a complete article of manufacture, and as such was put into use in the shops of the General Electric company, at Schenectady, N. Y., more than two years prior to the filing of the application for patent. The shops of the company were numerous, as also were the hands employed therein, and the article had been openly in use without the injunction of secrecy upon anyone from the early part of the year 1896 up to the present time. The use was not only open to the employes, but to any of the general public who might be sufficiently interested to inspect it, and was held to be a public use in the fullest sense of the patent law. It was the opinion of the court that the decision of the assistant commissioner, from which appeal was taken, was right, and should therefore be affirmed.

Value of the Rural Telephone.

C. H. Munsell, manager of the Brown County Telephone company of Hiawatha, Kan., presented a paper recently before the local Farmers' Institute, in which he emphasized the value of rural telephone lines. In the course of his address Mr. Munsell said:

"One of the first things to consider is how to procure the best service. There are exchanges maintained in all the larger towns, and the smaller towns will soon have their smaller exchanges, and the farmer who wishes telephone connection should arrange to have his telephone connected with an exchange switchboard. Now, the value of the telephone (or the telephone service) to the subscriber depends on at least two important features—first, the number of people he is in communication with, and secondly, the class and character of the service rendered. The time has arrived when nearly every farmer can and should arrange to have telephone connection, thus placing himself in communication with his neighbors and friends, as in case of sickness he can consult his physician in a few moments' time without leaving his home."

CORRESPONDENCE.

New York Notes.

New York, March 16.—It is hinted that arrangements are being made for an operating agreement between the Manhattan Elevated, Brooklyn Rapid Transit and New York Central. The former will be operated by electric power before long, the Brooklyn system is already so equipped and the New York Central has been experimenting for some time with electric power for handling its suburban service. When these improvements are all completed there will be little to prevent a through service between White Plains and Coney Island or Yonkers and the Battery. Russell Sage is said to be the only obstacle to the contemplated changes, and his influence is fast giving way to that of the Vanderbilts.

H. S. Beattie has resigned as treasurer of the Metropolitan Street Railway company and has brought suit against the company for $100,000 for breach of contract. He claims that this amount is due him as compensation for his services in securing certain franchises several years ago.

A bill has been introduced in the Assembly to compel the street-railway companies to run vestibuled cars in winter for the protection of their employes. The bill is actively supported by the labor organizations, which contend that sickness and deaths among the railway employes in Buffalo have been greatly reduced since the adoption of vestibules.

Controller Coler announces that the next sale of Rapid Transit bonds will take place on March 25th. The issue will be $2,500,000 at 3½ per cent., payable in gold May 1st and November 1st each year and maturing November 1, 1950, when the sinking fund created by the Rapid Transit act of 1897 and 1900 will be large enough to cancel all the bonds, thus paying for the work and making the city of New York owner of the rapid-transit railroad. This is the second issue, the first being $1,000,000. The total called for by the rapid-transit work is $36,000,000.

The formation of the United Railways company to buy the stocks of the local railway companies much after the manner of E. H. Harriman's syndicate in the steam-railroad properties is, it is predicted, not unlikely to be without important result in the market position of the local railway shares. The suggestion is made that this company is the forerunner of the consolidation of all the local railway properties.

Much interest is being taken in the Chamber of Commerce committee which is considering remedies for the crowding of the bridge terminal. Charges have been made that A. E. Orr, chairman of the committee, is a large holder of Manhattan stock and is using his position to procure valuable land near the bridge for the Manhattan company. Mr. Orr denies this, giving the dates and particulars of the sale of his holdings in Manhattan. One of the remedies proposed for the existing conditions is a moving sidewalk at the end of the bridge capable of handling a large part of the crowds. M. L. G.

Canadian Intelligence.

Ottawa, Ont., March 16.—The Ottawa Electric Railway company will commence early next month installing cast-welded joints on its tracks, and the necessary equipment for the work has been purchased. It is expected that about 100 joints can be placed each night, at a cost of about $5 a joint.

At a cost of nearly $250,000 the Royal Electric company of Montreal has purchased land to erect buildings which will enable the company nearly to triple its present production. The output is to be developed to 30,000 horsepower, of which the Montreal street railway will take 10,000 and the company's lighting business 20,000 horsepower. The capacity of the existing works is about 10,000.

A great telegraph case is before the Court of Appeals, in Toronto, Ont., and is occupying the attention of nearly all the prominent legal firms of the city. The plaintiff is George Morrow, a Boston broker, and he is suing to set aside a transfer of stock in the Montreal Telegraph company to the Great Northwestern Telegraph company, whereby the Western Union Telegraph company secured control of both companies. He failed before the lower court. It is said that $20,000,000 of securities are directly and vitally involved in the result of the action and appeal. It is claimed, incidentally, by the plaintiff that the Great Northwestern company is not earning the eight per cent. dividend it pays annually to the Montreal Telegraph shareholders, and that the Western Union is making up the deficit and charging it against the Canadian companies.

There will probably be no monopoly of the lighting and power business in the city of Montreal, for the Lachine Rapids Hydraulic and Land company, it is said, has definitely decided to have nothing to do with the Montreal Lighting and Power company. The negotiations, which have been some time in progress, to effect the amalgamation of the Lachine company with the combine, are reported to have ended without the desired result. The Lachine company is capitalized at $2,000,000, and most of the shareholders wanted $4,000,000 for the property, or at the rate of 200 for their stock. A few shareholders are said to have held out for 250 for their stock, at which rate they place the value of the concern at $5,000,000. The combine considered the price too high, and declined to pay, and as the Lachine people would not come down, negotiations were dropped. A. V. W.

From the Buckeye State.

Columbus, Ohio, March 16.—A new company has been formed to build an electric line from Columbus to Chillicothe. It is composed of Sternberger Bros. and T. J. Morgan, prominent coal operators of Jackson, Ohio, S. J. Patterson, wholesale coal operator, Dayton, and A. F. Johnson, brick manufacturer, Portsmouth, Ohio. All these gentlemen are well known in the state and have plenty of money.

The company building a line from Adrian, Mich., to Sylvania, to connect with the Toledo and Western, will be compelled to cross the Wabash tracks at Adrian on a steel bridge, according to the decision of the railroad commissioner of that state, who will not allow a grade crossing. It is said the bridge will be more than 1,400 feet long.

Arrangements are being made for the consolidation of the Dayton and Xenia Traction company and the Rapid Transit company of Dayton, and representatives of the companies have been in the East for a few days on business in connection therewith. The City Railway company of Dayton has filed suit against the Dayton and Xenia company to prevent it from using the tracks on Third street in that city.

The Cincinnati Traction company has created the position of assistant general manager and elected R. I. Todd of Pittsburg to fill it. Mr. Todd has had much experience in the street-railway business and has formerly been connected with the Consolidated Traction company of Pittsburg. He will have entire charge of the operating and engineering department. President McGowan is still confined to his home in Indianapolis by illness.

The Jewett Car company of Newark, Ohio, has brought suit against the Cincinnati, Lawrenceburg and Aurora Electric Street Railway company to collect $3,894.50, said to be due on account, and $,1,216.50, claimed for services. The allegation is made that the Tennis Construction company contracted the debts and then turned them over to the railway company for settlement.

S. N. Coe and P. D. Carpenter of Cleveland have been granted a franchise by the commissioners of Crawford County, allowing them to construct an electric line from Galion to Crestline. The Ohio Central Traction company is now operating a line from Bucyrus to Galion, and is preparing to extend the road to Crestline, which is only four miles distant. Just what company the above two gentlemen represent is not known, but they guarantee that the road will be built at once.

H. W. Wiswell of Warren, Ohio, and several other gentlemen will shortly incorporate a company, with a capital stock of $30,000, to manufacture electric lamps, at Niles. The town will donate a site for the factory, and it is expected that work will commence on the buildings within a short time.

The Marietta Electric company, Marietta, has increased the pay of motormen and conductors from 15 to 16 cents an hour.

A combination between the proposed Lake Shore Electric Railway company and the Northern Ohio Traction company is now being talked of. It is argued that a company possessing a large number of the electric lines in the northern part of the state can be operated much more cheaply than at the present time, as it would require a smaller number of power houses and other expenses might be reduced. This matter has not been settled, and nothing may be done unless several of the roads can be gotten to agree to the proposal.

The Columbus, Grove City and Southwestern Railway company of Columbus has been incorporated, with a capital stock of $250,000. The officers are as follows: President, A. G. Grant; vice-president, A. E. Appleyard; secretary, Emmett Tompkins; treasurer, John G. Webb; general manager, H. A. Fisher. J. S. Harshman of Dayton and George B. Darnell of Grove City are members of the board of directors. The new company is made up largely of the same men that are in the Columbus, London and Springfield Railway company and the Dayton, Springfield and Urbana Railway company. This company absorbs the line owned by A. G. Grant which extends to Grove City and Morgan Station. It is said that this line will be extended south to Portsmouth, and that the electric-railway men of central Ohio have in mind a plan to build a line down the north bank of the Ohio River to Cincinnati. While this would connect a very large number of small towns, it would be a great undertaking. If it should be done, however, a connection between Dayton and Cincinnati would complete a triangle of very valuable electric lines. The men interested in these companies are working out a large system of electric roads in the central and southwestern portion of the state.

The Wheeling and Western Railroad company of Bridgeport has been incorporated, with a capital stock of $10,000, to build an electric road from Bridgeport to St. Clairsville, Belmont County. The incorporators are A. M. McCaslin, W. H. Joplin, R. S. Proudfoot, D. G. Yeager and E. M. Gronemeyer.

It is said that the Cincinnati Traction company will oppose the granting of a franchise to the Cleveland and Cincinnati Street Railway company, on the ground that the new company expects to secure the right-of-way through the Probate Court, without compensation, and then sell it to the Cincinnati company which is making arrangements to build a suburban line to connect with all the roads which wish to come into the city.

There is a plan on foot in Cincinnati to combine all the lighting interests under one head and to furnish light of whatever kind is desired to the city and suburbs and also to the neighboring towns across the river. The newspapers have had a great deal to say about it, but no decisive steps have been made public so far.

Judge Bigger of Columbus has granted a change of venue in the Ross injunction case against the Columbus Railway company, and it will be tried in another county not yet named. O. M. C.

Southern Developments.

Charlotte, N. C., March 16.—The Radford (Va.) Waterpower company has been chartered, with a capital of $50,000, by G. M. Miles and others. The company is chartered to furnish electric, hydraulic and steam power.

An act has been passed authorizing the town of Abingdon, Va., to operate water, gas and electric-light plants.

The Charlotte and Prince Edward Electric Railway company has been incorporated by F. C. Thornton and others of Smithville, Va. The capital stock is placed at $100,000.

The West Hampton Park Railway company, with a capital of $300,000, has been chartered for the purpose of operating an electric railway in Richmond, Va., Manchester, Va., and the county of Henrico. W. T. Armistead of Richmond and others are the incorporators.

It is stated that the Knoxville Power company, backed by $800,000 of eastern capital, has abandoned its purpose of damming the Tennessee River at Knoxville, and will instead build a dam across the Little Tennessee, 18 miles from Knoxville. It is said that 900 horsepower can be generated and that it is proposed to build a plant as soon as possible. The Tennessee Legislature has passed a resolution permitting the construction of a dam at the place named.

It is said that the North Carolina Power company, which proposed to develop the waterpower of the Yadkin River some distance from Salisbury, N. C., may be dissolved on account of a lawsuit. Dr. Dillon Brown of New York, the principal promoter, is at present engaged in litigation. About $150,000 has been expended by Dr. Brown in the purchase of land.

A test run has been made of the Virginia Electrical Railway and Development company's plant at Richmond, Va., and it is thought the plant will be running at its full capacity and patrons supplied with power within about 10 days.

The Durham (N. C.) Traction company has approved plans for its new power-house building. This building will contain the city lighting plant, ice and cold-storage plant and repair shop. The car sheds will be placed in another quarter of the city. Tracks will be laid as soon as the factories can fill the orders which have been placed.

The Charleston, Suburban and Summerville Railway company has received its commission from the state of South Carolina. The line will be 28 miles in length. The capital stock is to be $600,000. J. J. O'Connell and others of Charleston, S. C., are the incorporators. L.

Northwestern Notations.

Minneapolis, March 16.—The first week in April the Seattle Electric company of Seattle, Wash., will move its head offices into its new building, now approaching completion.

The Twin City Rapid Transit company finds that the owl cars in Minneapolis and St. Paul are not a success, financially. They do not seem to have secured increased business, but merely string out the late passengers. The service will be given a longer trial before going back to the old schedule, however.

The Oelwein (Iowa) Light, Heat and Power company is investigating heating plants, with a view to installing one in connection with the electric-light plant.

The Electric Light company of Brandon, Man., is constructing a power dam on the Little Saskatchewan, seven miles northwest, and expects to have it completed before next fall. A large amount of power will be generated and an electric railway is probable.

The Public Service company of St. Cloud, Minn., has installed a new boiler of 350 horsepower. Another of similar power is to be installed. The two will quadruple the company's power. The increased power will be used for handling the street-car system, the electric lighting and district heating plants.

The Yakima Commercial Club is considering the feasibility of an electric line from North Yakima, Wash., to Moxee, Sunnyside and the Ahtanum.

The city of Estherville, Iowa, has made a proposition to a St. Louis firm to give warrants in payment for additional machinery for the electric-light and water system, with the understanding that the warrants are to be paid $2,000 yearly until completed. The firm has signified its willingness to accept such a proposition.

A. I. Woodring, an employe of the Rapid Transit company at Waterloo, Iowa, has devised a plan whereby the direction of the last car passing may be known. When a car passes in one direction, it causes an incandescent light in the signal to be lighted. When a car goes the other way, it turns the light off. The device will save time and delays at junction points.

The Manufacturers' Railway company has been formed at Tacoma, Wash., to build street railways, suburban lines, etc.

The street-railway company at Everett, Wash., is handicapped in its improvements and extensions by the inability of manufacturers to furnish the necessary supplies.

The Street Railway and Light company of Fond du Lac, Wis., has had plans prepared for a new office and car-barn building.

Carver, Minn., has voted in favor of a municipal lighting plant.

The municipal electric-light plant at Valley City, N. D., took in for February, 1901, $671.39, and the expenses were $396.15, leaving a gross profit of $175.24.

The Minnesota Legislature is considering a bill which makes telegraph companies liable for damages for mental anguish caused by delay in the delivery of telegrams. The bill is fathered by Representative Peterson, and it is claimed that there is a good deal of personal feeling on his part against telegraph companies.

An electric-light and heating plant is projected for Charter Oak, Iowa, soon.

P. S. Shufelt of Minneapolis has made a proposition to the village of Excelsior, Minn., to put in a complete system of electric lighting and waterworks. Another Minneapolis party is anxious to put in an electric-light plant.

The city of New Ulm, Minn., will vote, April 2d, on $30,000 bonds for a municipal electric-light plant.

The gas and electric-light franchise has passed the council of Waterloo, Iowa, and now goes before the voters for approval.

Chester M. Poor of Cincinnati has become manager of the Electric Light company at Livingston, Mont.

The Tacoma Railway and Power company of Tacoma, Wash., has put a 20-minute schedule into effect on the Edison line. R.

PERSONAL.

W. S. Boyd, electrical inspector of the Chicago Underwriters' association, has resigned, to accept the position of insurance manager for the Western Electric company at Chicago.

H. W. Buxton, who was formerly manager of the Southern Bell telephone exchange at Augusta, Ga., has gone to Atlanta, where he has assumed charge of the local exchange, succeeding R. L. West, promoted to the office of division superintendent.

James R. Chapman, formerly electrical engineer of the Chicago Union Traction company, arrived at Liverpool on the White Star liner Teutonic on March 14th, on his way to London to take charge of the construction work on the electric railways controlled by Charles T. Yerkes.

ELECTRIC LIGHTING.

Buckingham Palace, in England, is to be lighted electrically.

A bond issue of $80,000 for a waterworks and lighting plant is contemplated at Glenwood Springs, Colo.

A municipal lighting plant is proposed at Wheeling, W. Va.

An issue of $55,000 four per cent. lighting bonds is under consideration at Lincoln, Neb.

An electric-light plant has recently been installed at Victoria, in the Mexican state of Tamaulipas.

The Dewitt Electric Light and Power company of Des Moines, Iowa, has increased its capital stock from $3,000 to $9,000.

At a coming municipal election at New Ulm, Minn., the question of issuing $30,000 in bonds, for building an electric-light plant, will be voted upon.

The municipal lighting plant at Little Rock, Ark., will be enlarged and improved, contracts to the amount of $16,000 being contemplated. Information may be obtained from the mayor of the city.

ELECTRIC RAILWAYS.

An electric railway has recently been completed between Lerdo and Gomez Palacio in the Mexican state of Durango.

The directors of the Cleveland and Eastern suburban electric line are planning an extension of about 20 miles, to cost $300,000.

The Cleveland Southern Electric Railroad company has been incorporated, with $1,000,000 capital, to build a line from Cleveland to Wooster, via Cleveland and Berea.

The Wheeling (W. Va.) and Elm Grove Railway company, the Suburban Light, Heat and Power company, the Suburban Railway company, the Wheeling Park association and the Suburban Light and Water company have consolidated under the charter of the Wheeling and Elm Grove Railway company. Anton Reymann will be the president of the consolidated company and one of the chief stockholders.

AUTOMOBILES.

The Chicago Tribune recently published some interesting figures bearing on the financial results of the automobile livery business in different cities. The gross business of the Philadelphia company for 1900 amounted to less than $50,000, while expenses reached $64,000. The deficit was larger than for the first year. The New York company showed an operating profit of $11,279 for the first year. In Boston the New England company earned in the year to October 1, 1900, about $100,000, while expenses were $200,000. The loss of the Chicago company from September 13, 1899, to February 1, 1901, was $128,778.

PUBLICATIONS.

An article entitled "The Pan-American Exposition," written by William I. Buchanan, director-general of the exposition, and first appearing in Collier's Weekly, has been reprinted in attractive pamphlet form and issued by order of the board of directors of the exposition.

Lundell fan motors are described and illustrated very attractively in a recent catalogue issued by the Sprague Electric company of New York. Desk, bracket, column, suspended, ceiling and exhaust fans for both direct and alternating current are shown. Price-lists and code-word indexes add to the value of the catalogue. A feature is a picture of "The Real North Pole," indicating that a Lundell fan creates the intense cold at that point.

A neat booklet entitled "About a Street-railway Company" is published to show the great advantage of the use of Garton lightning arresters in electric-railway work. The experience of a Chicago street-railway company is cited. It is a curious thing about this booklet that the name and address of the manufacturer of the Garton arrester is not given in it anywhere. Perhaps it is assumed that all recipients, like the Western Electrician, know that this apparatus is made by the Garton-Daniels company of Keokuk, Iowa.

"Whitney Electrical Instruments of Precision" are described in the 1901 catalogue of Machado & Roller, general sales agents, 203 Broadway, New York city. The instruments listed include voltmeters and ammeters of different ranges and styles for both direct and alternating current, galvanometers, wattmeters, watch-pocket instruments, current and potential indicators and testing sets. The firm has made a new departure in the manufacture of shunts for ammeters of over 100 amperes' capacity, and these shunts are quoted, together with series transformers for alternating-current instruments.

Bulletin No. 2, recently issued by the Kellogg Switchboard and Supply company, Chicago, describing some of its switchboards which are adapted for small and medium-sized exchanges, has been issued. This booklet contains about 24 pages; it is written in an interesting manner and contains much valuable information concerning switchboards and switchboard parts, including about 20 excellent halftone illustrations. The Kellogg "express" switchboard for small exchanges, the "universal" switchboard for medium-sized exchanges and "desk style" boards for branch exchanges in factories and office buildings are described in detail. Views and descriptions are also given of a number of switchboard parts, such as strip of jacks, lamps, rotary and drop signals, combination self-restoring drops and jacks, listening and ringing keys, plugs and cords, etc. The Kellogg hook switch, though properly belonging to the preceding bulletin on "Telephones," was not fully described at that time and is also included here.

POWER TRANSMISSION.

The St. Joseph River in Indiana is to furnish about 5,000 horsepower for the town of South Bend. A dam will be built 21 feet in height, forming a lake about nine miles long, which is expected to become a popular summer resort.

TELEGRAPH.

The Western Union Telegraph company now has a direct connection between Chicago and Portland, Ore., enabling messages to be sent without being repeated, and permitting the transmission of cablegrams and New York telegrams to Portland with only one relay.

The new government cable to be laid to Alaska this summer will employ what is known as the sine-wave system, patents on which are controlled by the Crehore-Squier Intelligence Transmission company of Cleveland, Ohio.

ELECTRICAL SECURITIES.

Directors of the Westinghouse Electric and Manufacturing company have voted to issue $3,000,000 par value of the recently authorized increase of capital stock, the price, terms and conditions of the issue to be upon the recommendation of a special committee, determined at the regular board meeting of March 27th.

SOCIETIES AND SCHOOLS.

A new building has been contracted for at Cornell University, Ithaca, N. Y., to be devoted to the mechanical engineering department. The building is the gift of Hiram W. Sibley of Rochester, N. Y., and will cost $75,000. It will be a three-story, stone, fireproof structure, and will be devoted to museum and lecture-room purposes.

At a regular meeting of the Chicago Electrical association, held in the Monadnock building on Friday, March 15th, Arthur Vaughan Abbott, chief engineer of the Chicago Telephone company, gave an address on "Electrical Conditions in Chicago." The subject dealt largely with the causes of and remedies for electrolysis and was well illustrated with lantern slides.

The committee in charge of the conversazione of the American Institute of Electrical Engineers, which is to be held on April 12th, at Columbia University, New York city, is developing the plans vigorously, and a number of novel and interesting exhibits are promised. The offer will be both scientific and social in character. Many prominent inventors and leading electrical companies are expected to contribute items of intrinsic merit to the list of attractions. Besides the members of the Institute and their ladies, invitations will be extended to a select list of guests.

About 150 members of the Northwestern Alumni Association of the Massachusetts Institute of Technology held their annual banquet at the University Club in Chicago on March 16th. I. W. Litchfield, president of the association, was toastmaster, and among the speakers were Henry S. Pritchett, president of the Massachusetts Institute of Technology, Lyman J. Gage, secretary of the treasury, and Dr. F. W. Gunsaulus. President Pritchett spoke on "The Institute; Its Present and Future." The permanent shield which represents the Massachusetts Institute of Technology in the banquet hall of the University Club was electrically illuminated, and below it was the name "Pritchett" in electric lights. The officers for the ensuing year are: President, I. W. Litchfield; vice-president, E. L. Andrews; secretary-treasurer, E. M. Hagar; executive committee, A. P. Hall, Van Rensselaer Lansingh and W. G. Zimmermann.

MISCELLANEOUS.

The British naval estimates for 1901 provide for five submarine boats of the type invented by Holland of this country. The boats have been ordered primarily for the purpose of testing them and ascertaining their true value in naval warfare. The boats are now being constructed by the Vickers-Maxim company of England, which has bought the sole right to build Holland submarine boats outside of the United States. It is expected that the first boat will be launched in May. The French Admiralty also announces the immediate construction of three submarine boats, to be followed later by 20 more of the same type.

TRADE NEWS.

The Federal Electric company of Chicago has been incorporated, with a capital stock of $2,500, to do an electrical manufacturing business. The incorpo-

rators are Henry M. Bates, Evans Holbrook and Edward Frey.

The Olds Motor Works of Detroit, nothing daunted by its recent fire, announces that it is now prepared to take orders for automobiles for May delivery. All automobile drawings and patterns were saved, and none of the material in the warehouses was burned.

The dispute over taxes on its plant between the Siemens & Halske Electric company of America and the assistant tax collector of the town of Cicero, Ill., in which the plant of the company was formerly situated, has been settled, the collector having accepted $3,800, the amount tendered by the company.

At the recent annual meeting of the Cutler-Hammer Manufacturing company, Milwaukee, Wis., manufacturer of electric controlling devices, all of the officers of the company were re-elected, as follows: President, F. R. Bacon; vice-president, F. L. Pierce; general manager, H. H. Cutler; secretary and treasurer, J. G. Hickcox.

Under date of November 7, 1900, the government of Venezuela has made a provision whereby all apparatus and machinery for lighting with gas and electricity and for their manufacture carbide of calcium, carbons for electric lighting, carriages, accessories, and materials intended exclusively for railroads, telegraphic machinery and apparatus, when permission has been previously obtained from the government, shall all be imported free of any duty. Telephonic adjuncts and apparatus and covered wire are dutiable at 25 centimes of a bolivar per kilogram, or 4.8 cents.

The free-scholarship offer being made by the American School of Correspondence of Boston, Mass., for engineering and mechanical drawing is a feature which is attracting attention. Without leaving home or losing time from his regular work, the student pursues a thorough course of study under able instructors. Clear and concise papers on the different subjects are furnished him and special information concerning any difficulties that may arise in the course is also supplied. The American school has the advantage of being situated in the industrial and educational center of New England, and it has among its instructors men who are regular teachers in several of the technical schools of Boston.

BUSINESS.

The Electric Appliance company, Chicago, says: "Now is the season to buy lightning arresters, and we can supply them."

The Chicago, St. Paul and Missouri Railway company has placed a contract for 36 bridges with the American Bridge company.

J. J. Reidy of New Haven, Conn., states that he is having an unusually large trade in Donnelly's improved steel climbers for linemen. He says the Manhattan Electrical Supply company of New York city has sold 300 pairs of the climbers this year alone.

The Eldredge Electric Manufacturing company, Springfield, Mass., reports a greater demand for its instruments than it has been able to meet, although running over time. Its pocket instruments are especially popular among electrical men and automobilists.

The Emerson Electric Manufacturing company of St. Louis announces that it will send free to its customers electrotypes showing its various types of desk and ceiling motors. The cuts thus supplied are intended for the use of the dealer in advertising and creating a demand for the product.

The Marion Electric Light company, Marion, Ohio, has recently installed a 250-horsepower engine in its plant. The engine was built by the Ball Engine company, Erie, Pa., which company is also installing a 500-horsepower, self-oiling, cross-compound engine, direct-connected to two 150-kilowatt generators in the Norfolk navy yard.

The American Stone Conduit company of Chicago, reports a constantly growing business and interest in its product, which is said to be attracting considerable attention. The company has a large plant at Eighteenth and South Lincoln streets, where it manufactures conduits of all sizes and for all purposes. New machinery is being added to the company's plant which will materially increase its capacity.

The Electric Storage Battery company of Philadelphia has recently closed a contract with the Tucker Electrical Construction company of New York for the installation of a battery of Chloride accumulators for the estate of Henry Villard at Dobbs Ferry, N. Y. The battery is to be used for residence lighting, and consists of 68 elements, having a capacity at the normal rating of 280 ampere-hours, and will be operated in connection with two 12½-kilowatt dynamos, driven by two 20-horsepower gasoline engines.

Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, carry a complete stock of the Pecora machinery paints, which have been on the market and given excellent satisfaction since 1862. Flat-steel color is in paste form for engines, tools and general machinery. The eggshell gloss enamel finishing paint for engines, tools and general machinery dries hard in 30 minutes, and is sold only in liquid form. The Dresden machine enamel imparts a rich, glossy appearance for radiators, gas engines, etc. Other varieties of fillers, paints and cements for machinery are included in the stock. A sample of the Pecora blow-hole cement is sent free.

The Star Brass Works of 67-69 South Canal street, Chicago, call attention to their whitewashing and cold-water paint-spray machines, with the advent of spring. Power-house managers are told that the machines reduce labor, save time and money, and are unexcelled for durability, economy and beauty of work. One large job will pay for the machine, it is said. The Star cold-water fireproof paint is a mineral and chemical coating to be mixed with cold water and applied to woodwork for the purpose of diminishing and arresting the flames in case of fire. It is used in mills, factories, warehouses and other buildings for inside work only.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued March 12, 1901.

669,501. Supervisory Signal Apparatus for Telephone Switchboards. Oro A. Bell, New York, N. Y., assignor to the Western Electric company, Chicago, Ill. Application filed July 31, 1899.

Telephone lines extending from sub-stations to a central office are united by a pair of plugs and link conductors. A supervisory relay is associated with the pair of plugs. A local circuit includes a subsidiary supervisory signal controlled by the relay, a source of current, and is controlled by a manually operated switch key, whereby the subsidiary signal may be rendered independent of the supervisory relay.

669,517. Binding Post for Electrical Connections. Alexander Fischer, New York, N. Y. Application filed February 19, 1900.

The binding post has a longitudinal opening flaring inwardly, and the electrical conductor is provided with a split pin adapted to be inserted and expand in this opening.

669,536. Electric Switch. Thomas G. Meinema, Morton Park, Ill., assignor to Edward W. Hammer, Chicago, Ill. Application filed March 1, 1900.

A movable arm provided with a retracting device is associated with an electromagnet. An armature movably mounted in proximity to the poles of the electromagnet is adapted to be attracted thereby. A spring part connected with the armature is provided with an engaging end to hold the arm in a predetermined position while the armature is attracted by the pole-pieces.

669,543. Electric Gas Igniter. Oscar von Morstein, Berlin, Germany. Application filed December 8, 1896.

The subject of this patent is a device for igniting gas jets from a distance by means of secondary induction currents, consisting of a primary bobbin over which the conducting wires terminating at the burners are wound as induction bobbins and of a vibrating spring interposed in the conductor for the purpose of alternately closing and breaking the electric circuit during the time of its oscillations. The spring is so located at a distance from the contact piece that it can only reach the latter in its oscillations.

669,544. Apparatus for Party Telephone Lines. Frank R. McBerty, Downers Grove, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed May 21, 1898.

A telephone switch is adapted to open a normally closed short-circuit of the telephone, and to short-circuit the bell while the telephone is in use. (See cut.)

669,545. Apparatus and Circuit for Telephone Switchboards. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed June 12, 1899.

In a switchboard wherein metallic circuits and grounded lines center, the wires of the circuits are formed into cables. Open mate wires for the grounded lines terminate in the spring-jacks of the lines. Link conductors for uniting lines contain repeating coils, each of which has four windings in a substantially like inductive relation to each other, one terminal of each of the windings being grounded and the other terminal being associated with the link conductor to be brought into connection with one of the line wires or mate wires of the line. The object sought is to maintain the static balance of metallic circuits while cross-talk in the switchboard is prevented.

669,546. Portable Electric Lamp. Morris Newgold, New York, N. Y. Application filed March 8, 1900.

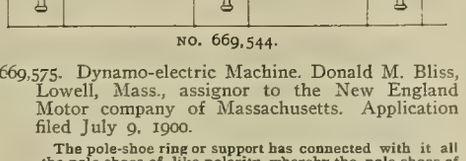
An enlongated battery casing carries a lamp at one end and a circuit-controller therefor at the opposite end, the circuit-controller comprising in its structure an angularly bent arm pivotally secured to the end of the casing, at or about its axis, extending along its side, and adapted to be brought into electrical connection with it.

669,573. Dynamo-electric Machine. Amos R. Bliss, Lowell, Mass., assignor to the New England Motor company of Massachusetts. Application filed June 25, 1900.

An armature support is slid endwise into the frame, and has three or more projecting members to engage the inner surface of the frame to center and support the armature with relation to the frame.

669,574. Dynamo-electric Machine. Donald M. Bliss, Lowell, Mass., assignor to the New England Motor company of Massachusetts. Application filed February 19, 1900.

The frame is provided with an internal cylindrical bearing surface. Pole-pieces are secured to the bearing surface, and an armature frame or cradle contains bearings for the armature and supporting portions, the outer surfaces of which are curved to conform to the diameter of the inner surface of the frame. The fastening devices for the pole-pieces and armature frame are interchangeable. The brush-holding ring has a supporting flange to fit the inner surface of the frame.



NO. 669,544.

669,575. Dynamo-electric Machine. Donald M. Bliss, Lowell, Mass., assignor to the New England Motor company of Massachusetts. Application filed July 9, 1900.

The pole-shoe ring or support has connected with it all the pole-shoes of like polarity, whereby the pole-shoes of like polarity are magnetically connected.

669,577. Casing for Electric Motors. Charles A. Eck, Newark, N. J. Application filed October 30, 1900.

A detachable but stationary end piece of the frame is provided with one or more apertures and terminates in a bushing or bearing, and a movable closing member rotates on the bushing of the end piece and is provided with a corresponding number of apertures adapted to be brought in and out of alinement with the apertures on the stationary member by the movement of the movable member.

669,580. Electric Lamp. Marshall W. Hanks, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 7, 1900.

The device contains a number of glowers and a heater constructed and arranged to raise their temperature to the conducting point. A controlling glower is provided, requiring either a higher temperature or a longer period of heating to render it conductive, together with a heater cut-out having its actuating member connected in series with the controlling glower. (See cut on next page.)

669,594. Magazine Ballast for Electric Lamps. Henry N. Potter, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed June 4, 1900.

Three or more ballast conductors are located within a chamber with means for electrically and mechanically connecting their inner ends, and means outside the chamber for connecting any two of the conductors in the glower circuit.

669,595. Electrical Controller. Charles R. Reynolds. Hartford, Conn., assignor to Henry J. Coggswell and Halsey B. Philbrick, Hartford, Conn. Application filed March 2, 1900.

Curved contact plates of different lengths are fixed flatwise to an insulating base on the arcs of different concentric circles. A rotatable arbor is mounted concentrically with the fixed contacts and carries arms Contact fingers are borne by the arms, those on some of the arms being electrically connected, while those on each of the other arms are insulated from each other.

669,610. Making Glowers for Electric Lamps. Alexander J. Wurts and Marshall W. Hanks, Pittsburg, Pa., assignors to George Westinghouse, Pittsburg, Pa. Application filed June 7, 1900.

The process described consists in forming a blank of the proper length for two glowers, attaching a terminal wire permanently to each end of the blank, passing current through the blank to shrink it, bisecting the blank and attaching a terminal wire to each end thus formed.

669,613. Dynamo-electric Machine or Electric Motor. Norman C. Bassett, Lynn, Mass., assignor to the General Electric company of New York. Application filed January 18, 1900.

The casing for the field magnet and armature is formed of a single casting, having an opening at the top for the introduction of the field magnet and a removable cover for the opening, an opening at one end for the introduction of the armature, a lateral extension of the casting at the other end forming an enclosure for the commutator and hand-holes in the casting to permit access to the commutator.

669,620. Electric Warp Stop Motion for Looms. John A. Clark, Worcester, Mass., assignor to Crompton & Knowles Loom Works, Worcester, Mass. Application filed December 20, 1900.

The movement of the shipper lever to start the loom renders effective the electric warp stop-motion to stop the loom. A device adapted to be moved out of engagement with the shipper lever prevents the operation of the electric warp stop-motion to stop the loom, and when moved into engagement with the shipper lever permits the operation of the stop-motion.

669,644. Signal or Alarm. Paul M. Jerrard, Johannesburg, South African Republic. Application filed October 5, 1900.

An hermetically closed casing is fitted with a flexible portion. A rod has one end rigidly connected to the edge of the signal bell, and the other end passed airtight through the flexible portion of the casing. A hammer within the casing is placed in proximity to the end of the rod and is electrically operated.

669,662. Multiphase Transformer. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric company of New York. Application filed December 14, 1898.

A three-phase transformer has its secondary windings subdivided so as to obtain more than one ratio of transformation, the number of connections with the secondary windings being less than three times the number of ratios of transformation obtainable.

669,670. Electrical Measuring Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed June 25, 1900.

A compound magnetic field is formed by two magnets set at an acute angle, the poles being relatively reversed with respect to the movable element. A measuring coil secured to the moving element is pivoted in eccentric relation within the fields, the moving element being normally under tension. The scale plate has its minimum indication a determinate range above unity corresponding to the tension of the movable element. (See cut.)

669,691. Insulator for Electric Wires. Morton Harloe, Hawley, Pa., assignor of one-half to Wilton S. Bloes, Peckville, Pa. Application filed September 19, 1900.

The insulator has a body portion with means for mounting it to swing, the body portion having located upon it a stud capped with an overhanging flange. A circuitous groove winds between the capped stud and the oppositely directed projections, into which the wire to be insulated is bent and retained by the projections and capped stud. An upwardly cut groove extends around the body portion, forming a petticoat.

669,706. Electric Switch. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, New York, N. Y. Application filed November 20, 1899.

A switch blade is pivoted on the base, and contacts are arranged on the base around the pivot of the blade. A segment secured to the base concentric with the pivot is provided with notches in its edge and with marks on its front side corresponding to the position of the contacts. A handle connected with the switch blade is arranged in the rear of the segment, and a spring-bolt in the handle is provided at its end with a catch which engages with the notches in the edge of the segment and with a pointer which traverses the marks on the front side of the segment.

669,707. Telephone-exchange System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 12, 1894.

A switch at the sub-station opens the line during the use of the telephone. An annunciator has an indicator and two electromagnets each adapted to prevent the display of the indicator, one of the magnets being included together with a source of signaling current in the telephone line, and a normally open local circuit including the other magnet of the annunciator. Switch contacts close the local circuit at any spring-jack when connection is made therewith.

669,708. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed February 28, 1895.

An electric circuit divided into two parallel branches includes a source of current and a resistance coil, and each branch includes a signal lamp. A telephone line is associated with the lamp in one branch. Switch contacts, closed in making connection with the line, complete the other branch, and other switch contacts controlled from the sub-station of the line close the first-mentioned branch. (See cut.)

669,709. Supervisory Signal for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 25, 1895.

Two telephone lines are united through a plug circuit in a telephone switchboard, and each is provided with a switch at its sub-station controlled in the use of the telephone for interrupting the line during the disuse of the telephone. Two signaling instruments in different bridges of the line circuit include a source or sources of current, and a key in the plug circuit breaks the circuit intermediate of the two bridges containing the signals.

669,710. Telephone Circuit. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed November 13, 1897. Renewed September 4, 1900.

In a centralized-battery telephone system, a main telephone circuit and a source of transmitter-current supply are included. A telephone transmitter, an induction coil and a condenser are placed at a sub-station, the transmitter and the condenser being in parallel branches of the main circuit. The primary winding of the induction coil is in one of the branches, and the secondary in the main circuit in series with the parallel branches thereof.

669,752. Electrolytic Apparatus. Paul W. Knauf, Philadelphia, Pa., assignor to the Electrical Lead Reduction company, Philadelphia, Pa. Application filed July 17, 1900.

Each of a series of superposed metallic receptacles has its lower portion of less diameter than the upper edge, and an exterior peripheral seat arranged below, but conforming throughout its whole extent with the upper edge. The receptacles are respectively provided with external gas-escape orifices adjacent to the seat, whereby a series of wholly isolated chambers having individual escape orifices is formed.

669,755. Controller. Carl F. Lundeberg, Hartford, Conn. Application filed July 17, 1900.

The controller drum has drum contacts, and a finger bar having finger contacts is provided. A quick make-and-break device first raises the finger contacts from the drum contacts at one point in the periphery of the drum and afterward brings the finger contacts into engagement with the drum contacts at another point.

669,759. Electric Motor. Charles Mildé, Paris, France, assignor to Ste. Ch. Mildé Fils et Cie., Paris, France. Application filed August 22, 1900.

This motor comprises two armatures keyed on separate shafts which are in line with each other, and eight exciting coils arranged four on each side of the central bearing for the two shafts, four such coils being identical and shunt wound while the other four are identical and series wound, the arrangement being such that a shunt coil faces and has on each side of it a series coil, while diametrically opposite to it is another shunt coil.

669,792. Combined Telephone and Alarm System. Angus S. Hibbard, Chicago, Ill. Application filed July 7, 1900.

The subscriber's station is provided with a telephone switch-hook to close a branch between the sides of the telephone line upon the removal of the receiver. A signal at the exchange is operated from the subscriber's station, the operating means serving to open the branch associated with the telephone switch-hook to prevent this branch from being closed upon the removal of the receiver. The alarm-operating means may thus act over the telephone line independently of the position of the switch-hook. (See cut.)

669,800. Telephone-receiver Holder. George S. Meyer, Newburg, N. Y. Application filed December 8, 1900.

A bar has a loop portion between its ends for engaging over a transmitter arm. A hook at one end engages around the under side of the arm, and receiver-holder loops are provided at the opposite ends of the bar.

669,802. Electrical Device for Converting Alternating Currents. Albert Nodon, Paris, France. Application filed September 6, 1900.

This is a device for converting alternating into continuous currents. An electrolyte formed of a solution of phosphoric acid with an addition of ammonia surrounds two electrodes, one formed of graphite or plumbago, the other composed of an alloy of zinc and aluminum.

669,803. Dynamo. Charles A. Parsons and George G. Stoney, Newcastle-upon-Tyne, England. Application filed December 15, 1900.

The subject of this patent is an automatic brush-shifting apparatus consisting of a device actuated by steam pressure and connected to the dynamo brushes, having a movement directly proportional to the load on the dynamo. An engine drives the dynamo, and a steam-supply connection to the device leads from a point where the steam pressure used to drive the engine varies with the load on the dynamo.

669,823. Electric-lamp Controller and Rheostat. Andrew H. Dreijer, Brooklyn, N. Y. Application filed April 23, 1900.

A resistance is contained in a cavity in the socket, and contact pins are so arranged as to allow a variable amount of the resistance to be placed in circuit.

669,832. Combined Telephone and Fire-alarm Apparatus. Angus S. Hibbard, Chicago, Ill. Application filed July 7, 1900.

A device responsive to fire is placed at the subscriber's station for propagating signals over the telephone line. A line indicator for the telephone line is operated by the responsive device, as is also a pilot indicator. Fire-alarm apparatus at a fire-alarm station is included in a suitable circuit, and means interposed between the fire-alarm circuit and the circuit of the pilot indicator, whereby the signals may be propagated to the fire-alarm station.

669,834. Primary Battery. Charles A. Hussey, New York, N. Y. Application filed July 24, 1900.

A tubular carbon in a jar is provided with an exterior flange, a funnel-shaped upper part and an interior flange at its lower end. A porous cylinder provided with an exterior flange at its lower part rests on the interior flange of the carbon. A zinc is supported in the cylinder, and an exciting solution is placed in the jar. An oxidizing salt is contained in the space between the carbon and the porous cylinder.

669,850. System of Electric Propulsion. Richard B. Painton, Williamsport, Pa. Application filed April 11, 1899. Renewed December 20, 1900.

Each driving axle carries a convertible dynamo-electric machine. A set of storage cells is provided for each machine, and a switchboard has independent wire connections with the individual machines and the storage batteries.

669,875. Coin-controlled Telephone. Julio E. Cordovez, Panama, Colombia. Application filed August 16, 1900.

A support for the receiver automatically changes its position accordingly as the receiver rests upon it or not. A circuit is closed by the movement of a movable coin support, and a movable coin retainer operatively connected with the receiver support keeps the coin upon the coin support, but releases it when the receiver is put back on its support.

669,900. Telephone Service Meter and Circuit. David S. Hulfish, Chicago, Ill., assignor to the American Bell Telephone company, Boston, Mass. Application filed December 18, 1900.

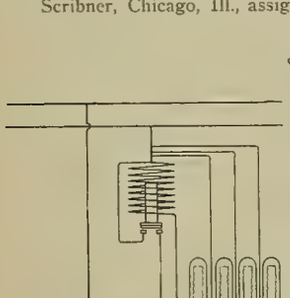
Several sub-station circuits are provided with telephones in normally open branches and switches for closing them. A service meter or register is placed in one of the severed conductors, with a call bell in a shunt. A linking plug circuit having a common source of current supply in a bridge between its conductors connects two sub-station circuits. An electromagnet in one division of the plug circuit has an armature adapted to complete a circuit including a second source of current supply, with the second division of the plug circuit.

669,901. System of Central Current Supply for Private-line Telephone Circuits. Malcolm C. Rorty, Dedham, Mass., assignor to the American Bell Telephone company, Boston, Mass. Application filed October 4, 1900.

An electromagnetic circuit chamber has its actuating magnet in a local circuit open normally while a switch at one station is in position to close the main circuit. A source of steady current and a source of alternating or ringing current are adapted for alternative connection with the main circuit by means of a circuit changer, the former when the local circuit of the actuating magnet is open and the latter when it is closed. The opening of the switch transiently closes the local circuit of the actuating magnet and then reopens it, the sources of current, circuit changer, and means for operating the same being all located at another station. The main circuit connection may be transferred from the source of steady current to the source of ringing current for a brief period of time to operate the bell at one station whenever the switch at the second station after having been in its circuit-closing position is moved to its circuit-opening position.

669,926. Process of Electrolytical Extraction of Metals. Carl Hoepfner, Frankfort-on-the-Main, Germany. Application filed September 27, 1899.

This patent covers a process which consists in placing a soluble metallic anode other than iron or zinc in a solution of a salt capable of dissolving it, placing a suitable cathode in a second solution containing a metal other than that contained in the anode, interposing a third solution between the two first mentioned, separating the solutions by means of suitable diaphragms, passing a current, thereby bringing the anode metal into solution and depositing the cathode metal, precipitating the anode metal from the anode solution, enriching it in the cathode metal and conveying the resulting solution to the cathode compartment.



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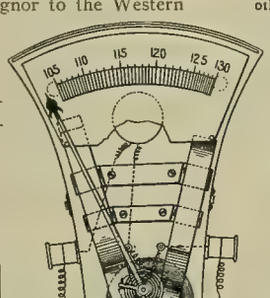

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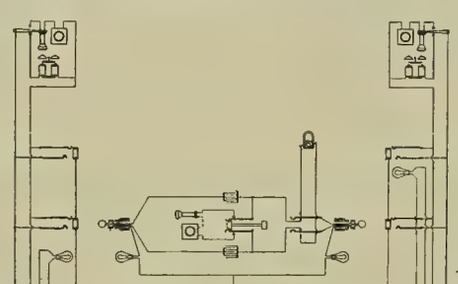

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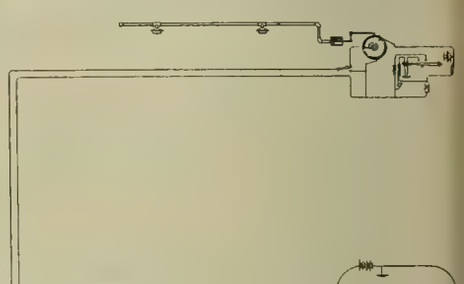

NO. 669,792.

669,940. Rectifier for Electric Currents. Franklin M. Gilbert, St. Paul, Minn., and George K. Wheeler, Topeka, Kan., assignors to the Electric Axle Light and Power company, New York, N. Y. Application filed December 17, 1898.

The current rectifier consists of a double solenoid, with a core movable in axial and opposite directions by magnetic action. Two sets of contacts are mounted on and carried by the core, and two sets of terminals are connected to the dynamo and a translating device in proximity and in the path of the two sets of contacts. A relay is electrically connected with the dynamo, a storage battery and the double solenoid, and has an oscillatory armature for engaging some of the electrical connections of the double solenoid.

669,941. Electric Switch. Franklin M. Gilbert, St. Paul, Minn., and George K. Wheeler, Topeka, Kan., assignors to the Electric Axle Light and Power company, New York, N. Y. Application filed December 17, 1898.

A potential switch consists of a relay connected to the dynamo, a solenoid magnet whose winding is also connected with the dynamo, an armature for the relay for including or excluding the winding of the solenoid magnet, and a pair of electric contacts at or near each end of the solenoid electrically connected with a storage battery and the dynamo, opened or closed by the core of the solenoid.

669,942. System for Generating and Distributing Electric Currents. Franklin M. Gilbert, St. Paul, Minn., and George K. Wheeler, Topeka, Kan., assignors to the Electric Axle Light and Power company, New York, N. Y. Application filed December 17, 1898.

An electric circuit contains translating devices, a pole changer, a dynamo, a storage battery, a dynamo circuit controller interposed between the pole changer and the electric circuit, an energizing winding in shunt connection with the dynamo and battery, a second winding in shunt to the dynamo terminals, a resistance forming part of the circuit, and contact terminals within the path of the circuit controllers to actuate simultaneously the dynamo and the resistance.

669,944. Telephone. Albion P. Merrill and Jenny W. Hays, San Francisco, Cal. Application filed January 10, 1900.

The transmitter is provided with a mouthpiece having an inner parabolic surface increasing in diameter from the inner small end to the outer large end, and so situated relatively to the transmitter diaphragm as to focus the sounds received by the mouthpiece at the center of the diaphragm.

669,968. Induction Coil. Leonidas G. Woolley, Kenton, Ohio. Application filed July 18, 1900.

In this apparatus designed for electrotherapeutic use the electrodes are supported upon a lever, and the vibrator is automatically set in motion.

DESIGN.

34,211. Insulating Support for Electric Conductors. Lewis B. Stillwell, Niagara Falls, N. Y. Application filed December 18, 1900. Term of patent, 14 years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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New Railway Power Plant at Basel, Switzerland.

By Frank C. Perkins.

Some of the details of construction and equipment of the modern Swiss railway power plant recently installed at Basel are of interest. The new building, consisting of engine house and boiler house, has a total floor surface of 846 square meters, of which the engine and generator room requires 330.3 square meters, the switchboard room 62.2 square meters and the boiler room 371.9 square meters. The chimney foundation covers 16.2 square meters. Plan and sectional drawings are shown in Figs. 2 and 3 on the next page.

The boiler house is equipped with three Cornwall boilers of Siemens-Martin iron. Each boiler has two Morrison corrugated fire tubes from 850 to 950 millimeters in diameter. The total length of the boilers is 8.7 meters, while the water-heating surface is 95 square meters. The diameter of the boilers is 2.2 meters and the working pressure is 10 atmospheres, while the boilers are carefully tested beyond 15 atmospheres.

At the right of the three boilers space is reserved for an additional boiler when the necessity arises, as indicated in Fig. 2. The feed water is supplied by a Worthington feed pump, with a stroke of 127 millimeters, and steam cylinders and pump cylinders, respectively, 133 millimeters and 89 millimeters in diameter. At the left of the boiler plant, next to the chimney, is installed a Green fuel economizer which has 192 tubes and is electrically operated. The chimney has a total height of 40 meters and a diameter at the top of 1.8 meters.

The engine room has at present, including the old and new equipment, a total capacity of 1,500 horsepower, and the general arrangement may be noted by reference to Figs. 1, 2 and 3. The two steam engines in the foreground (Fig. 1) are horizontal compound engines, with Sulzer valve gear. They are of the tandem-compound type, the stroke measuring 1,200 millimeters and the high-pressure and low-pressure cylinders measuring 420 millimeters and 700 millimeters in diameter, respectively. The speed of these engines is 100 revolutions per minute and the normal capacity at a pressure of nine atmospheres is 500 horsepower, while the maximum capacity is 600 horsepower. The engine flywheel has a diameter of 5.3 meters and has a weight of 23,500 kilograms, holding the speed very uniform, in spite of the great variation of load on the street-railway circuits. One 10-ton and two five-ton cranes are installed in the engine room.

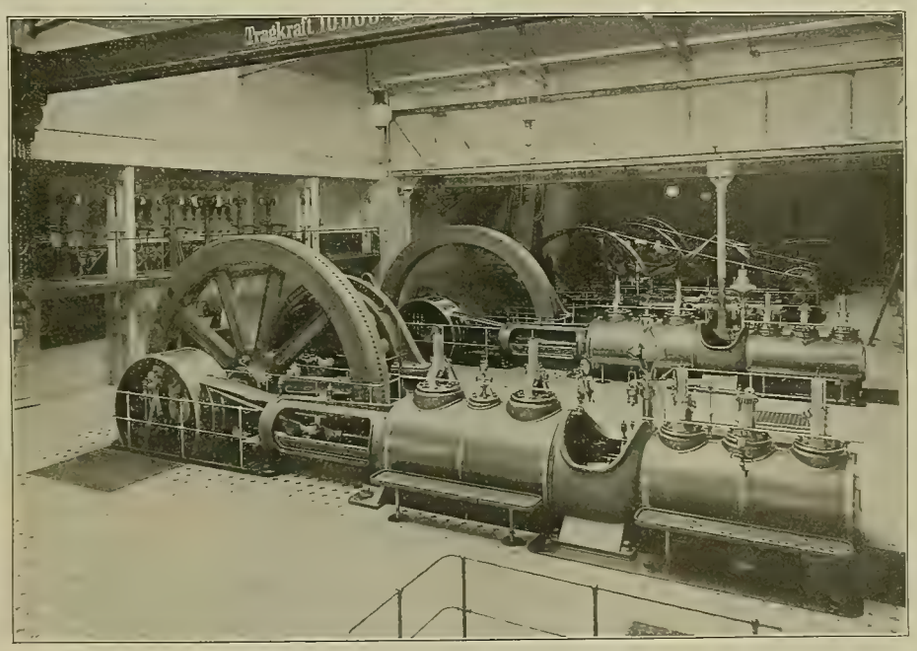


FIG. 1. NEW RAILWAY POWER PLANT AT BASEL, SWITZERLAND.—ENGINES AND GENERATORS.

In Fig. 4 is shown one of the direct-current, directly connected generators, built at the Oerlikon works. These generators were required to supply 77.8 kilowatts, 206 kilowatts, 347 kilowatts and 510 kilowatts when furnished with power by engines of 120 horsepower, 300 horsepower, 500 horsepower and 750 horsepower, respectively, the voltage remaining constant at all loads at 550 volts and the speed remaining constant at 100 revolutions per minute for all loads except the maximum, when the speed may drop to 96 revolutions per minute. The 347-kilowatt generators are required to run at the normal full load for 18 hours without the temperature rising above 35 degrees C. They are also expected to stand a maximum load of 520 kilowatts for two hours and a temporary overload of 675 kilowatts without injury. The mechanical construction of the generators is required to be such that it will stand a speed double the normal, and potentials up to 2,000 volts. The terminal pressure is constant with constant engine speed and may be varied by the excitation rheostat from 550 up to 588 volts; also down to 512 volts. With a variable load, from 250 horsepower to 500 horsepower, the engines are required to hold the speed constant within three per cent., and the voltage variation is not to exceed 12 per cent. The machines are purely shunt-wound generators and run in parallel with the smaller machines of the old installation. The armature has a total diameter of 2,500 millimeters, with an active width of iron core of 370 millimeters. The machine has 12 poles and a normal speed of 100 revolutions per minute. In each of the 663 grooves there are two copper conductors, 3.5 by 12 millimeters. The commutator has a diameter of 1,800 millimeters and an active width of 150 millimeters. There are 663 segments, and the collector brushes consist of 12 sets of six carbons each.

The weight of the field-magnet steel is 9,200 kilograms, while the field copper weighs 1,500 kilograms. The armature core has a total weight of 4,700 kilograms and the armature copper 600 kilograms, while the copper segments of the commutator have a total weight of 400 kilograms, the entire armature weighing about 11 tons.

The field-magnet resistance of this generator is 38 ohms, while the armature resistance is .02 ohm. The efficiency of the dynamo at loads from 350 kilowatts to 500 kilowatts is 94 per cent., while the temperature elevation does not exceed 25 degrees C. with normal load working 12 hourse consecutively.

Figs. 5, 6, 7 and 8 show the connections, instruments, switches and circuit-breakers installed in the switchboard room. The diagram (Fig. 5) shows the 16 feeder conductors on either side, with six return cables, with ammeters, and circuit-breakers for each feeder circuit. It also shows the connections to the six generators, with their main switches, voltmeters, ammeters, rheostats and field connections. As will be seen by Figs. 6 and 7 (page 218), the generator measuring instruments, switches and regulators are mounted on upright iron posts, the switches being controlled by levers, while the rheostats are operated by hand wheels, located near the posts. It can readily be determined by inspecting Fig. 8 that it will be impossible for the operator in throwing in or out any of the large generators to be burned or shocked or in any way come in contact with the live conductors.

The switchboard landing is 2.3 meters above the engine and generator-room floor, as represented in Fig. 6. The switches have a capacity of 900 amperes and are of a special design, known as the "Zugschalter system Oerlikon." Each feeder circuit is supplied with a circuit-breaker, while at the top is mounted an ammeter for each line.

Pan-American Exposition Notes.

In all about 350 men are now engaged on the electrical work of the Pan-American Exposition, and every part of it is being rushed with all the energy and vigor that can be applied by this small army of workers. The Agricultural building is the latest to be illuminated, and the effect was all that could be wished for. It is expected that the Electricity building will be seen under full glow in a few days, and there is little doubt that the display will be one of brilliancy and splendor.

Henry Rustin, chief of the mechanical and electrical bureau, is proving his great value as the head of this bureau by making rapid headway with all features that come under his supervision. His experience in exposition work stands him in good stead, and he surmounts apparent obstacles with ease. Down in the North Bay the electric-fountain island has been built while the bay was frozen over, thus enabling the men to carry the material used in its construction over the ice to the spot where the island is located in the center of the bay. With the bursting forth of the bright spring sun, the ice is rotted to a considerable extent, and this makes some of the people wonder how the 10-ton pumps are to be taken across to the island. Scows necessary for floating such heavy bodies are not found in park lakes, as a usual thing, and the North Bay is no exception. Still, the problem will be solved.

A flag floats from the apex of the electric tower, and scaffolding is all about where the Goddess of Light is to hold sway with undisputed right. The goddess has deserted her staff existence and is to appear in zinc, a material that will give her greater strength, combined with a fairy-like lightness, that will make her placing all the more easy.

Throughout the grounds the lamp-posts are receiving their crowns of incandescent lamps, while the staff about them will soon be placed. It is really wonderful, the progress that is being made in every section of the grounds, and all are bent on being ready for the glad opening of the great gates on May 1st.

If the present plan is carried out, the opening-day exercises of the exposition will be elaborate and unique, and electricity will play an important part in them. The exercises will be held in the Temple of Music at 1:30 p. m. Electrical wires will be so connected that instant communication will be established with the offices of the presidents of all the republics in the Western Hemisphere. Telegrams will be received from each of the presidents and the governor-general of the Dominion of Canada, and responses will be sent. At a certain hour each of the presidents will touch a button in his office, setting in motion some part of the machinery. President McKinley will be aboard of a special train speeding toward California, but telegraphic communication will be had with him, and in his private car, surrounded by members of his cabinet, he will touch a button that will set in motion the great fountain pumps. President's Day will be held early in June, on the return of the president from the West. The formal dedicatory ceremony will likely occur about May 12th, when Vice-president Roosevelt, Governor Odell and other prominent men will be in attendance.

There is a general preparation in Buffalo and Niagara Falls for the coming of the crowds that will attend the Pan-American Exposition. In all the cities and villages where the trolley systems are operated by the International Traction company every

detail of every department of the service is being carefully looked after, in order that all parts of the service may be in perfect condition to meet the unusual requirements consequent upon the exposition and its masses.

At Niagara Falls the International Traction company is about to break ground for a new terminal station, to be located on the Riverway, opposite the beautiful New York State Reservation. This structure will be a very handsome building, well in keeping with the beauty of the locality. When the new station has been completed it is understood the old car barn on Main street will be abandoned. In the new terminal the crowds will find all the accommodations necessary to their comfort, while the company's employes will be carefully arranged for.

The Niagara Gorge railroad has ceased operations for the time being, in order that its roadbed may be placed in the most perfect state of repair. It is intimated that new steel bridges, so long talked of, will this spring be placed in position to supplant the wooden structures on the lower part of the line. New cars are being added, and when spring and summer, with their rush of humanity, come, the Gorge road will be ready for them.

Special efforts will be made to capture the traffic that will come across Lake Ontario, exposition-bound. The steamers will land at Port Dalhousie by one route, and at Queenston, Ont., and Lewiston, N. Y., by the other route. Special rates will be made between these points and the exposition, and no doubt all the lines will capture a fair share of the travel, which, no doubt, will be very large.

A new feature in the trolley attractions of the Western New York section will be the opening of the Olcott route by the International Traction company. Olcott is a delightful spot on Lake Ontario, Niagara Falls being about midway between Buffalo and that point. Unfortunately, however, the route to Olcott does not run through the Falls, but diverges at North Tonawanda and goes off to and through Lockport, the county seat of Niagara. From Lockport on to Olcott the run is made through a fruit-growing section, and when Olcott is reached there is fishing, bathing and boating of the very best. The spot has been materially improved by the International Traction company, which has purchased a large acreage there. A new hotel and other buildings have been built, and everything has been done to add to the delight and enjoyment of people on a summer outing. The lower floor of the hotel has been entirely devoted to bathhouses, and it is close to the water, the beach being magnificent for bathing.

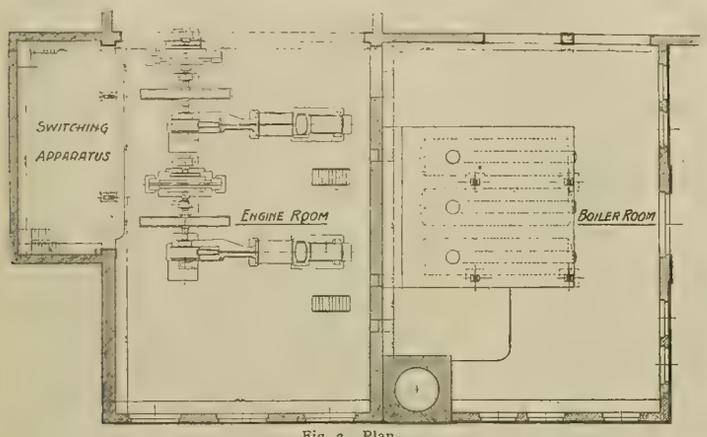


Fig. 2. Plan.

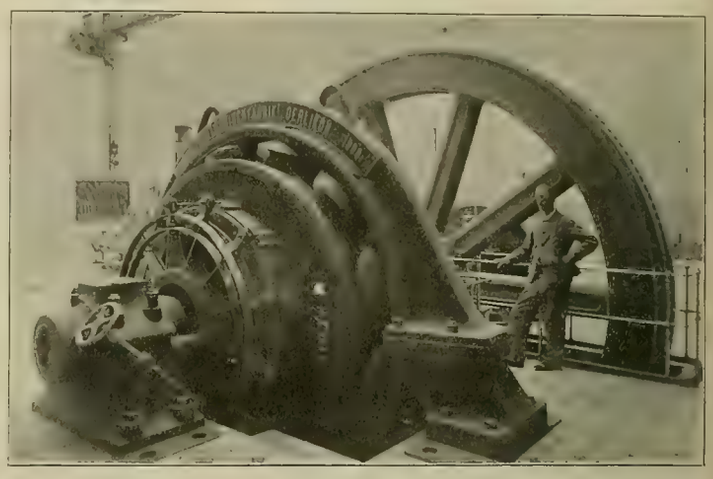


Fig. 4. 750-Horsepower Unit.

RAILWAY POWER PLANT AT BASEL, SWITZERLAND. (SEE PAGE 217.)

George F. Sever, superintendent of electrical exhibits, calls the attention of the Western Electrician to the fact that there is to be an extensive collective section in the Electricity building. There will be in charge a curator, Mr. W. J. Marland of 132 Nassau street, New York. "The idea," writes Mr. Sever, "is to make a flat rate for the individual exhibitors, this covering the cost of space, attendance, lights, platform and installation. A space 20 by 16 feet has been set aside for this exhibit, and I can extend it if demands for space become more pressing. Already there are a large number who have signified their desire for representation in this space. It will afford an opportunity for small exhibitors to make an exhibit, when otherwise it would not be possible."

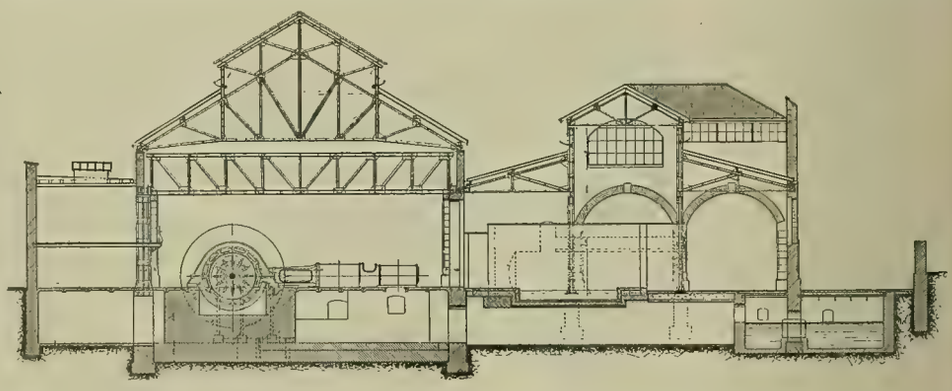


FIG. 3. RAILWAY POWER PLANT AT BASEL.—SECTION.

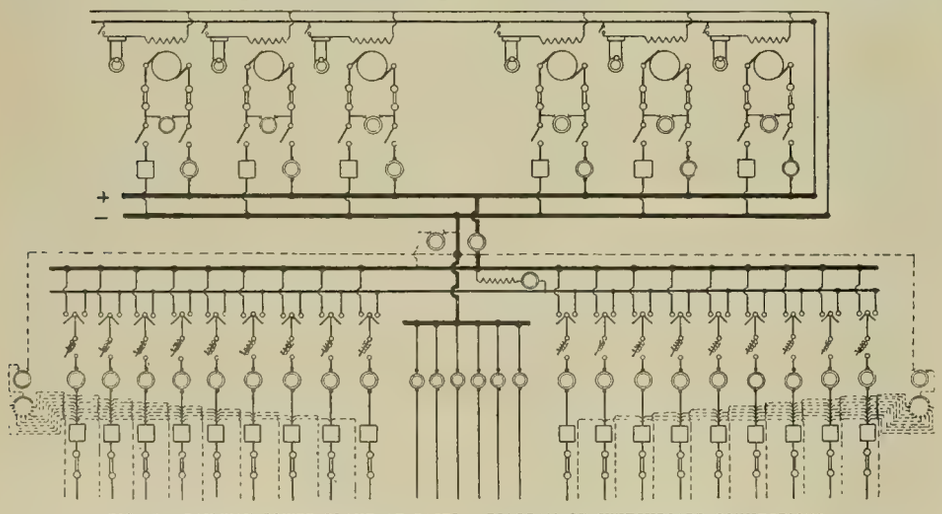


FIG. 5. RAILWAY POWER PLANT AT BASEL.—DIAGRAM OF SWITCHBOARD CONNECTIONS.

The Wisconsin River Valley Electric Railway company has been incorporated for the purpose of building and equipping an electric railway to connect Wausau and Merrill, Wis. In time the line will be extended south to Nekoosa and north to Eagle River. The incorporators are T. F. Frawley, C. T. Bundy and R. P. Wilcox.

Southwestern Gas, Electric and Street Railway Association.

The third annual meeting of the Southwestern Gas, Electric and Street Railway association will be held at Houston, Texas, April 19th to 22d, and a large attendance is expected. Special railroad arrangements have been made, and reduced fares secured for the meeting, and the headquarters of the association while in Houston will be at the Rice Hotel. The programme has been carefully prepared and includes papers by some of the best-known members of the association. The list is as follows: "Municipal Ownership vs. Private Corporations," T. D. Miller, Dallas; "Association Between Meetings," C. A. Newning, Houston; "Station Work," George Cushman, San Antonio; "Corporations and Their Employes," H. F. MacGregor, Houston; "Street Railways of Texas," F. E. Scovill, Austin; "Inspection," W. S. Rathell, Waco; "Electrical Potpourri," John G. Boyd, Terrell; "What Are We Here For?" E. L. Wells, Marshall; "Cheap Fuel and How to Use It Economically," L. T. Fuller, Calvert, and "Waterpower for Small Plants," F. R. Starr, Gonzales. The officers of the association are: President, J. F. Strickland; first vice-president, C. F. Yaeger; second vice-president, E. H. Jenkins; third vice-president, John R. Cullinane; secretary, T. H. Stuart; treasurer, T. D. Miller.

Annual Statement of Philadelphia Electrical Bureau.

The report of Chief Walker of the Philadelphia Electrical Bureau shows that more conduits were laid there during 1900 than ever before during the same length of time. During the year 438,000 feet of duct were laid by the bureau in different sections, making a total of 21,487,756 feet of duct laid under the streets of the city. Of this the city owns 2,442,033 feet. During the same period the bureau laid 6,383 feet of electric-light cable. In 1900 1,143,346 calls and connections were made on the city's telephone switchboard, and 41,393 messages were received and transmitted over the telephone switchboard. The report shows that in the city of Philadelphia there are 16,633 wooden poles, 29,146 iron poles (principally used by trolley companies), 6,552 city poles of wood and 2,310 of iron—a total of 54,665. There are also 6,857 miles of telegraph and telephone wire, 2,011 miles of electric-light wire, 1,614 miles of city wire and 675 miles of trolley wire—a total of 11,155 miles. The report expresses approval of the system of street lighting under which the contracts are all let to a single company, and it is stated that the supervision of the work is much simplified and the cost of power lessened.

Three Important Controller Decisions.

Three decisions have recently been handed down in the United States Court of Appeals (Second Circuit) which have an important bearing upon the manufacture of motor controllers for street cars, automobiles, etc. The first is in a suit of the Thomson-Houston Electric company against the Lorain Steel company for alleged infringement of a patent issued to Walter H. Knight for preventing the operation of the reversing lever on the controller excepting when the controlling lever is at the open-circuit position. The opinion of the Appellate Court was that the claims of which infringement was alleged were broader than the invention and were therefore not warranted. These claims are, therefore, declared invalid, and only that which treats of the particular device used for the purpose was allowed. It was claimed by the complainant that the patent covered all devices in use for regulating the action of the reversing lever.

Probably of greater importance than this decision, however, are those given in the suits brought by the Thomson-Houston Electric company against the Nassau Railroad company and the Lorain Steel company and against the Bullock company et al. These suits involved patents issued to Elihu Thomson, the first of which covered broadly the use of a magnet to extinguish an arc formed at a switch contact, and the second of which involved the use of insulating material in an arc-rupturing device. This last patent, as well as that covering the interlocking device, had been upheld in the lower courts, and the Court of Appeals reversed both decisions, while the decision of the Circuit Court upon the magnetic blow-out patent, in which the device is held void of patentable novelty in view of the prior art, was affirmed.

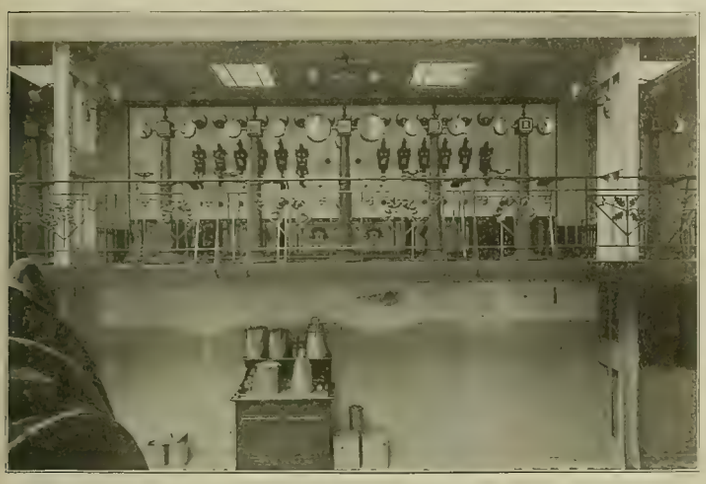


Fig. 6. Front View of Switchboard Platform.

Fig. 7. Side View of Switching Apparatus.

RAILWAY POWER PLANT AT BASEL, SWITZERLAND. (SEE PAGE 217)

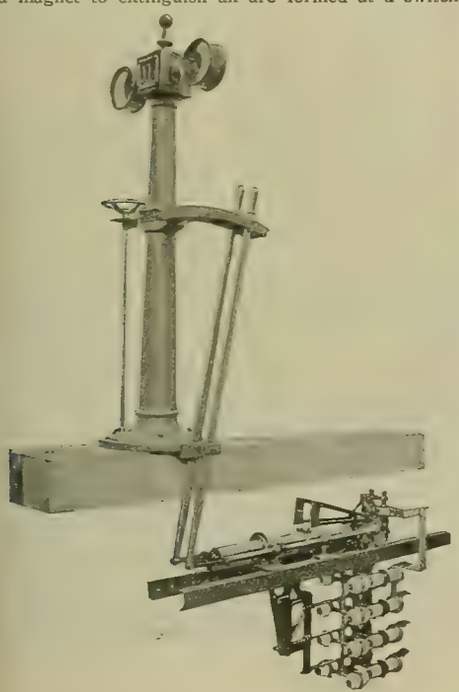
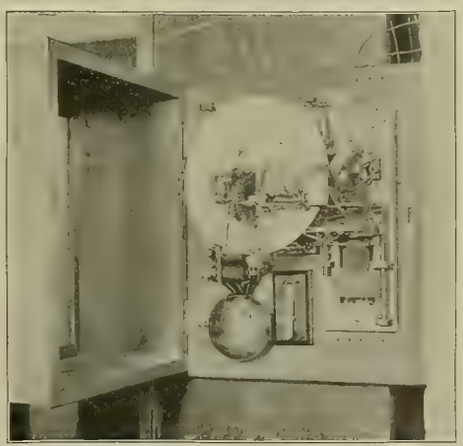


FIG. 8. RAILWAY POWER PLANT AT BASEL.—SWITCH-LEVER POST WITH MEASURING INSTRUMENTS FOR GENERATOR.

Safeguarding the Mails by Electricity.

It has been the aim of the Postoffice Department to utilize all practical means at hand to insure the security of mail matter. Experiments are conducted from time to time to test inventions designed to make the mail secure from organized thieves, and especially those disguised in the uniforms of the government mail collectors and possessed with duplicate keys to mail-box locks. At present the mail boxes and central-station apparatus invented by Frederick Williams of Boston are being subjected to exhaustive tests in Washington.

A number of mail boxes, with locks electrically controlled, have been installed on one of the mail routes in the business section of the capital. The electrical locking devices are under the control of the operator at the central station in the postoffice. The electric cables between the postoffice and the mail boxes are carried in ducts of the United States Electric Lighting company. At the central station is a clock, similar in appearance to the ordinary watchman's clock, provided with a mechanism which prints the numbers of the mail boxes when the boxes are opened, and again when they are closed.



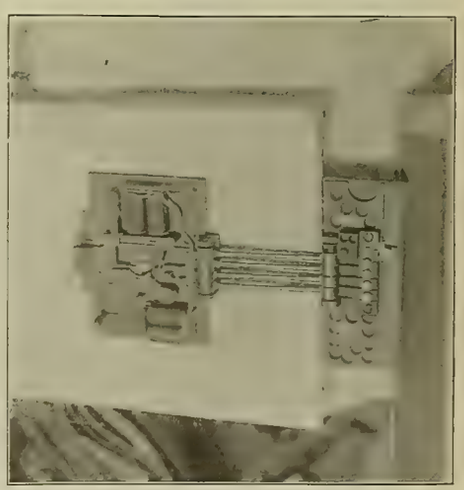
SAFEGUARDING THE MAILS BY ELECTRICITY.—ELECTRIC-LOCK TIME RECORDER.

Box No. 1 of each mail route must invariably be visited first by the collector, as this box controls the operation of the lock on box No. 2, and box No. 2 of box No. 3, and so on, throughout the route. After allowing the mail collector time to reach box No. 1 of his route the operator at central presses an electric button, which electrically releases a secondary locking device and allows the carrier's key to throw the lock bolt. The opening of this box performs the same operation on box No. 2 as that performed by the operator at central; that is, sets automatically the lock for the collector's key to open. Since succeeding boxes are set by the one last opened, it is obvious that the predetermined order of visitation by the collector must be strictly adhered to.

The act of opening and closing each mail box is instantly recorded on the time dial at "Central." The interval between the two registrations of a box number shows the length of time the collector remained at the box. The interval between the records of separate box numbers shows the time taken by the collector to cover the distance between mail boxes. In the case of damage to mail boxes from vehicles or from unlawful attempts to open them, "Central" is instantly notified of "trouble on route" by the ringing of an electric bell. Should the occasion arise requiring the collector to communicate with the operator at "Central," he can do so by pressing a button at any mail box, causing an electric bell to strike at "Central." A prearranged code of signals permits the collector to send a few important messages. For instance, two rings may indicate: "Taken sick; send relief." Three rings may mean: "Box damaged; send repair man," and so on.

As a rule the mail collectors are unjustly charged with neglecting to collect mail from the boxes. Hereafter, when a business man asserts that he mailed an important letter at a certain box in time for a certain collection and mail train, and the letter failed to reach the postoffice in time, he will be shown the official record of time the box in question was emptied of its mail, and then a little close questioning will probably reveal the fact that he did not deposit the delayed letter, but trusted it to an employe or friend, with the result that the letter was deposited too late for the earlier collection or was deposited in a box outside the business section, from which mail is taken at less frequent intervals.

The experiments conducted in Washington have been successful, it is said, and the practical side of the invention has impressed those government officials whose sanction may mean the permanent introduction of these boxes in the business section of the city. It is asserted that this system has been introduced in the postoffices in Boston, New York and Philadelphia, and it is said to be giving excellent satisfaction. The inventor does not care to make public the electrical details of operation at the present time, but the accompanying illustrations give some idea of the mechanism and show the compactness of the device.

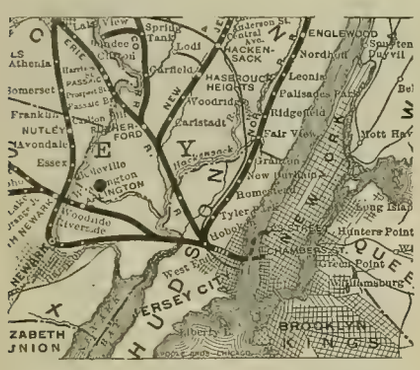


SAFEGUARDING THE MAILS BY ELECTRICITY.—ELECTRIC LOCK FOR LETTER BOXES.

An ordinance is being prepared for introduction in the Chicago City Council requiring all engineers in charge of steam boilers to make a written report to their employers every 90 days stating the condition of the boilers under their charge, the report to be countersigned by the employer and submitted to the board of examining engineers. The penal clause attached provides for revocation of the license of any engineer failing to comply with the requirements of the proposed ordinance.

That New Jersey Copper Mine.

When on November 24th last an invitation was extended to a select party of New Yorkers prominent in the financial and electrical fields to visit a copper mine located at Arlington, N. J., eight miles from New York City, or to put it into language easier to comprehend, within half an hour's ride of the Waldorf-Astoria, it is safe to say that about 90 per cent. of those receiving the invitation were affected with a mild case of incredulity. While, without doubt, many of the old residents in the vicinity of New York never heard of the old copper mine near Arlington, even those well acquainted with the property of that section could not bring themselves to the realization that there was anything of value in what was looked upon as an old, worked-out copper mine. According, however, to those in a position to know, expert mineralogists have examined the property at different times for investors, and report that at least 6,000 feet of underground drifts and tunnels have been driven, 32 shafts have been sunk, and the property is now being thoroughly opened up at great expense for work on an extensive scale. Five million tons of ore are estimated even now ready for mining and milling, which, with modern and



THAT NEW JERSEY COPPER MINE.—MAP SHOWING LOCATION.

efficient machinery installed in the copper reduction works, now nearing completion, can be treated and the copper contents extracted, the experts of the Arlington company believe, at the low cost of $2.50 per ton of mineral. This low cost is possible in treating the ores by the leaching process and depositing the copper from the copper sulphate solution by means of electricity, thereby making refined copper at an exceedingly low cost.

The bold idea of resurrecting, so to speak, this old copper property was due in the main to the enterprise of Charles L. Dignowity, the general manager of the present Arlington Copper company. The mine, as it stood when Mr. Dignowity became interested, was largely filled with water—so much so that this gentleman is credited with not only having spent personally $16,500 on pumping alone before the water in the mine shafts began to drop, but likewise as having subjected himself to the criticism that by his pumping he was merely lowering to a slight degree the level of the Passaic River! In fact, a total of $24,000 is said to have been spent by him before others were asked to join in the enterprise.

The mine is located east of the old Belleville waterworks and just north of the Hudson county boundary line. The property is in Bergen County.

The mine is one of the oldest copper mines on the American continent. The tract which includes the mines was purchased about 1700 by Arent Schuyler, son of the celebrated Peter Van Schuyler, who came over here from Holland. Schuyler bought the tract from William Kingsland, who was said to be a kinsman of Oliver Cromwell.

After Schuyler had owned the land about ten years, a negro slave, while plowing the field, found a large stone, the heaviness of which excited his curiosity. He carried the stone to his master. Schuyler soon found that it contained copper of a superior quality.

Schuyler and his heirs developed the copper mines on the tract in a desultory way and according to old-fashioned methods. The ore was sent to Swansea, Wales, and there smelted and refined. The heavy expense of operating the mines rendered them unprofitable, when copper began to go down in value in the middle of the present century, and the work was abandoned.

The first copper pennies that were minted by the United States government were, it is said, made of copper taken from these mines, and some of the guns that Washington used in his battles with the British were made from copper taken from the same locality.

When the mines were shut down the last time 180 men were employed there.

Recently, too, the rise in the value of copper, caused largely by the heavy demand for copper in the manufacture of electrical works, resulted in a revival of interest in these mines, and the present company was formed.

A representative of the Western Electrician recently visited this mine and obtained information as to its character. A visitor to the property may leave the Erie depot at Jersey City any week-day at 2:34 p. m. and reach Arlington station on the Greenwood Lake division of the Erie railroad at 2:47 p. m., a ride of just 13 minutes. The small map shows the relative location of the mine to New York, Jersey City, Newark and other points. A few minutes' ride in a trolley car in Arlington to the north or an easy walk of only a few blocks brings one to a building (Fig. 1) that looks for all the world like a corner grocery store in the suburbs of the small town. This is the office of the Arlington Copper company. Soon, equipped with overalls and miners' lamps or lanterns, after a walk down a short road and across lots, or, better, through what could easily be called an apple orchard, the mine inspector pro tem. suddenly finds himself overlooking the Jersey meadows on the brow of what seems to be a stone quarry. From the bottom of this seeming quarry the amateur inspector would have seen, a year or so ago, the view illustrated in Fig. 2.

FIG. 1. THAT NEW JERSEY COPPER MINE.—OFFICE OF ARLINGTON COPPER COMPANY.

showing the temporary blacksmith shop and the thick, copper-bearing strata on the left.

The primitive way of mining and shipping the ore to Europe was so expensive that only the purest ore was taken out. Some of the drifts in the old shafts show that the ancient miners must have worked on their hands and knees. According to New Jersey's geological records, 80,000 tons of ore running 15 per cent. in copper and upward were shipped from these mines to England.

Instead of digging vertical shafts down from the top of the hills, as the former workers of the mines did, the present company has begun operations by tunneling into the hills from the Hackensack meadows, where all the buildings are being constructed.

Figs. 5 and 6 are interior views of the mine. Accompanied by a guide, a visitor descends to a depth of approximately 100 feet, where there are abundant indications of copper in large quantities—copper impregnating the sandstone in the form of malachite and chalcocite to a depth of 40 feet. At this point there are several large chambers, where ore had been extracted during the eighteenth century and shipped abroad. Tunnels and drifts radiate from this point, comprising some 6,000 feet of underground development work, all completed. The experts say that the copper deposit is a blanket formation averaging 41 feet in thickness, and underlying all the company's property, which comprises approximately 150 acres. This has been demonstrated clearly by more than 32 shafts tapping this blanket deposit at various points of the bed.

Generally speaking, the mode of getting the pure copper from the ore is a simple one. The ore is first reduced to the consistency of sand by means of crushers, rollers and pulverizers; then it is roasted and afterward placed in vats containing a mild solution of sulphuric acid, which dissolves the copper. This copper solution is drawn off into tanks, and here the copper is deposited by means of an electric current on lead plates. These plates are drawn from the tanks and stripped of their copper, which comes off in perfect sheets. These sheets are again placed in

Fig. 2. Open Cut, Showing Copper Ore Outcrop.

Fig. 3. Power House in Course of Construction

THAT NEW JERSEY COPPER MINE.

To-day, however, the scene is different. All is activity, bustle, and one sees on every side evidence of a large expenditure of money to develop the mine. Fig. 3 will give only a meager idea of the way the works are being rushed toward completion. This view is from the brow of the open cut, looking to the north, and shows the smokestack and power house in course of erection.

Fig. 4 represents the construction work as seen from the base of the big smokestack looking west,

the vats and accumulate copper to any desired thickness. The ordinary plate is 24 to 36 inches in length and width. By this method a chemically pure copper, manufactured in proper form for immediate sale, is obtained.

Dr. N. S. Keith, the chief engineer of the Arlington company, authorizes the following more technical information relative to the process to be employed by his company: The proposed plan of working the mine includes driving a main haulageway 12 feet wide down the copper-bearing strata following the dip—about 15 degrees. This gangway is started. An endless rope haulage plant will be used when the mine is opened.

Fig. 5. Deep Workings 240 Feet from Surface.

Fig. 6. Ore Body at 100-foot Level.

THAT NEW JERSEY COPPER MINE.

The ore from the mine in the projected mill will be dumped automatically into a size C "Comet" crusher and from that will fall into an ore bin of about 500 tons' capacity. The coarsely crushed ore is dried in this bin by waste heat from the roasting furnace. From the bin the ore will be conveyed to Fraser & Chalmers crushing rolls 36 by 12 inches. From the rolls the ore will be elevated to Berthollet screen separators. What is under 40 mesh will go direct to a Brown straight-line roasting furnace with a hearth 10 by 200 feet, and what is coarser will be put through two Kent mills with a capacity of four tons an hour each, and then elevated to the furnace. From the furnace it is proposed to flush the roasted ore into four leaching tanks, each 30 feet in diameter and having a capacity of 125 tons. The leaching agent is to be a weak solution of sulphuric acid. At a lower level will be 120 precipitating tanks two by three by 12 feet each, in which the copper is to be deposited by electrolysis. Lead anodes and cathodes are proposed, the thin film of copper being removed from the cathode and made of any thickness as a cathode afterward. The precipitation building will be 48 by 144 feet on the ground. The crusher building will be 48 by 66 feet, the furnace building 36 by 240 feet, and the boiler and power house, 48 by 72 feet. The latter is of stone and the walls are already up; the foundations for the precipitation and roasting buildings are completed as well as those of the leaching tanks. Two stacks, one 30 feet high and one 100 feet high, are to be erected. The gases from the roasting furnace will be carried through a long flue and used under the boilers. A battery of Babcock & Wilcox boilers, nominally of 325 horsepower, is in place; also a Kent smoke-consuming furnace in front of the boilers.

The ore is mostly carbonates, with occasional bunches of chalcocite, and varies considerably in richness. Native copper is rarely found. The gangue is mostly sandstone. The poorest rock mined is expected to contain 1½ per cent. copper, the best mined, in any quantity, six or seven per cent. The consumption of sulphuric acid per ton of ore, it is said, will be light.

The electrical generator is to be of 300 kilowatts' capacity, and is made by the Crocker-Wheeler company, to give 1,200 amperes at 250 volts. It will be direct-connected to a tandem-compound-condensing engine, made by the Erie City Iron Works. The boilers are made by the Aultman-Taylor company, Mansfield, Ohio, and are of the Babcock & Wilcox water-tube type. From this generator current will be taken for the electrodeposition of the copper. This current will pass serially through the depositing vats. Power for the various machines in the plant will be transmitted from the generator to electric motors belted or directly connected to the machines. Electric rock drills will be used, as well as electric hoists for moving the ore cars from the mine to the mill.

A spur is being built from the Delaware, Lackawanna and Western railroad to the plant, for taking in coal and removing the copper and sand to the market. The plant is essentially an electrometallurgical one.

The head of the present company is Mr. William McKenzie, who is also president of the Hobart Trust company of Passaic and president of the Standard Bleachery at Carlton Hill, N. J. John Scott, vice-president of the Varley Duplex Magnet company, is vice-president of the Arlington Copper company; William C. Eakins is secretary; Henry G. Bell, president of the Rutherford Heights association, is treasurer; Charles L. Dignowity, a capitalist of Boston, is general manager; Captain Addison Ely, director of the Bergen County Gas and Electric company, is general counsel, and Dr. N. S. Keith is chief engineer and electrometallurgist. These officers, together with William Kent, vice-president of the Domestic Exchange National Bank of New York, form the board of directors.

Dr. Keith, the chief engineer and electrometallurgist of the company, is well known as the organizer of the American Institute of Electrical Engineers in 1884. He was the first secretary of the Institute and he has been considered an authority in electrolytic work for many years.

FIG. 4. THAT NEW JERSEY COPPER MINE.—TEMPORARY BLACKSMITH SHOP (COPPER-BEARING STRATA ON THE LEFT).

New Commissioner of Patents.

Frederick I. Allen of Auburn, N. Y., was appointed commissioner of patents by the president on March 25th. The appointment was made in accordance with an agreement with Senators Platt and Depew of New York. Walter H. Chamberlain, the present assistant commissioner, was endorsed for the place by the Patent Bar association of Chicago. Mr. Duell, the retiring commissioner, will engage in private practice in New York.

Engineering and Its Classification.

Thomas C. Clarke, past president of the American Society of Civil Engineers, in a twentieth-century article on "Civil Engineering" in the New York Sun, says:

The material prosperity of the last century is due to the co-operation of three classes of men: The man of science, who lives only for truth and the discovery of nature's laws; the inventor, eager to apply these discoveries to money-making machines and processes; and the engineer, trained in mathematical investigation and in knowledge of the physical conditions which govern his profession, which is the mechanical application of the laws of nature.

Engineering is sometimes divided into civil, military and naval engineering. The term civil engineering is often used by writers as covering structural engineering only, but it has a much wider meaning.

The logical classification is: Statical engineering, including that of all fixed bodies, and dynamical, covering the movement of all bodies by the development and application of power.

Statical engineering can be again subdivided into structural engineering, or that of railways, highways, bridges, foundations, tunnels, buildings, etc.; also into hydraulic engineering, which governs the application of water to canals, river improvements, harbors, the supply of water to towns and for irrigation, disposal of sewage, etc.

Dynamical engineering can be divided into mechanical engineering, which covers the construction of all prime motors, the transmission of power, and the use of machines and machine tools. Closely allied is electrical engineering, the art of the transformation and transmission of energy for traction, lighting, telegraphy, telephoning, operating machinery and many other uses, such as its electrolytic application to ores and metals.

Then we have the combined application of statical, mechanical and electrical engineering to what is now called industrial engineering, or the production of articles useful to man. This may be divided into agricultural, mining, metallurgical and chemical engineering.

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CONVENTIONS AND EXPOSITIONS.

Southwestern Gas, Electric and Street Railway association, Rice Hotel, Houston, Texas, April 19th to 22d.

Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Boston, Mass., June 19th.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Astronomers do not seem to take kindly to Mr. Tesla's hypothesis that the inhabitants of Mars may be transmitting electrical signals to Earth. Edward S. Holden, formerly director of Lick Observatory, in a recent article in McClure's Magazine, is disposed to be sarcastic: "Mr. Nikola Tesla has announced that he is 'almost confident' that certain disturbances of his apparatus arise from electric signals received from some source beyond the earth. They do not come from the sun, he says; hence they must be of planetary origin, he thinks; probably from Mars, he guesses. It is a rule of sound philosophizing to examine all probable causes for an unexplained phenomenon before invoking improbable ones. Why fasten the disturbances of Mr. Tesla's instruments on Mars? Are there no comets that will serve the purpose? May not the instruments have been disturbed by the Great Bear—or the Milky Way—or the Zodiacal Light? Until Mr. Tesla has shown his apparatus to other experimenters and convinced them as well as himself, it may safely be taken for granted that his signals do not come from Mars." Mr. Holden is perhaps unnecessarily severe on Mr. Tesla; but, unfortunately, the electrical inventor has invited criticism of this sort by the vague, mystical way in which he chose to make public announcement of the disturbances on which his assumption is based.

At a meeting of the British Institution of Electrical Engineers last month the society placed on record its high appreciation of the brilliant qualities "as a man, as an investigator and as a leader of scientific thought" of the late Prof. G. F. FitzGerald of Dublin. Professors Ayrton and Perry, General Webber and others spoke to the resolutions, but we are particularly struck with some of the remarks of Prof. S. P. Thompson. This speaker told his hearers that they ought not to forget what an important part FitzGerald's ideas played in the development of the question of the propagation of electric waves. Before the researches of Hertz had resulted in the experimental methods of exploring electric waves, FitzGerald had already read at least two papers before the British Association suggesting ways in which such waves might actually be started; in fact, making the suggestion beforehand that Hertz accomplished. One of the first, if not the actual first, suggestions for a coherer for detecting waves was made by FitzGerald. In thousands of ways did he suggest different things, but he left it to others to carry his ideas out. He gave them ideas to carry out which he could easily have carried out himself, but his mind was so fertile that he could not possibly have carried out one-twentieth part of the brilliant suggestions that he gave freely to others and to the scientific world. He was a man who was, to a certain extent, overloaded with administrative and educational work that ought never to have been put upon him. He ought to have had freedom for research and means for carrying out experimental research.

Professor FitzGerald appears to have been a worthy type of the retiring, unselfish man of science who conducts his investigations primarily for the good of mankind and with little or no thought of monetary remuneration or even of the applause of men. There are a few such even in the United States—less in number, perhaps, than in some other countries, for here the demands of the "strenuous life" bear heavily on all—and, as Professor Thompson says, or, rather, implies, there should be state-endowed or other purely benevolent institutions where such men could do their work with every facility, without financial worry and unhampered by the routine of teaching.

We trust that before any of the suggested "gasoline arc lights" are permanently installed for street lighting in the city of Chicago Mayor Harrison and City Electrician Ellicott will give the matter very careful consideration. It appears that six "2,000-candlepower" gasoline lights have been installed in Warren avenue for trial. The lamp is figured to give the service of three gas lamps. In case the gas company fails to take the contract for city lighting at terms acceptable to the city authorities the new-style light may be put into service, it is said. The gasoline is supplied from a tank in the base of the post. Compressed air forces the fluid from the tank to the burners, which resemble those in a Welsbach gas lamp. There are two mantles in a circular globe. A time attachment shuts off the gas at a certain hour each morning, and the gasoline stored away will last five days. It is not stated in the daily newspaper accounts where the compressed air comes from. Possibly it is stored in the tanks containing the gasoline. In that case it would constitute another possible element of danger.

These gasoline lamps were discussed by practical men in the lighting business at the most recent conventions of the Northwestern Electrical association and the Iowa Electrical association, and a number of instances of fire and explosion were given to show that they are dangerous. It was thought that the underwriters, who are very strict in relation to electrical appliances, should give the subject more attention. As far as competition goes, the gasoline lamp seems principally to enter the field of gas lighting where it is tolerated at all. Indeed, this is precisely the case in the proposed street-lighting installation in Chicago. The local gas company is slow about making a renewed offer for street lighting, and the "gasoline arc" is trotted out in consequence. Electric lighting is not involved at all, except as these difficulties hasten the day when electric lamps shall illuminate all the streets of Chicago, instead of comparatively few, as at present. But while the attitude of the gas company may be annoying and perhaps indefensible, the city authorities should not close their eyes to the lessons to be drawn from the recent gasoline-lamp explosion at Canton, Ill., the hotel fire at Beardstown, in this state, due to a gasoline vaporizer, and the fire on Halsted street in this city only a few weeks ago, when a gasoline tank broke down on the street and sparks from a passing trolley car ignited the inflammable liquid. These are a few random instances, and the list could be greatly extended.

Gasoline lamps will bear investigation.

Arctic and Antarctic explorations have both a fascinating and a practical interest—fascinating to all who are charmed by adventure and the combat with Nature's fastnesses and practical in extending the bounds of human knowledge. Magnetic observations in the polar regions are particularly valuable to navigators. The Antarctic regions, so remote from possible bases of supplies, have been hitherto neglected in comparison with the almost unceasing efforts to penetrate the secrets of the North, and it is interesting, therefore, to note the preparations now making to explore the region surrounding the South Pole. One expedition, to go in a vessel just launched in Dundee, Scotland, is of especial scientific interest. This vessel is the Discovery, and is built entirely of wood on plans insuring extraordinary strength. Iron was barred for the reason that in the very forefront of the expedition's programme is magnetic survey work, as the result of which it is trusted that navigation in the far southern seas will in the future be much assisted. At present iron ships in these waters sail many miles out of their way, and an iron exploration ship would be useless for such work. Geographical discovery and geological and biological investigation are also important among the expedition's objects, but to the commercial mind it is probable that the one first named will appeal with the most force. The Discovery will have cost £50,000 when completed, and is built so that when the ice pack closes in on her she will rise and lift herself away. If rudder and screw propeller are threatened, both can be hauled on deck. She has air locks between her exterior and interior, so that those who enter and leave her will not disturb the warm atmosphere within. Food for 40 men for three years will be taken. In command of the ship is Captain R. F. Scott, R. N., late of the Majestic, who has since last autumn been working energetically. The scientific director of the expedition is Professor Gregory, professor of geology at the Melbourne University. A Mr. Shackelton is the physicist. It is possible, if certain difficulties can be overcome, that the expedition may seek to avail itself of wireless telegraphy, for Captain Scott is skilled in this work and has had charge of such arrangements in Channel Squadron maneuvers of the British Navy.

Chicago Automobile Exhibition.

The exhibition of automobiles and accessories at the Chicago Coliseum opened auspiciously on the evening of March 22d. admissions on this evening being only by invitation. On March 23d the doors were thrown open to the public, and although the bad weather had prevented the delivery of all the exhibits by Saturday night, the attendance was good and many interesting exhibits were shown.

The Woods Motor Vehicle company has on exhibition a luxuriously finished landau and a brougham of attractive design, besides a number of lighter vehicles, and several of this company's hansoms were seen on the track during the evening. The standard styles of the Electric Vehicle company are well known and are arranged in an attractive manner near the center of the building. One of the most noticeable exhibits of electric vehicles is that of the National Automobile and Electric company, which also has its exhibit in the oval surrounded by the track. A feature of this company's exhibit is its controller, which marks a decided advance over other styles. The contact-making devices approach very closely to the lines of an ordinary knife switch, in contrast with the cylinder carrying contact strips engaging with flexible spring fingers so commonly employed. Spring clips corresponding to the clips of an ordinary knife switch are arranged in pairs side by side, and are engaged by sets of knives carried on an arbor, forming sectors of circles for making and breaking contact at different positions of the controller lever. The whole construction is very substantial and attracts much attention.

A number of exhibitors of steam and gasoline machines have attractive exhibits. Prominent among these is the steam racer of the Milwaukee Automobile company, which is to be seen on the track under the guidance of Mr. Frank P. Illsley, and for which a record of half a mile in 27 seconds is claimed.

Several of the exhibitors have machines in operation on the track for the accommodation of visitors, and extensive use is made of the opportunity thus offered of comparing the merits of the different types. Vehicles of every description, from a gasoline-driven bicycle to an electric bus, are to be seen in operation, and the advance over machines of previous years is marked. In the first place the absence of noise from the electric vehicles is noticeable, even at moderately high speeds, indicating great improvement in the construction of gears. Then, too, the exhaust of the gasoline engines is much less offensive than was commonly supposed possible, a year or two ago, and it is seldom that any visible exhaust can be detected. The steam carriages, with their chain gears, are quite noiseless at moderate speeds, run very smoothly, and are much in demand as public carriers. Charging facilities have been provided in several parts of the building for the use of the makers of electric vehicles. From the viewpoint of attractiveness the show is a success, and the attendance has indicated that it will be generally recognized as such.

Wire Conduits for Massachusetts Cities.

The Massachusetts legislative committee on mercantile affairs is considering a bill by which the towns and cities of that state, excepting Boston, will be authorized to construct and maintain conduits for electric wires, cables and conductors. This bill was presented to the House of Representatives, on the petition of the mayor of Cambridge. The bill very closely resembles one passed by the House and killed by the Senate last year. It purposes to enable towns and cities to get rid of overhead wires—trolley and long-distance telephone wires excepted. The bill is permissive and has a referendum provision. The cost of construction is to be met by the proceeds of conduit loans outside of the debt limit. The rentals received will be devoted to the cancellation of the bonds, and, it is believed by the framers of the bill that the building and maintenance of the conduits will entail no financial burden upon the cities and towns which build them. Each corporation is not to be compelled to remove over one mile of overhead wire during the first year after the completion of a conduit, nor more than two miles during any one succeeding year. The amount to be charged corporations is not to exceed 12 per cent. per annum on the cost of construction of the conduits; this amount to be apportioned among the affected companies and the charge not to exceed $350 per mile, annually, for each duct, 2½ or three inches in diameter. The city or town is to pay rental for its own wires. Corporations can appeal to the Board of Electric Light and Gas Commissioners in cases of dissatisfaction in regard to the rental charges. Conduits already laid by corporations may be purchased by cities and towns.

OBITUARY.

L. D. Parker.

Leander D. Parker, for 18 years general superintendent of the western division of the Postal Telegraph-cable company, died at his home in Evanston, Ill., on March 19th. Mr. Parker's health had been failing for several years, and a physical collapse which he suffered in his office nearly three years ago led to his resignation the first of the present year, his work being taken up by Edward J. Nally, formerly the assistant general superintendent.

Mr. Parker was born at Stuckley, Lower Canada, in 1837. His parents moved to Medina County, Ohio, when he was two years old. About 1851 the boy Leander learned to telegraph on the old "Wade Line" in Ashland, Ohio. He remained in the employment of that company, first as operator and later as manager, until it was absorbed by the Western Union Telegraph company. Mr. Parker came to Chicago in 1855 to enter the service of the Illinois and Mississippi Telegraph company, taking charge at different times of several offices of that company in Illinois and Iowa, until the beginning of the war, when he enlisted for three months and was assigned to duty as military operator at Cairo, Ill. He remained in the government service until 1863, when he returned to Quincy as manager of the

LEANDER D. PARKER.

Illinois and Mississippi Telegraph company. Mr. Parker made his home at Quincy until 1869, and it was while there, in 1864, that he married Miss Ellen Oakley, who survives him.

In 1869 Mr. Parker returned to Chicago and was appointed chief clerk to the district superintendent of the Western Union Telegraph company, being promoted to assistant superintendent in 1880. The next year he left this position to become assistant superintendent of the Mutual Union Telegraph company, which had just been organized. In the fall of 1882 Mr. Parker undertook the construction of the Postal Telegraph-cable company's lines, which he completed as far as Chicago during the next year, when he was made general superintendent of the company for the western division. He remained in this position until January 1, 1901, when he was forced to retire on account of his failing health.

Mr. Parker had a thorough acquaintance with the western portion of the country and its business interests, and his long practical experience in the various branches of the telegraph service made him a valuable officer of the Postal company. Although his connection with that company was nominally terminated at the time of his resignation, he was frequently called into consultation by its officers, and he had been voted a generous salary for the remainder of his life, in recognition of his faithful and untiring service in the establishment and development of the Postal telegraph system. He leaves a widow and four children.

William F. Channing.

Dr. William F. Channing died at a Boston hospital on March 19th, aged 81 years. He was the son of Dr. William Ellery Channing, the famous Boston divine. He received his education in the Boston public schools and at Harvard, where he was graduated in the class with Dr. Edward Everett Hale. Subsequently he studied medicine in Philadelphia and received a doctor's degree from the University of Pennsylvania, although he never practiced medicine. He continued his studies abroad and traveled extensively, finally settling in Providence, R. I., where he resided many years. Sixteen years ago he went to Pasadena, Cal., on account of his wife's health. Six months ago Dr. Channing returned to Boston, and was taken ill on February 22d with a severe cold, which resulted in pneumonia. He was the inventor of a fire-alarm telegraph, a hand telephone, a marine railway and a number of appliances for use in medical electricity. He is said to have written the first books ever published on medical electricity, and spent much time in experimentation along this line. During the abolition movement Dr. Channing was a leader among the agitators. He is survived by four children.

General Fry.

General Charles Carleton Fry, prominently connected with the Lynn (Mass.) Gas and Electric company since its formation, died of pneumonia on March 21st, at his home in Lynn. He was born in 1842 and held many city offices, being president of the present Board of Aldermen. He was connected with the militia from 1861 until 1897, when he retired with the rank of brigadier-general. He was a prominent Mason, having been grand commander of the Knights Templar. General Fry was a bachelor.

Copper.

The current price of copper is 17 cents a pound for the lake brands, with a decidedly firm tone. The uniformly steady market has been a feature for several weeks past, says the New York Sun of recent date, and the present level of values is maintained with comparative ease, owing to the large home consumption and the judicious system of not crowding the market with supplies beyond its ability to absorb them. There are no weak holders of copper now on this side of the Atlantic. The leading producers are strong financially, and have splendid cash balances to their credit; hence they have an ample supply of funds with which to carry their own copper when they may deem it advantageous to do so. But the recent phenomenal demand has required immediate shipment of the bulk of the output fresh from the smelting and refining plants to the furnaces of the consumer.

Capital is a much more important factor in the copper business than ever before, and the large resources of the principal copper producers at present contrast strongly with their financial position a few years ago. The entrance of the Amalgamated magnates has resulted in the formation of the strongest combination in copper ever known. Supply and demand have been favorable to their projects. No arbitrary use of money, even to an unlimited extent, could have produced the extraordinary conditions existing in the copper world at present.

Copper mining is likely to enjoy uninterrupted prosperity for a long time to come. The industry is now on a basis where the earnings ought to satisfy the most ambitious.

The Houghton (Mich.) correspondent of the Iron Age, under date of March 18th, writes: "The activity of this region, with the continuance and apparent reasonable permanence of 17-cent lake copper, is wonderful. Within the past week two contracts have been let for immense stamp mills, one each for Champion and Trimountain mines. They will be on the shore of Lake Superior, near that of the Adventure mine, that will soon be under rapid construction. The great mill of the Isle Royale company is ready for work, and one head will be started at once. The Baltic mill, on the shore of Lake Superior, west of Houghton, is almost completed, but cannot be stamping rock until late in the coming summer. The Mass mill, still further west, is now under way and will be at work next winter. The Wolverine and Mohawk mills, to the northwest, will be started as soon as the deep snow is off the ground. All these mills will add largely to the copper-producing possibilities of the region, and another year should see a very considerable increase in the amount of refined copper turned out from this rich district. Nearly 40 stamps are included in these new mills, and they will be able to crush about 40,000 tons of rock daily."

Articles of incorporation of the Caconine Copper company have been filed with the clerk of Hudson County, N. J. The company's capital is placed at $6,000,000, but it will begin business with $3,000,000. It is said it will control 31 mines, water rights, etc., in the Kaibab Mountains, Caconine County, Ariz. The incorporators are Donald Grant of Faribault, Minn., Ex-Judge Lawrence P. Boyle of Chicago and ex-Judge Thomas F. Noonan of Jersey City. Others interested are W. H. McCormick, a banker of Salt Lake City; Henry M. Ryan of Chicago, Peter Kimberley of Sharon, Pa., and Aquilla Nebeker of Utah. Donald Grant is the president and Mr. McCormick is the treasurer.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

The Twin City Telephone company has bought a site at the corner of Dale and Hague streets, in St. Paul, for a sub-exchange. The company has made a proposition to the citizens of Excelsior, Minn., and the residents of the lower lake of Lake Minnetonka, to establish a local exchange, belting the lower lake, if given a reasonable patronage, at $2 per month for business connections and $1.50 for residences. A canvass is being made which is resulting well. This company has also secured a contract in Minneapolis to establish a local exchange of 32 connections in the courthouse.

A local exchange is planned for Winthrop, Minn.

Contracts have been awarded at La Crosse, Wis., for the erection of the new telephone exchange.

The Kerkhoven and Hayes Telephone company has been formed at Kerkhoven, Minn.

Work has been resumed on the new telephone line between Eau Claire and La Crosse, Wis.

The La Crosse Telephone company will place its wires in the business district of La Crosse, Wis., underground during the coming summer.

The farmers of Fairview township, Hanson County, S. D., have formed a telephone association and will build a line to Alexandria, where they will connect with the local exchange.

The Ada and Twin Valley (Minn.) Telephone company will extend its toll lines in several directions.

A larger switchboard has been put in for the local exchange at St. James, Minn.

The Oakfield Telephone company has been incorporated at Oakfield, Wis., with $4,000 capital stock.

All of the larger debts of the Mississippi Valley Telephone company in both Minneapolis and St. Paul have been settled and the receiver will soon ask for a discharge.

The Mandan and Northwestern Electrical company has been incorporated at Mandan, N. D., to build a telephone line from Mandan to Oliver County.

The local exchange at Casselton, N. D., has grown so that a new switchboard is necessary. Extensions will be made into the country.

The telephone line connecting Acoma, Minn., to Hutchinson, will be extended to Brookfield.

A substitute telephone bill has been offered in the Minnesota Legislature in place of the Burns measure, which has caused so much unfavorable comment. The new bill grants to individuals the same rights through unincorporated towns that telephone corporations now enjoy.

The Citizens' Telephone company of Mankato, Minn., will extend lines from Mankato to Rapidan, Garden City and Mapleton; also to Lake Crystal the coming season.

Edward Benson proposes a telephone line from Browns Valley, Minn., along the east shore of Traverse Lake.

The Gary (Minn.) Telephone company will extend its lines to Fertile in the spring.

The Webster (S. D.) Telephone company has been incorporated, with $10,000 capital stock. Materials are arriving for the new plant.

Seven mutual telephone companies of Ringgold County, Iowa, have demanded better connections at Mount Ayr, threatening to install a switchboard and exchange of their own.

A line is projected from Arapahoe to Gosper, Neb.

The Farmers' Mutual Telephone company of Adair, Iowa, has been incorporated, with $10,000 capital stock.

The Nodaway Valley Telephone company asks a franchise at Villisca, Iowa.

A rural telephone line is projected in Humboldt township, near Columbus, Neb.

The Farmers' Telephone company of Dodge, Neb., has been formed.

The Rocky Mountain Bell Telephone company will build a toll line east from Great Falls, Mont., to Fort Benton this season.

The Keya Paha and Brown County Telephone company has been incorporated at Ainsworth, Neb. Construction is to be begun as soon as possible.

The Sumner (Iowa) Telephone company will extend its lines to Waterloo the coming season.

Afton, Iowa, will vote, March 25th, on granting a franchise to the Mutual Telephone company.

A bill has passed the House of the Washington Legislature, fixing telephone rates. The maximum for a single wire is $4 a month, for a two-party line, $2.50, and for more than two-party, $1.50.

The Mutual Telephone company of Des Moines, Iowa, will extend its underground-conduit system this summer.

A mutual telephone exchange is projected for Wellman, Iowa.

The Western Electric Telephone company will rebuild and improve the exchange at Cherokee, Iowa.

The Pitcher Telephone company of Galena, Ill., is extending a toll line toward Dubuque, Iowa.

The Wisconsin Telephone company will place its wires in Appleton, Wis., underground as soon as possible.

The Billings (Mont.) Telephone company has been reorganized and will continue in business. Some extensive improvements are planned for the coming spring.

Work will soon be started on a copper toll line between Sioux City and Des Moines, Ia., by the Iowa Telephone company.

The Iowa Telephone company in Dubuque, Iowa, announces a cut in rates to $2 a month for single lines for business houses and $1.25 for residences; party lines for business houses, $1.50 a month; for residences, $8 a year.

Farmers of Lake View, near Cedar Falls, Iowa, have formed a telephone company because of difficulties with the Bell company.

The Farmers' Kent and Lenox Mutual Telephone company is building a toll line between Kent and Lenox, Iowa.

The Iowa Independent Telephone association, recently in session at Des Moines, agreed to refuse toll-line and exchange connections to any company infringing on the rights of members by building parallel or competing lines.

A. E. Whitney proposes a local exchange for Volga, S. D.

Miss Katherine Murray, a telephone operator for the Northwestern Telephone Exchange company, in St. Paul, has been confined to her home with blood poison, resulting from contact of a brass plug in the central office with her lips. R.

Ohio Telephone Notes.

Within the next few months the United States Telephone company will have completed several lines that will make the scope of its usefulness very much wider than at present. Its part of the line for connection with Pittsburg is completed, and the officers have the assurance that the Pittsburg and Allegheny Telephone company will have its portion completed, so that connection may be established early in April, thus giving all exchanges connected with the United States Telephone company access to all the points reached by the lines extending east from Pittsburg, and vice versa. While the plans of the United States Telephone company are not fully matured, it has been decided to build a line from Ironton, the present southern Ohio terminus, to Gallipolis and Pomeroy, along the northern bank of the Ohio River. Another line will be built from Logan, Hocking County, to Parkersburg, by way of Athens, and still another from Steubenville to Wheeling, giving connection with West Virginia at two different points. The company has in contemplation a line from London, Ohio, to Richmond, Ind., to connect with the new long-distance company at that place. This line will pass through some important Ohio towns on this route and extend the service in the eastern part of the state. Another line is contemplated from Xenia to Kenton, by way of Springfield, Urbana and Bellefontaine. In addition, the Michigan line into Toledo will be completed within the next 60 days, which will give connection with all the Independent companies of Michigan. The material for all of this work has been purchased, and men are at work on the right-of-way and the obtaining of franchises where these have not already been secured, which is pretty fair evidence that the lines will all be completed as rapidly as the company can get to them.

The Franklin Telephone company of Columbus is rapidly demonstrating the feasibility of furnishing telephone service for the small towns and the farmers. This field of business was hardly thought of in Ohio until Manager Frank L. Beam of the Citizens' Telephone company of Columbus took it up, and he has found that there is a great demand for it. An exchange is now in operation at Worthington, north of Columbus, with 28 town subscribers and 29 farmers' telephones, with others to follow. The exchange at Canal Winchester has 28 town subscribers and 11 country subscribers. The Westerville exchange has 65 subscribers in all. In addition to these, exchanges are being built at Hilliards, Dublin and Grove City, all with good prospects. Lines are being built all through these sections for the use of farmers.

Superintendent Arthur W. Hoge, who has had charge of the construction and maintenance of the Columbus Citizens' Telephone company, and has been in active charge of the construction of the long-distance lines in this section of the state during the last year, has resigned his position, to accept a similar one with the Independent company of Detroit, Mich., where a large exchange will be built. He has been very successful in his work at Columbus and has made many friends there, who regret to see him depart. A. J. Lighthouse, who has been his assistant, has been promoted to the position of superintendent at Columbus.

Manager Frank L. Beam of the Columbus Citizens' Telephone company, has been made manager of the Lancaster Telephone company, and will conduct its affairs from the Columbus office, Lancaster being but 25 miles distant.

The Bell Telephone company has arranged to erect a new building at Marietta, which will be used exclusively for an exchange. It will be 40 by 75 feet in dimensions and two stories high above the basement. The basement will be used as a workshop and the first story as a storeroom. The second story will contain the exchange and the offices of the manager and his assistants. A new switchboard will be installed, and it is thought that the building will be ready for occupancy about July 1st.

The Mansfield Telephone company, Mansfield, has established offices in the Scattergood building, where the exchange will be located. The local exchange of the Star Telephone company, which was purchased a few days ago, will be moved to the new location early in April. Charles Fritzinger will be made superintendent of the company's plant.

The Bell people at Springfield are making five-year contracts with their customers, to secure themselves against the possibility of an Independent company being organized there. But the time is not far distant when the Independent exchange will be built. Springfield is too important a point to be missed. The Bell company is building rural lines out from Bloomdale, the subscribers paying the same as they do in the town.

The Farmers' Co-operative Telephone company of Mansfield has made an assignment to A. H. Brown of Belleville. The company has lines in Richland and surrounding counties. It is said the liabilities will reach from $8,000 to $10,000, while the assets are not much more than half that amount.

The Hillsboro Telephone company, Hillsboro, Ohio, has increased its capital stock from $10,000 to $30,000.

The Citizens' Telephone company of Middletown has been incorporated, with a capital stock of $10,000, to build a plant in that city. The incorporators are Charles Margerum, Charles S. Barkelew, W. H. Johnson, Charles L. Goldman and Charles W. Faber.

The People's Telephone company, Jacobsburg, Belmont County, has been incorporated, with a capital stock of $1,000, by W. G. Simpson, Miles R. Hart, P. W. Helpbringer, G. C. Meek and Albert Kelvey. O. M. C.

Indiana Telephone Items.

The Star Telephone company of Shoals (capital stock, $2,000) and the Warrington and Markleville Telephone company of Warrington (capital stock, $11,000) have filed articles of incorporation with the secretary of state.

The Henry County Telephone company, organized at Knightstown, has disbanded on account of the low rural rates offered by the Bell company.

The Home Telephone company of Greensfork is now putting the finishing touches on a modern plant in that prosperous town and reaching out over a wide section of the surrounding country. Telephones are furnished at 40 cents a month, and that price includes free service over the long-distance lines within a prescribed territory.

The Central Union Telephone company is proposing to establish an exchange in Hartford City, and announces that it will furnish telephones at 90 cents a month. The present rate of the Independent company is $2 and $1 a month for business and dwelling houses, respectively.

The Town Board of Scottsburg believes in free competition, and in consequence has granted a telephone franchise to each of four applicants—the Hoosier Telephone company, Scott County Telephone company, C. E. Gregory of Sheridan and E. E. Daugherty of Brownstown.

The New Telephone company at Indianapolis has entered a vigorous protest to the Board of Public Works against allowing the Indianapolis Light and Power company to place its wires under those of the telephone company on poles in the streets, requiring workmen to crawl up through a network of high-potential wires to get to their own. The rule has been for each company to over-construct the other, according to precedence in the street. An effort will be made to get all the wire companies together and agree, if possible, upon a code of ethics in the matter.

One of the last acts signed by Governor Durbin provides that all telephone, telegraph, electric-light or other wires of any kind hereafter constructed over the tracks of any steam railroad in the state shall be supported by substantial wooden poles, of a size not less than 12 inches in diameter at the bottom and not less than six inches in diameter at the top, or iron or steel poles not less than five inches in diameter at the bottom and three inches at the top, set in the earth not less than six feet and well tamped. Such wires are required to clear the top of the rails at least 25 feet and be securely fastened in place, except that trolley wires of electric railroads need not be more than 22 feet above the rails. To the Circuit Court is given authority to see that the provisions of the act are enforced, and anyone proceeded against for failing to comply with it is made liable for the cost of the proceedings in case the court decides against him. This act is said to have been passed as a protection to the railroads and their employes against neighborhood telephone lines, the wires of which are often strung on inadequate poles.

The Scott County Telephone company and the Sugar Creek Township Farmers' Telephone company of New Palestine, Hancock County, have incorporated by filing articles with the secretary of state.

The City Council of Bedford has granted a franchise to the Carter Telephone company over a veto of Mayor D. Y. Johnson.

Arthur B. Irwin has petitioned the Indiana Appellate Court for a rehearing in his case against the Rushville Co-operative Telephone company for damages for discontinuing his service. Irwin owed the company for service and attempted to set off

against it an account he purchased against the company.

The Independent Telephone company organized by Bicknell and Vincennes people will begin on a local exchange at Bicknell at once. The company will work with the Central Union company and will furnish long-distance service over the toll lines of that company. It also purposes building lines to all surrounding villages.

The court at Franklin has supported the view that the leaving of a message to be telephoned announcing the death and burial of a relative was not binding on the company; that the undertaking to deliver was a personal one with the operator, and his failure could not bind the company.

Mayor Taggart of Indianapolis in his annual message refers to the income received from the telephone companies and says the Central Union and the New Telephone companies each paid the city $6,000 during the past year.

The Stromberg-Carlson Telephone Manufacturing company of Chicago brought suit on the 18th inst. against the Central Energy company of Frankfort, on a promissory note for $7,000, to foreclose a mechanic's lien and to have a receiver appointed to take charge of the business, alleging insolvency. The plant was established a year ago by J. H. Murphy of Indianapolis. As soon as the new plant was ready for business the Bell company reduced its rates from $2.50 and $1.25 to 70 and 40 cents a month. Mr. Murphy met these prices, and the war has been bitter, placing Mr. Murphy's plant in severe financial straits. When the case was called in court it was stated that an agreement of the creditors had been reached looking to the sale of the plant to Indianapolis capitalists, and the court granted a continuance for one week. In the event that a sale is made the company will reorganize at once with J. H. Murphy as general manager, and the plant will be operated as an Independent one, as heretofore. F.

Lockwood on Telephony.

Thomas D. Lockwood delivered an address at the monthly banquet of the Association of Railroad and Steamboat Agents of Boston, last week, during which he said: "If there are any newspaper men present, I hope they will never again print the assertion that electricity is in its infancy. The appliances may be, but electricity itself has reached a vigorous manhood." Mr. Lockwood said that the American Bell company operated 640,000 miles of underground wires, employed 32,000 persons, and its lines carried 2,000,000,000 conversations per annum. He deprecated the fact that the nation, the state, and the city found it necessary to legislate continually against the railroads, the telegraph, and the telephone. He declared that these interests were entitled to a respite and should be let alone for a time. He gave some interesting telephonic reminiscences. He said that the first comment on a message over a telephone wire was made by the emperor of Brazil at the Philadelphia Centennial Exposition, when Professor Bell was giving a practical demonstration of his invention. Mr. Lockwood said that after the commercial value of the telephone was established, 13 different persons claimed to be the inventor.

T. T. C. Company Disposes of Indiana Interests.

A telephone deal was completed last week at Fort Wayne, Ind., whereby the stockholders of the Home Telephone company of that city purchased from the Telephone, Telegraph and Cable company of New York all the interests represented by the National Telephone company for $120,000 cash. The National company has, it is said, 1,100 miles of wire connecting Sturgis, Mich., North Baltimore, Ohio, Auburn and Kendallville, Ind., and a number of intermediate points. It is stated that the Bell people made an effort to get the property, but failed.

GENERAL TELEPHONE NEWS.

The general offices of the Knickerbocker Telephone and Telegraph company have been removed from No. 418 Broome street to No. 100 Broadway, New York city.

The Columbus (Ohio) Post states that a meeting of the Independent companies of Ohio will be held at the Chittenden Hotel, Columbus, on April 5th. The meeting is called by Judge J. M. Thomas, president of the state association, and the object is to consider matters which may result in a more harmonious co-operation on the part of the Independent companies, of which there are about 180 in the state.

To meet the demands of a rapidly growing system, the directors of the Bell Telephone company of Philadelphia have voted to increase the capital stock of the corporation $2,000,000. This increase, if ratified by the stockholders at a meeting to be held on Tuesday, May 21st, will make the capital of the company $8,000,000. One year ago, March 20, 1900, the capital was increased from $4,000,000 to $6,000,000. When the company was incorporated in 1881 the capital was $1,000,000.

Important European Electrical and Engineering Developments at the Close of the Nineteenth Century.[1]

By William J. Hammer.

The Nernst lamp is the invention of Professor Walther Nernst of Göttingen University, a leading authority in the chemical world, in which his originality had left an important impress before he made his discoveries resulting in the electrolytic lamp. Professor Nernst informed the author last November at his laboratory in Göttingen that the discovery of the principles underlying his lamp had been made during a series of experiments to determine what caused the efficiency of the Welsbach, or, as it is called abroad, the "Auer" mantle. More or less secrecy has been observed as to the materials used in the Welsbach mantle, but it is well known that certain metallic oxides, such as thorium, yttrium, cerium, zirconium, glucinum, erbium, and others less known, have entered into their manufacture. Probably the first three mentioned are the ones chiefly used, although the ingredients and proportions have been varied from time to time.

The efficiency of incandescent illuminants, as far as radiation goes, depends simply upon the temperature. The carbon filament in an incandescent lamp is structurally too weak, and has too low a specific resistance to stand very high temperatures. The blackening of the globe of an incandescent lamp is indicative of its rapid disintegration, and of the fact that its highest practicable temperature has been reached. Probably the most refractory substances thus far used as illuminants are zirconium, used to replace the lime in the lime light, and the oxides of the so-called rare earths, already referred to, used in the Welsbach mantle and the Nernst lamp. It is a well-known fact that the Welsbach incandescent gas mantle falls off in candlepower very rapidly. I believe the loss is about 25 per cent. in the first 60 hours. So closely is the composition of the Nernst filament or glower related to the Welsbach mantle burner, that it is an interesting question as to what extent the Nernst lamp will fall off in its efficiency. The greatest difficulty experienced by the manufacturers has been the proper clamping of the filament. I have examined some of the platinum connections after considerable use, and they seemed to have been eaten away, and even the glower itself is slightly diminished in thickness and becomes crystalline near the anode or positive pole in lamps run on a continuous current. Many experiments have been made to obviate this difficulty, such as forming a blob of refractory material around the platinum connections, and bringing the platinum wire to the surface to reduce somewhat the temperature by radiation. There seems to have been also considerable difficulty caused by expansion, which the London Nernst company claims to have obviated by running a platinum wire from the end of the glower through the loop in the supporting wire, enabling the platinum to slide back and forth in this loop.

The London company was for a long time puzzled in its endeavors to get rid of the buzzing noise of the cut-out magnet when operating upon alternating-current circuits. It was finally found to be due to the air confined back of the armature, by reason of the form employed; by cutting the iron away a trifle this was entirely obviated.

The company is now standardizing lamps for eight, 16, 32, and higher candlepower for circuits of 100 volts and upward.

The 220-volt lamps are usually made of 25, 50 and 100 candlepower, although I saw some at Ganz & Co.'s works at Budapest and elsewhere of as high as 160 candlepower, which were being tested experimentally.

All of the lamps which I saw in Europe were run on a 200 to 220-volt circuit, excepting a few I saw in London on 100-volt circuits, and, as a rule, 25-candlepower lamps were used.

There is undoubtedly a large field for the application of lamps of the Nernst type between the field occupied by the 16 to 50-candlepower incandescent lamps and the arc lamp, and it lends itself to decorative effects equally well with the incandescent lamp. The candlepower of arc lamps is something that has never been satisfactorily determined, and it has not infrequently been the custom in judging the candlepower of arc lamps to "guess at it and multiply by four." In candlepower steadiness, color of light and ability to throw the light down where it is needed and in requiring less attention, the Nernst lamp will doubtless prove superior to the arc lamp. There will be little difficulty in making lamps of the Nernst type of very high candlepower by employing longer filaments, or, preferably, a number of filaments in series or multiple series, and potentials of 500 to 1,000 volts may thus be employed. Promising as the Nernst lamp undoubtedly is, it will probably by reason of the difficulties in the manufacture of the lamp, be a long time before the carbon lamp is entirely displaced, if it ever is.

In this connection, it will be remembered that with the advent of the Edison carbon filament incandescent lamp, it was believed that gas as an illuminating agent was doomed, whereas it has been shown that the incandescent lamp exercised a stimulating and beneficial influence upon the gas light, which is more extensively employed to-day than ever. The tendency of all great inventions is rather in the line of building up than tearing down.

It is impossible to operate the Nernst lamp in a vacuum, at all events where a direct current is employed, as, being an electrolytic lamp, it is said to be necessary to admit oxygen to reoxidize the magnesium liberated at the cathode. Where continuous currents are used in electrolytic lamps of the Nernst type, the liberation of ions at the connections produces a serious difficulty. I heard it claimed by some, while abroad, that the lamp operated more satisfactorily with a continuous current. Others, however, were positive that an alternating current was preferable. One prominent engineering authority went so far as to state to me that he did not believe that the lamp would be a commercial success, except when operated from a storage battery.

The Nernst lamp gives a most pleasing light; in color it stands midway between the yellow and red rays of the incandescent-carbon lamp and the violet and blue of the arc lamp; it is, however, so dazzlingly white that it is, as a rule, placed in ground-glass globes, thus securing much greater diffusion, with a loss in the light probably not exceeding 15 to 18 per cent. I watched carefully the 54 Nernst lamps installed by the Allgemeine Elektricitaets Gesellschaft in the Café Bauer, in Berlin, this being one of their first installations, and the light certainly produces a much more pleasing effect than the carbon incandescent lamps (used in certain places in the same fixtures), and is also superior to the Welsbach mantles used in the same rooms. Arc lamps are also burned in front of the café, so that in this one installation four types of lighting were employed —three of them being electrical.

During my three weeks' stay in Berlin, I observed carefully every evening the 54 lamps which were here installed, and which were doubtless, on account of their prominent position, of the best type made by the Allgemeine Elektricitaets Gesellschaft, and I noted that there were usually from two to four or five lamps out, and even at times as high as eight or nine out; however, with an efficiency approximately half that of a carbon filament lamp, a much shorter life may be permissible. It was also quite common—both in this installation and others, especially at the Paris Exposition, where the Allgemeine Elektricitaets Gesellschaft exhibited about 300 lamps, to see the lamp running with the heating coil in circuit, giving a dull and sickly light.

Personally, I have no doubt of the ultimate solution of the knotty and peculiar problems met with in the manufacture of the Nernst lamp, nor of the immense value this invention will ultimately reach to the owners and the world at large.

The Osmium Lamp.

During my stay in Vienna last October, through the courtesy of Director Gallia of the Auer company, I was permitted to see several of the new osmium incandescent lamps burning, and although I was unable to secure full particulars about this new and interesting development, I learned that the lamp, which is the invention of Dr. Auer von Welsbach, operates at an electromotive force of 25 volts and shows an efficiency of from 0.9 to one watt per candle. The three lamps which I saw in use were all connected in parallel and operated with key sockets, and differed but little in general appearance from an ordinary carbon-filament lamp. The globe was somewhat longer than an ordinary 16-candlepower lamp, and the filament, which was of the hairpin shape, was much longer. It must be used in a vertical position, owing to its flexibility. I was told that these lamps had shown a life under test of 700 to 800 hours. It will be interesting to learn to what extent the low voltage of the lamp and the rarity of the material used in its manufacture will affect its commercial application. It had been intended to show the osmium lamp at Paris before the close of the exhibition, but there was not sufficient time. Osmium, which was discovered by Tennant in 1803, is a blue-white, metallic element, and is almost infusible. For a long time it was known only as a crystalline, grain-like material, and when fused in the electric arc, as a hard, brittle substance, unfit to be worked. I was informed in Paris, where I first heard of this lamp, that the successful method of handling this material, which has always been most difficult to work with, was due, to a large extent, to Mr. Waldron Shapleigh, of the American Welsbach company, which concern controls the patent rights for the United States. According to Engineer Scholz, in his lecture before the German Incandescent Gaslight company, on January 23, 1901, an osmium lamp, after burning 1,500 hours, was still intact, and had fallen off in candlepower but 12 per cent.

Its efficiency at starting was 1.45 watts per candlepower, and at the end of 1,500 hours was 1.7 watts. It is claimed that as long as the filament remains intact it can be renewed several times. While the present range of voltage for these pure osmium lamps is 25 to 50 volts, a number of filaments can be connected in series or multiple series for higher potentials, and it is proposed to increase the resistance by coating or uniting the osmium with certain oxides. Mr. Scholz refers to a test conducted upon four 25-volt osmium lamps in series and four 100-volt carbon lamps in parallel; the osmium lamp showed a consumption of 0.96 ampere, and the carbon lamp 2.40 amperes, the former effecting a saving of 60 per cent.

A 20-candlepower osmium lamp run at 27 volts required 24 watts, and a 20-candlepower carbon lamp

1. Abstract of paper presented at a meeting of the American Institute of Electrical Engineers, New York, February 28, 1901.

required 68 watts, the former effecting a saving of 44 watts, or about 35 per cent.

Utilization of "High-furnace" Gases and Big Gas Engines for Electrical Purposes.

The utilization of high-furnace or blast-furnace gases marks an epoch, not only in the employment of gas engines of great power, but in the supplying of a new field for the application of electrical machinery. It is estimated that a blast furnace having a capacity of 100 tons of pig-iron per 24 hours produces 7,000,000 cubic feet of gas daily, equivalent to 2,800 horsepower. If we deduct the power required to drive the furnace proper, there remains 2,000 horsepower, which, so far, has been entirely wasted, and which, it has been found, may be successfully utilized in gas engines; and it appears that only one-sixth to one-quarter as much gas is required as would be necessary when burning the same gases under boilers for producing steam power, and, furthermore, it enables us to dispense with costly boilers. Between 25 and 30 years ago it was customary to burn these gases at the top of the stack. They are even so burned to-day to some extent. They were thought to be too poor in quality and too variable in composition, too full of dust, particularly metallic particles, tending to clog and injure the moving parts; too full of acid matter, and of too high a temperature to enable their use in gas engines; but means have been found, by passing the gases on their way from the stack to the engine through pipes and dust pockets in which the particles settle, and through coke and water scrubbers and sawdust, so that the temperature is lowered, and the gases sufficiently well cleaned. Even at the Friedenshütte Iron Works, which I visited in Upper Silesia, they operated successfully with gas charged with 40 per cent. of zinc dust, which only required more purifiers. Although some analyses show the presence of sulphuric and phosphoric acids and chlorine, the alkalies and lime probably neutralize their effect, and there is no apparent corrosion. There is little trouble from variations in quality, and gas works well in a gas engine of a quality which ignites with difficulty under a boiler. The first application of the high-furnace gas was made in February, 1895, at Wishaw Iron Works, near Glasgow, with a 20-horsepower gas engine, which indicated 15 horsepower when driven with these gases. During the same year high-furnace gases were applied on an eight-horsepower engine at the Cockerill Iron Works at Seraing, Belgium, and at the Hörde Iron Works, in Westphalia, Germany, where they were used in a 12-horsepower engine. The first patent for the utilization of high-furnace gases in gas engines was taken out the previous year, in May, 1894, by Mr. B. H. Thwaite of England. The high-furnace gases are similar in quality to the forms of producer and power gas made by Dowson and other processes, and, taken directly from the stack, contain, as a rule, about 27 per cent. of combustible gases, chiefly carbon monoxide, and a little marsh gas and hydrogen, the balance being mainly (about 57 per cent.) inert nitrogen. It is estimated that at the blast furnaces in England alone, over 2,000,000 horsepower is annually going to waste, which might be utilized for electrical purposes. The gas-engine industry is about 30 years old. During that time, one company, the Otto, has sold in England and Germany alone about 37,000 gas engines, approximating 500,000 horsepower. As indicating the development of the large gas-engine industry, it is interesting to note that the Cockerill company of Seraing, Belgium, and its licensees have sold, in less than a year, 70 engines of the Delamare, Deboutteville & Cockerill system, like the 1,000-horsepower "Simplex" engine. This engine develops 650 horsepower when employing high-furnace gases. The engine cylinder is four feet three inches in diameter by four feet seven inches in stroke. The diameter of the air cylinder is five feet seven inches by four feet seven inches in stroke. The length of connecting rod, connecting two cylinders, is 14 feet five inches, diameter, 11.8 inches. Tested without blowing cylinder, this engine showed 573 brake horsepower, with a consumption of 123.7 cubic feet of gas per brake horsepower, or with a mechanical efficiency of 72 per cent., and a thermal efficiency, taking the brake horsepower, of 20 per cent. With the blower connected, this engine showed 886 indicated horsepower and 725 brake horsepower, with a gas consumption of 101 cubic feet per brake horsepower-hour and a thermal efficiency, taking the indicated horsepower, of 31.5 per cent. Until recently, the speed of these blowers has ranged from 50 to 60 strokes per minute. An ordinary gas engine runs at a speed of 100 to 150 revolutions per minute, according to its size, and giving its maximum efficiency at maximum speed. (According to Kennedy and others, a gas engine at one-half load consumes 25 per cent. more gas than at full load.) I saw recently at Falvehütte, in Upper Silesia, Germany, a plant equipped with Horbiger and Rogler valves, enabling these blowers, which, in this case, were operated by steam generated by furnace gas, to operate at a speed of 80 strokes per minute. There are several types of valves now on the market, which enables these blowers to be run at a speed adapting them to be driven successfully by large gas engines.

As an illustration of the great increase in the reliability and the simplicity of the modern gas engine, I call attention to an engine which I had the pleasure of seeing at the Cockerill Works at Seraing, Belgium. It has been running steadily for over two years, both night and day, operating with high-furnace gas. Professor Aimé Witz's test showed an average of 181 brake horsepower, and it showed a mechanical efficiency of 85 per cent., and consumed 116.5 cubic feet of furnace gas per brake-horsepower-hour. The thermal efficiency, taking the brake horsepower, is 20 per cent. The speed is 105 revolutions per minute. The cylinder has a diameter of 31.5 inches by 39.3 inches' stroke. The electric plant at Friedenshütte Iron Works, in Upper Silesia, is operated by high-furnace gases. At the time of my recent visit to this installation, it consisted of two 200-horsepower gas engines, direct-coupled to two direct-current dynamos, and two 300-horsepower gas engines, direct-coupled to two alternating-current dynamos. The gas engines are of the Otto-Deutz type driving Shuckert dynamos. They were supplying a couple of hundred arc lamps and several thousand incandescent lamps and electricity for power purposes. The total horsepower was 1,000, and at the time of my visit this was being increased to 2,400 horsepower. The entire installation, as it will be in operation shortly, consists of six 300-horsepower engines for power purposes and three 200-horsepower for lighting.

Sulphur-dioxide Gas Engine.

It is claimed that a 2,000-horsepower, central-station engine would furnish power to drive an additional 1,000-horsepower SO_2 engine,[1] which can be connected as an extra cylinder to the steam engine, or run independently and thus increase about 50 per cent. the power developed without adding a pound to the quantity of fuel consumed. Professor Josse states that, in mining and iron works' districts, there are a large number of engines, which are condensing and non-condensing, which consume more than 10 kilograms of steam, and in such cases 2,000 horsepower would be gained in a plant of 3,000 horsepower by the use of the cold-vapor engine.

A triple-expansion steam engine, to which an SO_2 gas engine has been attached, is being used for supplying light and power to the technical high school in Charlottenburg. Exhaustive tests have been made, and are being made, on this engine by Professor Josse and his assistants. Through the courtesy of Professor Josse and Mr. Louis Magee, director of the Union Electric company of Berlin, I was enabled to secure the data here presented, and had the pleasure of seeing, recently, this engine running and undergoing test. Professor Josse informed me that, even with the triple expansion, the SO_2 engine gave an increase of horsepower of 35 per cent., with practically no increase in the operating expenses. I had hoped to present the latest results secured by this new engine, but they did not arrive in time to embody them in this paper. Professor Josse informed me that he believed it was inadvisable to go higher than double expansion, and that the preferable method of construction was to place the cylinder of the SO_2 engine in tandem with the steam cylinders. On my asking if there was any danger in moisture getting into the system, thus forming sulphuric acid, which would attack the surface of the cylinder, etc., he said this was impossible. This development in engineering practice is certainly a most interesting and promising one, and it is of interest to note that the Allgemeine Elektricitaets Gesellschaft is now installing an SO_2 engine in its Markgrafenstrasse station in Berlin. The system is not without its disadvantages, and even possible danger. Everyone knows the discomfort produced in a room where a common sulphur match is ignited, and in all types of engines there is always a possibility of a leak occurring. A comparatively small amount of sulphur-dioxide gas produces a large amount of discomfort, and a large amount of it may incapacitate those working about the machinery, and if exposed thereto for a considerable length of time may even result in death. There are also the well-known corrosive effects produced. These are not cited with a view of disparaging this most interesting development but would rather serve to indicate that for such a system to be most successful the SO_2 engine should be operated as an independent engine, and so boxed in and ventilated as to reduce to a minimum the disadvantages resulting from possible leakage. The care of this engine is exceedingly simple, as no lubricant is necessary, and, as for the existing steam engine, absolutely nothing need be changed. In the methods of construction very great care is taken to reduce the chances of leakage to a minimum. Great care is taken in the packing of the stuffing boxes, and, in addition, an extra stuffing box is placed on the cylinder and connected to the condenser so that, although the pressure inside of the cylinder is 14 atmospheres, there is a pressure of but from one to 1½ atmospheres at the outer stuffing box. Professor Josse says the engine can be made absolutely scentless, and that no difficulty need be experienced on this score. He also says the results of his tests far exceeded the original calculated and estimated results and completely justify the practical application of the Behrend system for the improvement in steam engines.

W. P. Knowles, superintendent of City Gas Works, Richmond, Va., will receive sealed proposals until May 1st for furnishing to the city for one year 560 arc lights of 1,200 candlepower for street lighting. A separate bid for the above lights per light per night will also be received.

1. The sulphur-dioxide engine was described in the Western Electrician of March 10, 1900, pages 153 and 154.

Liability for Injury of Lamp Trimme

A lamp trimmer who had been instructed that the first thing to do in trimming was to throw the switch at the top of the lamp to cut it out of the circuit, and had subsequently had something like a year and a half's experience as a lamp trimmer, was injured by receiving an electric shock while reaching for the switch one cold, damp morning. The short-circuit was caused by the wire of his employer coming in contact with a transformer of another company, on another street, unknown to him. He sued both companies for damages. Against the company that employed him he charged negligence in not instructing him as to the increased danger in working upon pole lamps in wet weather, and in allowing the wires of the two companies to come in contact on the other street. But both of these grounds of complaint the Supreme Court of New Hampshire holds untenable, the case being that of Carr against the Manchester Electric company and the Union Electric company. In the first place, it found no evidence that the dampness, if it appreciably existed, caused the injury. Then, it holds that, knowing, as he admittedly did, the risk of injury from the wires of his employers coming in contact with the wires of other electric companies, and thus becoming charged and alive, he manifestly assumed that risk as between himself and his employers, besides which, it points out, they had guarded him absolutely against that source of danger by means of the cut-off switch, the use and purpose of which he admittedly understood. So, irrespective of the question of his own negligence, the court holds that the motion of the company that employed him for a nonsuit should have been granted. As against the other company, however, it holds that he assumed no risks of his employment. They stood as strangers to each other, and, as between them, the only rule to be applied was that of ordinary care. This rule required that he should make use of such means of protection and safety as were within his control to guard against the risks that were known to or reasonably to be apprehended by him from the negligence of the company. Among those risks was that of the other company's wires becoming crossed with those of his employers. True, he was not only apprised of that danger and understood it, and was also equipped with a complete safeguard against it by turning the cut-off switch, but, as he testified that he was attempting to do this when he received the shock, the court holds that the question whether he exercised ordinary care in his way and manner of doing it was properly left to the determination of the jury, which decided in his favor and against the other company.

Marconi Patents Declared Valid.

The suit brought against Marconi by the owner of the Dolbear patents for a mode of electric transmission without wires has been decided in favor of the defendant by Judge Alfred C. Coxe in the United States Circuit Court. Lyman C. Learned, the assignee, claimed that Marconi had infringed this patent in all of his work in this country, and asked damages of $100,000. Marconi's answer was that his apparatus was an original invention and that it did not infringe on the Dolbear patent rights. In this contention he was supported by two expert witnesses called on his side, Dr. John Ambrose Fleming of the University College, London, and Charles R. Cross, Thayer professor of physics at the Massachusetts Institute of Technology. Dr. Fleming, in his testimony, which was made in the form of a deposition, said that he had tried the Dolbear patent instructions and had failed to obtain any such signals or effects as were described therein. No evidence was heard on the side of the plaintiff. The suit was dismissed by Judge Coxe after the decision of Mr. Learned to offer no testimony, it being claimed that the plaintiff had decided that wireless telegraphy without selective arrangements had no commercial value.

Power Supply for General Electric Company's Shops.

The General Electric company of Schenectady has closed a contract with the Hudson River Water Power company, under which the latter agrees to supply to the General Electric company 5,000 horsepower for five years, beginning with the completion of the power company's plant. By the execution of this contract, in addition to those already entered into by the Hudson River Water Power company, the entire interest charge, fixed charges and estimated operating expenses of the latter company are guaranteed, together with five per cent. on the entire capital stock.

By the terms of the contract the General Electric company is to pay $50,000 a year to the power company for 2,500 horsepower, with the privilege of using any part of 2,500 additional horsepower at the rate of $25 a horsepower per annum. It is said that it costs the General Electric company nearly double the above amount to furnish its own power at Schenectady, and as it uses 5,000 horsepower there, it will probably save over $100,000 a year by the contract.

Progress on the Boston Elevated Railway.

The Boston elevated railway is fast nearing completion, and although the time set by the Legislature for the commencement of operation has been extended six months, it is hoped to have trains running by the middle of summer.

The main line will run from Dudley street north on Washington street and through the subway to the North station and on Causeway street and over the new Charlestown bridge, by way of Main street, to Sullivan Square. Upon the completion of the new West Boston bridge a line will be built to the neighborhood of Harvard Square. The plan of operation is to bring people on the surface in surface cars to the three terminal points, Sullivan Square, Harvard Square and Dudley street, to run the surface cars up to the level of the elevated structure in the terminal stations by means of inclines, and there to transfer from surface cars to the elevated trains, or vice versa, if they are going away from Boston. Large numbers of surface lines concentrate at these points. Cars can be run on the surface outside of these points at a considerable rate of speed with safety; inside it is not feasible to run at any but a very slow rate. The running time of surface cars between Dudley street and Sullivan Square, it is hoped to reduce at least one-half, on the elevated, making it 20 minutes instead of 40 minutes, and making it with reasonable certainty, the only obstacle being the draw on the Charlestown bridge, and the opening of this may be confined to certain hours. A branch line also runs from the corner of Castle and Washington streets, by way of Motte street, Harrison avenue, Beach street, Atlantic avenue and Commercial street, by the South station and Rowe's wharf and the ferries as far as the new Charlestown bridge, meeting the main line at that point.

Careful attention has been given to the inspection of the materials used in construction and the requirements have been most rigid. The ties are from seven to eight feet long, and those that support the third rail are nine feet in length. They were cut from the hard-pine forests of Georgia, and are calculated to remain in service for about 10 years. The method followed in laying them results in their acting as cushions for the rails, and reduces the vibration due to the passing of trains.

The distance from Dudley street to Sullivan Square will be covered in about 20 minutes, and it is stated that one train a minute can be dispatched from either terminal without reaching the limit of the operating department. Trains of four cars each will be run, weighing in all about 80 tons loaded.

Several trial tests were made in Charlestown on March 10th, which are said to have indicated that it would be possible to run from Sullivan Square to Dudley street in 15 minutes instead of 20, the schedule decided upon. The car in use for these trials was fully equipped as it will be when the overhead road is opened for business. There were stops at the stations, the platform gates were opened and closed, and the imaginary passengers allowed to enter and leave the car. These preliminary drills are to acquaint all the operating officials with their duties and fit them to instruct the motormen, conductors and station men. Arrangements have been made to test all the cars before putting them in service.

Automatic Water-bucket Alarm.

A writer in Cassier's Magazine, after saying that "open pails and buckets, filled with water, have not yet been surpassed in efficiency as first aids in fire fighting," gives the particulars of an arrangement adopted by a mill superintendent to insure that the water pails about the factory shall be constantly filled with water. The hooks from which the pails were suspended were fitted with pieces of spring steel strong enough to lift the pail when nearly empty, but not sufficiently so to lift a full pail. Just over each spring, in such a position as to be out of the way of the handle of the pail, was set a metal point, connected with a wire from an open-circuit electric battery. So long as the pails were full, their weight, when hung on their hooks, kept the springs down, but as soon as one was removed, or lost a considerable portion of its contents by evaporation or otherwise, the spring on its hook would rise, come in contact with the metal point, and thus close the battery circuit and ring a bell in the manager's office, at the same time showing on an annunciator where the trouble was. As the bell continued to ring until the weight of the delinquent pail was restored, it was impossible to disregard the summons, and no further reason was found in that establishment to complain of the condition of the fire buckets.

Purdue Annual Inspection Trip.

About eighty students of mechanical, electrical, civil and chemical engineering at Purdue University reached Chicago on March 25th on their annual inspection trip. Accompanying the students were W. F. M. Goss, dean of the schools of engineering; W. E. Goldsborough, director of the department of electrical engineering; Robert S. Miller of the mechanical engineering department; W. D. Pence, civil engineering department, and W. H. Test of the department of technical chemistry. The programme included visits to the principal power plants and industrial establishments of Chicago and vicinity and a banquet given by the Chicago alumni to the students at the Chicago Athletic association. The party was scheduled to return to Lafayette on the evening of March 29th.

Extraordinary Electrical Phenomena.

[New York letter from "Holland" in Philadelphia Press.]

A few days ago an electrical engineer was establishing a cable across the Jersey marshes. It was necessary to set up some very delicate instruments to do that work. The engineer discovered some disturbances recorded by the instrument that were regular and rather systematic, but which he could not trace to any conceivable source. He made an exhaustive investigation, only to be more and more confounded, and at last he gave up in despair. The disturbances seem to have been somewhat similar to those noticed by Tesla, but the fact was that one of his subordinates, in a spirit of mischief, waved a crowbar regularly, like the beating of a pendulum, when the engineer's back was turned, and thereby produced these remarkable disturbances—so remarkable that they were reported to the electrical engineers.

One of the most capable of the electrical scientists in this city narrated an experience he had recently. He was engaged in some very delicate work that involved the use of one of the most sensitive of electrical apparatus. He noticed disturbances that seemed to be regular, and that could not be traced or explained. He was alone with the instrument; he had divested himself of his keys, his pocketbook, his fountain pen, and even a coat with steel buttons. There was no iron or other metal within sight. The disturbance was very perplexing and could easily have been ascribed to some unknown phenomenon or influence. But the engineer noticed that the disturbance grew more marked as he bent over the apparatus. At last he took off his hat to discover immediately that these disturbances ceased. There was a steel rim around the edge of his hat.

So, too, in one of the best known of our schools of technology, some remarkable, mysterious perturbations were occasioned in one of the most sensitive of electrical instruments. The instructor deemed it worthy of the most careful and prolonged investigation. The disturbances took place during certain lectures, when the class was gathered around the instrument. At last it was discovered that one of the pupils, a young woman, one of the brightest of the students, when near this instrument, caused the most pronounced of the disturbances. By a modest and delicate suggestion she was persuaded to appear in the class wearing stays with whalebone instead of steel supports and a disturbance, upon which might have been based precisely the claim Tesla made, was removed.

So, too, at Columbia University, which is the center of electrical investigation and experiment, a certain extraordinarily sensitive instrument was found at one time to be sensibly disturbed, and by regular beats so to speak. The phenomenon was deemed worthy of exhaustive investigation and the cause was at last discovered. It was demonstrated with absolute accuracy that these rhythmic disturbances were caused by the influence of sun spots. Therein Tesla may perhaps get some justification for his view that the phenomena he noticed with his sensitive instrument were occasioned by celestial rather than terrestrial influences.

Deposits of Electricity.

Mysterious, ghostly shocks of electricity having attracted observation in certain houses on Charles street, in Baltimore, a correspondent of the Sun of that city offers the following unique explanation:

"Permit me to offer an explanation of the electrical phenomena on North Charles street. Technique and theory are all right in their way, but should always go hand in hand with common horse sense.

"Frictional and animal electricity is a well-known fact, but it cannot exist in one house or locality and not in another under like circumstances. An electric agitation can be produced by shuffling on a well-insulated floor or by stroking one over the head and shoulders with fur, but the magnetism or deposit of an electric force is not possible in this way. Electricity deposited is dispensed or digested only by moisture, exactly as is moisture taken up by dry ventilation. As an old telegrapher, I am positive that electricity deposits exactly as dust and moisture.

"In this special case it is not dangerous or unhealthful, but the reverse. The ground upon which the houses stand is sand and the atmosphere dry. Upon examination it will be found that they stand within a circle or semi-circle obstructing electric waves, caused by either a leak or intense abnormal induction, precisely upon the principle of wireless telegraphy. The deposit is not sufficient to be carried off by pipes until connection is made by the flesh, or otherwise. It is impossible that this current can come in through the pipes.

"I would say, therefore, that it is induced waves held in suspension between the source and the point of induction, which will disappear in damp weather."

"Synthetic Coal."

A company is arranging to build a plant in eastern Massachusetts for the extensive manufacture of "synthetic coal." It is said that this coal has been practically tested in a fire engine, a machine shop and a pottery manufactory, and the company believes that it has found a fuel that will completely take the place of ordinary coal. It is asserted that the fuel is not deteriorated by atmospheric conditions and that it has great calorific value.

"Synthetic coal," as its name implies, is a fuel made by compounding the essential elements of coal. It is the invention of G. M. Randall, M. D. The fuel is of the briquette order, otherwise waste material being compressed and sold in the form of a brick. The composition of the fuel includes peat, bituminous pitch, petroleum, calcium, and a few other ingredients. It is a mixture and not a compound, none of the elements in its composition changing their nature till the moment of combustion. "Then," says the inventor, "in addition to the normal burning of the carbon ingredients, there is a generation of calcium carbide, which, changing at once to acetylene gas, is at once consumed. The resulting acetylene flame, which is thus a constant factor, though never a large one, is the combustion of all the volatile carbons present—the ingredients which would otherwise go off in smoke." Peat is much the largest component of the mixture, the others serving mainly as a cement, with incidental aid in combustion, excepting the elements relied on to produce the acetylene.

The advantages, as enumerated by the inventor, are many. Economy is one, there being, it is said, a greater number of heat units per ton than in any of the commercial fuels. The residual ash is 60 per cent. less than that of any bituminous coal. There is no dust in handling. There are no deleterious gases during combustion, or at least escaping, as, on account of the principle of the acetylene combustion, the gases are consumed.

Engineering Lectures at the University of Illinois.

The following course of lectures, under the auspices of the Mechanical and Electrical Engineering Society of the University of Illinois, will be delivered by non-resident engineers during the current spring semester:

Mr. J. V. Schaefer, of the Link Belt Manufacturing company, Chicago, Ill., on "The Handling of Materials by Means of Endless Elevators and Conveyors."

Mr. John Birkinbine, consulting and expert mining engineer, Philadelphia, Pa., on "From Mine to Furnace."

Mr. William Kent, associate editor of the Engineering News, New York city, on "Steam Boiler Efficiency."

Mr. W. L. Abbott, chief operating engineer, Chicago Edison company, Chicago, Ill., on "Recent Development in Central-station Electrical Supplies."

Mr. W. A. Layman, electrical engineer, Wagner Electric Manufacturing company, St. Louis, Mo., on "Some Important Considerations of the Design, Manufacture and Use of Transformers."

Mr. T. P. Gaylord, electrical engineer, Westinghouse Electric and Manufacturing company, Chicago, Ill., on "Alternating-current Power Work."

Mr. Bion J. Arnold, consulting engineer, Chicago, Ill., on "Central Power-station Design."

Professor L. P. Breckenridge, Ph. B., professor mechanical engineering, University of Illinois, on "Locomotives at the Paris Exposition."

Twentieth-century Advancement.

[From advertisements in a New York daily.]

"It will be a very short time until the Ocean Power company will be supplying New York city and all other cities and towns near the seacoast with their heat, light and power, and the holders of its stock will be reaping a golden harvest. Prospectus and full information may be had," etc.

"Wireless Telegraphy.—Invest now in the parent company of America. The first and only legally recognized organization in the United States incorporated for use of wireless telegraphy with letters patents. Shares, par value, $10, full paid and non-assessable, for a limited time only, at $1.50 per share. Price will be advanced shortly to $2.50, as an operating sub-company is formed which will place in parent company's treasury $1,250,000 in stock, which means a 25 per cent. dividend to stockholders. An unquestionable opportunity for investment. Send subscriptions for number of shares desired," etc.

New Russian Tariff on Dynamos.

By the new punitive tariff on manufactures of metals from the United States Russia levies a customs duty of $1.71 per pood (36 pounds) on dynamos. A machine weighing 10,000 pounds would thus bear a duty of about $475. The conventional duty on such a machine (or the duty collected before the punitive decree went into effect) would be about $300. The increase named in the decree is 30 per cent., but it is calculated upon the general, or maximum, tariff rather than upon the conventional, or minimum, tariff.

CORRESPONDENCE.

New York Notes.

New York, March 23.—At a joint meeting of the directors of the Brooklyn Rapid Transit company and the Brooklyn Heights Railroad company, held at 54 Wall street, on March 20th, Clinton L. Rossiter resigned as president and director of the two companies mentioned. Jacob L. Greatsinger, president of the Minnesota Iron company and the Duluth and Iron Range Railroad company, was elected at the same meeting to fill Mr. Rossiter's place. A resolution was adopted by the directors, expressing appreciation of the earnest efforts of the retiring president toward the improvement of the property, and wishing him equal success in whatever he should undertake in the future. Various reasons are given for the change. It is said that this move marks the acquirement of control of the roads by Standard Oil interests, but Mr. Rossiter has stated that he resigned voluntarily and was offered an opportunity to remain as an officer, which he declined. Another reported reason for the retirement of President Rossiter is to the effect that his management has resulted in hostility of the employes toward the company.

The stock, franchise and plant of the Worcester Traction company of Worcester, Mass., have been sold to Vermilye & Co. of New York. The sale was ratified at a recent meeting of the stockholders, 38,000 of the 50,000 shares being voted in favor of the transfer. The company is capitalized at $5,000,000, $3,000,000 common and $2,000,000 preferred.

The Mutual Life Insurance company has sold to a syndicate of New York and Elmira capitalists a number of street-railway and lighting properties which will give to this syndicate complete control of all public utilities in Elmira with the exception of the telephone and telegraph franchises. These properties include the waterworks, railway lines, electric-lighting plant, gas works, and a number of parks which are of value to the railway companies. The amount involved is said to be over $4,000,000.

Albert L. Johnson, ex-president of the Nassau street-railway system, has announced through his attorney, John M. Ward, that he wants to build the Brooklyn extension of the rapid-transit tunnel. Mr. Johnson, if his bid is accepted, will take up the contract and follow the route outlined by the commission, but will have a spur of the road leave the tunnel at a point opposite Second avenue, and, running partly overland and partly underground, to Fort Hamilton. The only other change in the existing plans suggested by Mr. Johnson is the widening of the tunnel so that four tracks may be accommodated. He insists that the fare shall be three cents. This is said to be a part of the plan for the trolley road to Philadelphia, as the spur mentioned would cross the Narrows to Staten Island and from there run to the mainland in New Jersey. It is proposed to make a 50-cent rate between New York and Philadelphia, with three-cent fares and universal transfers in the city of Philadelphia. At a hearing conducted recently by the Railroad Committee of the Municipal Council Mr. Johnson said in part:

"I mean to wake New York up to the fact that there are tremendous possibilities in the way of a tunnel system which will connect South Brooklyn with Staten Island, and I stand ready to build the tunnel if I have half a chance. I know that there are objections made to the South Brooklyn route on the ground of additional cost and because of the unwillingness of any company to take the contract to construct the road. That is all nonsense. Let the Rapid Transit Commissioners agree to a route from the Battery to South Brooklyn, as near Second avenue as possible, and I will make them a proposition that they will be afraid not to accept, for it will remove the danger of exceeding the city's debt limit, and bring fares all over New York down to a three-cent basis."

One block of the rapid-transit subway in Section 3 is practically completed. The steelwork is in place, the concrete flooring and roof are laid, and only a small amount of finishing remains to be done. The contractors for this section have a power plant on the north side of Union Square. It is here that they produce all the compressed air used in working machinery along that part of the subway from Thirty-third street to the City Hall. In the plant are four 200-horsepower boilers and three 300-horsepower compressors. The air that is employed to work the excavating machinery in the Park avenue tunnel, just north of Section 3, and in Forty-second street, is supplied by a plant owned by Contractor John B. McDonald and situated at the foot of East Forty-second street. In this last plant there is a 1,000-horsepower compressor. On the whole of Section 3 about 600 men are employed daily.

Some differences of opinion have been brought to light by the bill providing for the establishment of a state laboratory of electricity at Schenectady, in connection with Union College. Dr. Raymond, president of Union, recently wrote a letter defending the bill and setting forth some of the advantages of such an institution, in which he expressed approval of a plan by which the state should encourage the further development of electrical science, and mentioned as precedents the establishment of a state school of forestry at Cornell, as well as a state veterinary college and a state biological laboratory. Dr. Raymond's letter has provoked an editorial from the Rochester Post-Express in which government encouragement of the development of electrical science is ridiculed on the ground that so much progress is being made in New York by private enterprise, and in which a rather doubtful analogy is attempted by likening this growth to the development of steam machinery. The Post-Express further condemns the institutions founded at Cornell by the state as being bad precedents which should never have been set and should not be followed. The statement is made that these schools were provided for in acts whose passage was obtained solely by lobbying at Albany, and that they are supported by the taxpayers, with whose similar private enterprises they compete. In contrast to this view of the matter, the Albany Journal points out that the bill does not provide for a school of engineering, as there is already such a department at Union College, but for a laboratory to be used primarily to meet the needs of the state, and only incidentally to afford instruction to the students of Union College. It is intended to be a source of authoritative information upon questions involved in legislation, and upon which the state should not be dependent for its information upon the expert testimony of rival commercial interests.

An explosion in the rapid-transit tunnel near One-hundred-and-eighty-first street resulted in the injury of three men on March 21st. The excavation is lighted with gasoline lamps, and it is supposed that the oil in the tank became ignited and set off a box of dynamite that was standing near. A car at the top of the shaft was blown from its track, but the men below were not seriously injured, escaping with cuts and burns. M. L. G.

New England News.

Boston, March 23.—The Deerfield (Mass.) selectmen have granted the Greenfield and Deerfield Street Railway company a franchise on the condition that the road be built from Cheapside to Sugar Loaf in a year. The remainder of the road can be built in three years. The selectmen can regulate the speed of cars, and children must be carried to and from school at half fare.

The Massachusetts Automobile Club has decided to erect a model automobile clubhouse, with stable accommodations for 100 or 150 vehicles.

The Milford, Holliston and Framingham Street Railway company has been given permission to lay a double track on Main street, Milford, with the proviso that it allow other companies the right to use the tracks. The first section must be completed by July 1st and the remainder within a year from that date.

The Milford and Worcester Street Railway company has been granted a franchise by the Milford selectmen. Construction must be begun before July 1, 1901, and the road must be completed within a year.

The selectmen of Manon have granted a continuous location to the New Bedford and Onset Street Railway company. The company must pay not more than $4,500 toward the expenses of the other locations which were granted by the selectmen. Children are to be carried to and from school for half fare, and the company must maintain waiting stations and shelters.

Wire Commissioner Lott of this city has abolished the position of consulting electrician of his department, the change to take effect on March 30th. The position was held by William Brophy, who was appointed chief electrician when the department was organized and whose title was changed by Commissioner Lott. Messrs. Lott and Brophy have had considerable friction. Commissioner Lott says that he considers that the office of consulting electrician is a useless one. Under previous commissioners Mr. Brophy had executive duties, but last summer these were delegated to Executive Secretary Frank Rice.

On March 22d Professor A. E. Dolbear lectured on "Wireless Telegraphy" at the North End Union in this city. He gave an historical review of the Hertzian waves and described Marconi's resonator and some accessory instruments.

On March 21st the legislative committee on street railways reported a general bill, under which electric-railway companies can carry United States mails and act as common carriers of newspapers. J. S. B.

Canadian Intelligence.

Ottawa, Ont., March 23.—The Niagara District, Wellandport and Dunnsville Electric Railway company, the head office of which is in Thorold, Ont., is seeking incorporation to construct a line of electric railway from Niagara Falls through Thorold, Port Maitland and the townships of Pelham, Clinton, etc. Jos. Battle and W. M. German, M. P., are interested.

The City Council of Halifax, N. S., has decided to establish a municipal electric plant, to supply municipal and commercial lighting, and thus enter into active competition with the Halifax Electric Tramway company. The estimated cost of a suitable plant is placed at $100,000.

The annual report of the Halifax Tramway company of Halifax, N. S., presented at the annual meeting, showed that during the year 1900 there was a decided increase in business. The net profits were $74,631, as compared with $61,798 for the year previous. The operating expenses were increased during the year by $16,000. The number of passengers carried by the railway was 352,580 greater than during the previous year.

The corporation of the city of Toronto, Ont., petitions the Dominion government to enforce the clause in the act of 1892, providing that existing rates should not be increased by the Bell Telephone company without the consent of the government; also that the company be obliged to supply telephones to all persons who require and are willing to pay for the same.

Application has been made to list the stocks of the Canadian General Electric company on the Montreal stock exchange. The capitalization of the company is $1,500,000, of which $300,000 is preferred, bearing six per cent. interest. The common stock bears 10 per cent. per annum, and the closing quotation in Toronto a few days ago, where the stock has been active for some time, was 210¼. The capitalization will be increased to $2,000,000. Last year the company paid out, in dividends, $127,623. The Royal Electric company of Montreal holds 3,000 shares of Canadian General stock, which it received in payment for its manufacturing plant a short time ago. The Royal got this stock at 160, which would make its original value to the company $480,000, but since that time the value of the stock has risen in value, until it is now worth about $630,000.

The Canadian General Electric company of Toronto, Ont., has acquired a tract of land in that city for the extension of the Canada Foundry company's works, which are now owned and controlled by the former company. The electric company will erect large buildings and equip the foundries on a scale larger than anything of the kind in Canada. For the past month the company has had several of its expert employes and an architect seeking information as to the latest and best methods of shop construction, machines, tools, appliances and manufacturers' methods and equipment in several of the large American cities. The new works will consist of a large general foundry, pipe foundry for pipes, valves, etc., machine shops, blacksmith shops, power house, structural-iron shops, and other buildings necessary for the proper equipment of works of such proportions. Railway tracks will run into and through the works, and electric cranes will be installed for the handling of materials up to 50 tons' weight. All machines will be operated by electricity, supplied from the Canadian General Electric works. This company employs in its shops in Toronto, Montreal and Peterboro', between 1,200 and 1,500 hands. It will very largely increase this force when the new works are ready for operation. It is expected that construction work will commence early in the coming summer and be completed in a year from the date of beginnig the work. The Peterboro' branch of the General Electric works has been considerably extended of late, the main shop being 600 feet in length. About 40 acres of ground are occupied in that city by the company.

Mr. Edwin Hanson, president of the Havana Electric Railway company, who has been in Cuba for the last few weeks, returned recently. He lives in Montreal, and expresses himself as well satisfied with the progress that has been made in the construction work of the railway. The system which is being built in Havana by Canadian and American capitalists will comprise some 40 miles of track. Mr. Hanson states that about one-half will be running by the end of the present month. The company will start with over 100 cars, these being very similar to the closed cars of the Montreal street railway. Half of the Havana electric-railway system will be double-tracked, and the system installed will be the double overhead trolley. The success of the venture is assured, from the fact that no one walks in the city of Havana. This feature of city life, in fact, has been carried to such an extent, he says, that there are 1,400 licensed cabs and 200 buses now employed in the Cuban capital. The company is contemplating the extension of the railway to other parts of the city and its environs. A. V. W.

Niagara Falls, N. Y.

Niagara Falls, March 23.—Efforts are being made to incorporate a new power company for Niagara Falls, a bill having been introduced in the state Legislature for that purpose. The name selected is the Lower River Power and Water Supply company. The capital is $5,000,000. The incorporators are Commodore Vedder, Tunis G. Bergin, William Williams, Charles E. Hotchkiss and De Witt V. D. Riely of New York, and Patrick F. King, George W. Knox and James S. Simmons of Niagara Falls. King and Knox are lawyers and Simmons is a real-estate dealer. Under the provisions of the bill, the company is authorized to construct and maintain pipes or tunnels through or under the town of Lewiston and the city of Niagara Falls and the streets and highways thereof, extending from such point or points outside of the New York State Reservation. The site of the projected development is nearly two miles from the Falls down the river at the Whirlpool Rapids, where the company seeks to build a tunnel, starting at the level of the water just below the great railway bridges, and carrying it through a neck of land nearly 200 feet below the surface to a point far below on the river, known as the Devil's Hole, where the power station would be located. In no way would the company's plan interfere with the water of the Falls, but it would divert a portion of the present flow of the rapids. This, however, would not be so much as is diverted and returned by the power companies up the river, and the water would be returned to the river after passing through the tunnel to the Devil's Hole.

The project has been under discussion for several years, and it is understood that a head of about 80 feet would be obtained from end to end of the tunnel. The company figures that the excavation of the tunnel would be greatly simplified by the fact that dump cars, operated by an electric engine or motor car, could be run right into the tunnel to carry away the excavated material, all of which could be used to great advantage by the Niagara Gorge Railroad company in strengthening its roadbed along the rapids.

The certificate of incorporation of the Power Installation company has been filed in the office of the clerk of Erie County. The capital stock is $5,000. The directors are George F. Westcott, M. E. Westcott and Max Mauran.

On Sunday, March 17th, Wu Ting Fang, Chinese minister to the United States, was a guest at Niagara Falls. He traveled there in company with several prominent Buffalonians, in the private car of President Ely of the International Traction company. For all the Niagara Gorge road was closed, it was thrown open for his accommodation, and in the private car of President Jones he made the trip through the gorge. He was greatly pleased with the scene. While at Niagara he was disappointed that no one could tell him what electricity is, but laughed heartily when told the water was green at the Falls because it "was just coming over." Minister Wu enjoyed his visit to the Falls most thoroughly.

In the Niagara Railway Supply company Niagara Falls has captured its first iron industry. This company, has been incorporated, with a capital of $500,000, and it is announced that it will at once build a plant on the property of the Niagara Falls Power company at Niagara Falls, where it will manufacture the McPherson safety frog and switch and other railway supplies. The incorporators are DeLancy Rankine, Niagara Falls; Charles R. Huntley and Robert W. Pomeroy of Buffalo. Power for the operation of the plant will be supplied by the Niagara Falls Power company.

The Niagara Falls Power company has made a contract with the Natural Food company of that city for 2,500 electrical horsepower, to be delivered as soon as the food company's large new factory is ready for it. When completed, it is expected that this plant will be the most marvelous manufacturing establishment in the world. It will be a model in every feature. The structure itself will be very large, as its length will be 542 feet, width, 66½ feet, and height, six stories.

Some months ago the Castner Electrolytic company purchased the plant and good will of the Mathieson Alkali Works of Niagara Falls, and now comes the announcement that the new syndicate is to make very material and extensive improvements to the works, which are on the property of the Niagara Falls Power company. A contract has been made with the Niagara Falls Power company for 5,000 additional horsepower, part of which is to be delivered in November next and part in January next, or as soon as the buildings and installation are prepared to receive and use it. The Niagara Falls Power company is now supplying the plant with 2,000 electrical horsepower, so that when the new block of power is in use, the works will be consuming 7,000 electrical horsepower, or the output of more than one of the generators in the big power house. The extensions to the works will be carried to the east of the present buildings, and will be of the same substantial construction of brick. In their completed state the works will cover about 10 acres of land, and they will rank first in the industries of Niagara Falls, especially in the number of hands they will employ. Now the works give employment to 240 hands, while, when the additions are made, there will be over 700 names on the pay-roll. The output of the works at present is about 300 tons a week, and the additional block of power contracted for will increase this to 1,000 tons a week, the product being caustic soda and bleaching powder. The extensions will cost in the neighborhood of $500,000. D.

From the Buckeye State.

Columbus, Ohio, March 25.—The Cincinnati and Columbus Traction company of Cincinnati has been incorporated, with a capital stock of $10,000, which is only nominal, if the promoters succeed in the plans which they have before them. The names appearing on the papers filed with the secretary of state are as follows: Henry Burkhold, Frank O. Swing, Philip C. Swing, Richard E. Swing and A. J. Becht. The purpose of the company is to build an electric line from Cincinnati to Columbus, through Hamilton, Brown, Highland, Fayette, Ross, Pickaway and Franklin counties. A portion of this territory is now covered with proposed lines, but work has been commenced on but one or two of them. There are several wealthy men back of this enterprise.

The Urbana, Bellefontaine and Northern Railway company of Springfield filed articles of incorporation with the secretary of state a few days ago. The capital stock of the company is placed at $50,000, and the incorporators are J. S. Harshman, John G. Webb, W. R. Nivens, A. Jay Miller, W. T. Havalind and Fred J. Green. The application states that it is the purpose of the company to build an electric line from Urbana to Toledo. Several of the gentlemen in the new company are interested in the Dayton, Springfield and Urbana and the Columbus, London and Springfield lines.

Another new incorporation is the Lakeside, Napoleon and Western Electric Railroad company, which was authorized to capitalize at $300,000. The application states that the line to be built will extend from Marble Head, on Lake Erie, to the western line of the state, passing through Ottawa, Sandusky, Wood, Henry and Williams counties. The incorporators are Robert F. Muir, W. B. Johnson, Charles C. Muir, H. P. Reiter and David B. Brown. Mr. Brown and the Messrs. Muir are Indiana men and have had experience with electric roads. It is possible that this line will be extended from Bryan, the proposed western terminus, into Indiana, later on. A surveying party started out as soon as the incorporation papers had been received to go over the line. It will reach several important lake resorts.

The City Council of Springfield has granted the Little Miami Traction company a 25-year franchise for its route through the city. There has been some contention over the matter.

President Corwin of the Dayton City Railway company has denied the report that the Philadelphia syndicate which controls the Cincinnati lines has also secured the Dayton road. It is said that a foothold has been secured in Hamilton.

John C. Welty of Canton says that the electric line in which he is interested will be built from that city to Akron, notwithstanding what the Northern Ohio Traction company may do. The latter company, it is stated, will not ask for a franchise in Canton, but will connect with the city lines. This will probably do away with a contest at that end, but Mr. Welty may not be so fortunate at the Akron end of his line.

Cincinnatians are speculating over the probable erection of a large power plant, which will supply power for that city as well as for the Covington and Newport street railways, and furnish light for all three cities. The matter will be in the hands of the Cincinnati Traction company.

The Union Light, Heat and Power company has been incorporated in Kentucky, to control lighting companies in Covington and Newport. The capital stock is placed at $1,500,000. James E. Ernst has been made president of the company and other officers have been chosen. C. W. Wetmore, one of the incorporators, is president of the North American company, so it may reasonably be supposed that that company is at the head of the new organization.

The Columbus Railway company has organized a school of instruction for motormen. An expert, Louis Hamilton, has been appointed to drill the men in handling cars with the least waste of current, and a car has been fitted up with an amperemeter and a wattmeter, so that the amount of current used may be measured in running cars by different methods over the same portion of a line. In this way they are able to show the saving by correct handling of the cars. Tests already made show that there may be a great deal saved by careful education of the motormen.

Negotiations have been completed through which a Cleveland syndicate, represented by the Cleveland Trust company, the Western Reserve Trust company, the Savings and Trust company and the Colonial National Bank, come into possession of the Aurora Street Railway and the Aurora and Geneva Electric Railway company, in Illinois. They were purchased of Fahnestock & Co., New York bankers. Through connection with lines in the same portion of the state, purchased a few months ago, the syndicate will secure a Chicago line, which will make a very valuable property. L. J. Wolf, of M. J. Mendelbaum & Co., Cleveland, conducted the negotiations.

It is stated that the Southern Ohio Traction company has secured a franchise through College Hill, Cincinnati. If so, there remains little to be done in accomplishing the purpose of gaining an entrance to the Queen City.

The Cincinnati Traction company lost $30,000 a few days ago by a fire in one of its car barns. Sixteen summer cars were burned, but only one of them had a motor, or the loss would have been much more.

Ex-Mayor Robert McKisson of Cleveland spent a few days last week in Toledo, and it is claimed that he has a project on foot to connect several of the lines between Toledo and the eastern part of the state, and eventually make a through line between all the large cities on Lake Erie.

The Cleveland, Elyria and Western Railroad company has begun the extension of its line from Oberlin to Norwalk, where it will connect with the Toledo, Fremont and Norwalk. The distance is 22 miles. This is a portion of the Lake Shore plan.

George Wood has been appointed superintendent of the Sandusky city lines, and now has charge of the city and the Sandusky and Interurban lines.

Thomas Wood of the Sandusky and Interurban road has been made manager of the Sandusky, Norwalk and Southern.

The suit for a receiver against the Hamilton and Lindonwald Rapid Transit company, Hamilton, has been dismissed from court.

The commissioners of Union County have granted a 25-year franchise to the Union Electric Railway company.

It is said the Little Miami Traction company of Xenia has in contemplation lines to Columbus and Dayton, and also several others in the southern part of the state. John P. Martin, the president, is a hustling street-railway man.

The Bullock Electric Manufacturing company has declared a quarterly dividend of 1½ per cent. on preferred stock. The annual meeting of the stockholders was held a few days ago, when George Bullock was made president, Joseph S. Neave, vice-president, and J. W. Bullock, secretary.

Work is now in progress on the line of the Toledo, Fremont and Norwalk road, between Monroeville and Norwalk.

The Sandusky, Monroeville, Berea and Norwalk Electric Railway company has been financed, and it is stated that work will begin on it at an early date and that the road will be pushed to completion.

O. M. C.

Information from Indiana.

Indianapolis, March 23.—Work is well under way on a new electric-light plant at Knightstown. It will be operated in connection with the waterworks system.

The Town Board of Pendleton has decided to construct an electric-light plant. W. H. Aiman has asked for a franchise.

Municipal ownership of the electric-light plant is very unsatisfactory to the city of Frankfort. There has been trouble ever since the construction of the plant. Superintendent Wells tendered his resignation, which was accepted with such unanimity as to warrant the inference that it was requested. Frankfort's ardor in the municipal-ownership idea has cooled considerably. The city was bonded to build the plant and this brought on a lawsuit with people who claimed that the city had exceeded the statutory limitation of indebtedness. The contractors became alarmed, and slow progress was made until the matter was settled. The city was victorious, but more trouble arose. The city had been in darkness all summer, and when the plant was started it was a failure. Citizens procured pumpkins, hollowed them out, put candles in them and after lighting up the jack-o'-lanterns, sent for the councilmen to see "the new electric lights." Open threats were made of removing the poles if the service was not improved. The plant is not self-supporting, and the moonlight schedule is resorted to in the interest of economy.

A number of business men of Elwood, headed by E. E. Green, are working among the prominent citizens of Richmond, with a view to organizing a stock company to construct an electric line to connect with the Union Traction company's system at Anderson, and to run through Middletown, Sulphur Springs, Mellville, Newcastle and Hagerstown, to Richmond. The route parallels the Panhandle tracks almost the entire distance. The project is being very favorably considered and meetings are being held to discuss the project.

One lone farmer stands in the way of the proposed interurban line from Muncie to Newcastle. The line is surveyed through his farm and between his house and his barn. He says that he doesn't want any railroad in his backyard to frighten his cows and fowls.

Within a short time the Indianapolis Street Railway company expects to complete an entirely new overhead system and to have in full operation the new distributing station at St. Clair street. The company's manager says this improvement will enable the company to have an abundance of power to handle the heaviest traffic satisfactorily.

Benson Bidwell, who claimed he was the inventor of the overhead-trolley system, and sued the Indianapolis company for infringement, has dismissed his case in the federal court. He asked for an injunction and that the company be required to account for the profits it had made by the use of the trolley system. He failed to make any showing in his suit.

Hugh J. McGowan, president of the Indianapolis Street Railway company, who has been ill for some days, is reported not so well and alarming bronchial complications are feared. Mr. McGowan is one of the best-known street-railway men in the country. His recovery is greatly hoped for, and every attention is given him.

The Legislature has passed an act permitting street-railway companies to secure land for rights-of-way and depots by condemnation procedures.

The work of surveying the route of the New Castle and Muncie interurban electric line has been completed. The road passes through Mt. Summit, Springport, Oakville and McCowan.

As soon as the Union Traction company can secure the right-of-way it will begin the line from Daleville to Middletown. The intention is to have the proposed route intersect the line from Muncie to New Castle.

Anderson claims to have the greatest system of interurban roads in the United States. Its total mileage is 156. More lines are to be added, and every city in Eastern Indiana, including Indianapolis, will be connected.

General Manager Charles Ford of Kokomo, representing the Central Traction company, has secured from the Noblesville council an extension of time for the completion of the electric line from Indianapolis to Kokomo by way of Noblesville. Work is to be begun soon. The officers of the company are: President, W. L. Kann, Pittsburg, Pa.; vice-president and general manager, C. A. Ford, Kokomo; secretary, George Lilly of Anderson; treasurer, H. Stillwell of Anderson. The road is financed by Smithers & Co., New York bankers, and the contract for the construction has been awarded to the J. E. White Construction company of New York.

Due to short curves and high speed the Union Traction company is having much difficulty with

the new lot of cars received from the St. Louis car shops, the cars being longer and heavier than the old ones.

H. T. Yaryan of Toledo, Ohio, has applied to the city council of Richmond for a franchise to install a hot-water system to be operated in connection wth the municipal electric-light plant.

The project has been revived at New Albany to utilize the water power of the falls of the Ohio River, and a committee appointed to work up a sentiment among the business men of New Albany, Louisville and Jeffersonville, with a view of devising a plan of operation. It is claimed there is abundant power to run the steel railways, the electric-light plants and factories of the three cities. It was the fine water power that induced the Scribner brothers to establish the town of New Albany at the foot of the falls nearly 100 years ago.

The motor car that the Pennsylvania company is having made at the Indianapolis car works will soon be furnished and ready for operation. A test of it was made a few days ago and a speed of 50 miles an hour was reached. The car is handsome in design, fitted up with all the modern improvements and appliances, and will be operated on the tracks of the Indianapolis and Vincennes between Indianapolis and Martinsville. The purpose is to compete with the electric line paralleling this line. If the car proves a success others will be built and operated on the Pennsylvania system, wherever they come in competition with electric lines.

In appreciation of their services in saving the plant of the Lea Electric Manufacturing company of Elwood from destruction, Jacob Loomis, president of the company, gave the firemen an elaborate banquet the night following the fire.

In an address before the tax assessors of the state Auditor Hart attacked the manner in which county commissioners are giving away interurban franchises, and said: "I think it is criminal, almost, that these valuable franchises all over the state are given away to-day, and it would be much more profitable to the state if in franchises that are enjoyed by corporations in Indiana there had been a provision requiring a certain proportion of the proceeds to come into the treasury of the state."

F.

Northwestern Notations.

Minneapolis, March 23.—It is reported that the electric railway at Hurley, Wis., is to be extended to some point west of the present terminus, probably the village of Pence.

The city of Fort Atkinson, Wis., has bought the plant of the Fort Atkinson Electric Light and Power company. It will be combined with the water plant.

The purchase of the electric-light plant at Dayton, Wash., by the city, is under consideration.

The promoters of the electric line from Des Moines, Ia., to Newton, ask a bonus and agree to give a written pledge to have the line in operation by January 1st, if given a franchise.

The Everett (Wash.) Railway and Electric company has been given a five years' lighting contract.

The Tacoma (Wash.) Railway and Power company will give better service and lower fares on the Puyallup and South Tacoma lines.

A rural trolley line from Madison, Wis., is projected. Several routes have been considered—one from Beaver Dam and another from Fort Atkinson.

The Twin City Rapid Transit company is building a number of new cars for its Grand Avenue, Seventh Street and Rice Street lines in St. Paul. They will be double-truck cars, equipped with four 25-horsepower motors, one geared to each axle. The cars will have a new tight-fitting floor, enabling them to be washed without wetting the motors.

The electric-railway project for a line from La Crosse to Melrose, Wis., has been revived by the citizens of the latter place.

The labor party has nominated a full ticket at the municipal election in Butte, Mont., and demands the public ownership of electric-light and telephone systems at once.

The council of Duluth, Minn., finds that the estimates of cost for a municipal electric-lighting plant are too low, being based on too small a lighting circuit in several instances. Action has been deferred until further information can be secured.

The corporation attorney of St. Paul has been directed by the Board of Aldermen to proceed against the street-railway company for $34,836.29, alleged to be due for back taxes. It is alleged that the company has paid but a portion of its taxes each year, and on only two occasions did the company settle in full. Two years are missing from the records, and it is believed that they will bring the total due up to about $50,000.

The case of the city of Kaukauna, Wis., against the electric-light company, which has been in the courts for two years, has been decided in favor of the city by the Circuit Court. The city had a contract, which provided that the company should give $5,000 bonds to bury its wires when ordered and that additional lights should be furnished when wanted. In August, 1899, the city demanded that the conditions be complied with, and the company is alleged to have refused to do so. The council then voted to annul the company's franchise. The matter was taken into court and the annulment held to be illegal. The council then determined to make the company adhere to its contract, and refused to pay further rentals for light. Suit was brought, finally resulting in the decision of the Circuit Court that the city is not obliged to pay its rentals until the company has fulfilled its contract.

L. H. Ong, who has been with the Mason City and Clear Lake (Iowa) electric railway since its inception, has resigned as superintendent, the resignation to take effect April 1st.

R.

PERSONAL.

General William A. Bancroft, president of the Boston Elevated Railroad company, has purchased 300 acres of land in Groton, Mass., his native town, for an estate to be known as Shawfieldmont.

Frederick W. Job, a young Chicago lawyer in successful practice, well known to many members of the electrical fraternity in the West, has been appointed a member of the state Board of Arbitration by Governor Yates.

Charles H. Duell, commissioner of patents, who resigned on March 15th, to take effect on the appointment of his successor, will resume the practice of law. He will open an office in New York city, and will have associated with him W. A. Megrath, who has been for many years law clerk to the commissioner of patents, and F. A. Warfield, an examiner in the Patent Office. Mr. Duell was appointed about three years ago from Syracuse, N. Y., and has made an efficient commissioner.

ELECTRIC LIGHTING.

An electric-light plant will soon be built at Stonington, Ill.

The town of Reading, Mich., will issue $6,000 lighting bonds.

The citizens of Bolivar, Mo., have voted to establish an electric-light plant.

A new $8,000 electric-light plant will soon be erected at Yorktown, Texas.

A. L. Dickinson is preparing to erect an electric-light plant at Coleman, Texas.

The mayor of Tifton, Ga., will soon advertise for bids for lighting the town by electricity.

An election at Manton, Mich., has resulted in favor of an issue of $9,000 electric-light bonds.

The Borough Council of Media, Pa., has passed a resolution to build its own electric-light plant.

At a recent council meeting at Woodbine, Iowa, it was decided to build a $4,000 electric-light plant.

The town of Harbor Springs, Mich., will be bonded in the sum of $10,000 for an electric-lighting installation.

Arrangements are being made to add $7,000 worth of electrical apparatus to the electric-light plant at Wolcott, N. Y.

H. C. Mercord, proprietor of the electric-light plant at Prescott, Wis., is preparing to enlarge and remodel his plant.

The Legislature has passed a bill authorizing the issuance of $35,000 bonds for an electric-light plant at Dunn, N. C.

On April 1st an election will be held at Mansfield, Ohio, to vote on an issue of $65,000 four per cent. electric-light bonds.

W. H. Wheeler of Beloit, Wis., will soon ask the council of Ripon, Wis., for a franchise to construct and operate an electric-light plant.

The Southern Indiana Railroad company will install a complete electric-light plant in its new roundhouse at Terre Haute, Ind.

The Henrietta Light and Power company of Henrietta, Texas, has been organized, with $5,000 capital stock, by G. A. Jackson and F. P. Neville.

The borough of Frenchtown, N. J., has passed an ordinance giving J. Hyde of Trenton the right to construct and operate an electric-light plant.

Colonel Blees of Macon, Mo., owner of the Kearney (Neb.) electric-light plant, contemplates the enlargement and improvement of the property.

The City Council of Tipton, Ind., will next fall erect a municipal electric-light plant. Plans for its construction are being submitted to contractors.

The city of Gastonia, N. C., will hold an election on May 6th to decide upon the issuance of $25,000 of bonds for waterworks and electric-light plants.

At the April election at Butler, Mo., the question of issuing $20,000 in bonds for the purpose of erecting an electric-light plant will be voted upon.

The People's Water and Electric Light company of Frankfort, Ky., has been incorporated, with $20,000 capital stock, by L. I. Crawford and H. M. Stegenan.

The Washington Power company of Tacoma, Wash., has been incorporated, with capital stock of $1,000,000, by J. L. McMurray, A. R. Waren and J. M. Bell.

The Citizens' Light and Transit company of Pine Bluff, Ark., has been organized, with $200,000 capital stock, and has been granted a franchise for lighting the city. J. B. York is president of the company.

The Consolidated Light and Power company of Whitehall, N. Y., has been incorporated (capital stock, $75,000), by C. F. King, J. H. Barker and J. M. Cronin.

The Ravenna Electric company of Coeymans, N. Y., has been incorporated for $100,000, by A. Nodine and S. W. Mosher of Coeymans and N. Niles of Albany.

Bids will be received until April 3d by M. E. McMahon, mayor, or R. Pendt, clerk, of Carrollton, Ill., for furnishing that city with 45 arc lights of 2,000 candlepower each.

The Winstanley Electric Light, Power and Gas company of East St. Louis, Ill., has been incorporated, with a capital stock of $2,500, by H. P. Taussig, W. W. Dean and Marc J. Gautier.

The Cooper Electric Light company of Cooper, Texas, has been incorporated by C. Tuttle, W. R. Evans and E. S. Kelley, to supply light, heat and power. The authorized capital is $12,000.

The Bloomington (Ind.) Light, Heat and Power company is to install transformers to the capacity of about 5,000 lights, and to make other improvements, to cost in all about $25,000. A. M. Barron is superintendent of the company.

The Gloversville Citizens' Electric company has been incorporated, with a capital stock of $40,000, to supply electriicty to Gloversville, Johnstown, Northville and Broadalbin, N. Y. The directors are J. Begley, F. S. Sexton and K. Klein.

Sealed proposals will be received at the office of the supervising architect of the Treasury Department until 2 p. m. on April 25th, for the installation of an electric-wiring system for the outbuildings of the United States Bureau of Engraving and Printing, Washington, D. C., in accordance with drawings and specifications, which may be obtained of James Knox Taylor, supervising architect.

In the transformation of the old Star Theater at Clark and Kinzie streets, Chicago, into the "Victoria," incidental to the proprietorship of D. R. McGinty, new theatrical wiring has been done throughout. There are 800 sign lights and 700 stage lights, the stage being equipped with a switch on either side. There are 12 circuits in the borders, eight floor pockets and five dimmers, two of the latter being 100-ampere ironclads, the others, together with a 200-ampere one for the front of the house, being spirals. The work was done by Joseph Hutchinson, chief electrician.

ELECTRIC RAILWAYS.

The Iola Electric Railway company of Iola, Kan., has been incorporated, with a capital stock of $50,000.

The Berkley street railway, in operation in Berkley, Va., and its suburbs, has been purchased by D. E. Evans of Baltimore, who contemplates extensions.

The Midland Railway company of England has sent two engineers to study American methods, including the adaptation of electric power to railroads.

The Citizens' Street Railway company of Vincennes, Ind., has in contemplation the extension of its lines from that city to adjoining villages and towns.

The Fox River Valley Electric Interurban Railway company has decided to build its line to the city limits of Kaukauna, Wis., during the coming summer.

Right-of-way has been granted through Arlington, Ind., to the Indianapolis, Morristown and Rushville Traction company. Work will begin on the traction line in the spring.

G. Ross of Chicago, S. A. Duncan of Atlanta and J. Z. George of Vicksburg are making a preliminary survey of Natchez, Miss., with a view to putting in an electric street-railway system.

The Winstanley Park Railroad company of East St. Louis, Ill., has been incorporated, with a capital stock of $10,000, by D. P. Alexander, John Voitleine, C. White, E. O'Connell and B. B. Smith.

R. Judson of New York city is at the head of a project to build an electric railway from the Massachusetts state line to Bridgeport, Conn., thus forming a continuous trolley line from New York to Pittsfield, Mass., about 175 miles long.

The Aurora and Geneva electric road and the Aurora street-railway line have been purchased for about $1,000,000 by the Cleveland syndicate which controls the Elgin, Carpentersville and Aurora, and the Aurora, Wheaton and Chicago systems.

The council of Niles, Mich., has granted a franchise to the Indiana and Southern Michigan Street Railway company for the use of the streets through Niles. The road is to run from South Bend, Ind., to St. Joseph, Mich., by way of Berrien Springs.

The Scotia Traction company of Scotia, N. Y., has been incorporated for $30,000, to operate an electric street railway from a point on the Fitchburg railroad, in Scotia, to Schenectady. The di-

rectors are G. W. Linch, W. H. Delaney and H. V. Munderse.

The Town Council of Manheim, Pa., has passed an ordinance granting a franchise to the Manheim and Lebanon Electric Railway company to lay tracks on the streets of the village. It is proposed to build the line from Manheim via Mastersonville and Mount Gretna to Lebanon.

The Toledo-Chicago Railway company has been incorporated to construct and operate a railway from the Wabash line at Montpelier, Ohio, to Toledo, a distance of 65 miles. The capital stock is $250,000 and the incorporators are B. C. Winston, F. J. Reynolds and G. H. Beckwith.

Sans Souci Park, a summer garden on one of the lines of the Chicago City Railway company, has been transferred by D. G. Hamilton, president of the company, to the Metropolitan Amusement company, for the consideration of $1. The transfer is supposed to have for its object the apparent severing of the connection of the garden with the street-railway company.

The Twin City Rapid Transit company has been incorporated in New Jersey, with a capital stock of $20,000,000, to operate railways in Hennepin and Ramsey counties in Minnesota, in the state of New York and elsewhere. The incorporators are Thomas Lowry of Minneapolis; George S. Coe of Englewood, N. J.; George Bliss, J. Kennedy Tod and Henry A. Cannon of New York, and Charles S. Fairchild of Boston.

The prospects for an early winding up of the affairs of the Illinois National Bank of Chicago are considered bright. Just as soon as the Calumet electric-railway line is sold by Comptroller Dawes, the funds will be ample to meet liabilities. "I have been offered $2,000,000 for the road," Mr. Dawes is reported to have said, "but it is worth $3,000,000, and I will get that much before disposing of it. With this amount in hand we will be enabled by the use of the balance of assets which we hold to pay the depositors in full. The road has increased earnings, and is now showing net earnings."

AUTOMOBILES.

The first successful public automobile service in London began operations recently between Streatham and Clapham Junction.

It is said that the Department of Posts and Telegraphs in France has decided to adopt automobiles for the distribution and collection of mail. One hundred vehicles have been ordered for the purpose, according to a recent report.

POWER TRANSMISSION.

The Elba Power company of Elba, Ala., has been incorporated, with J. W. Comer, president, H. M. Comer, vice-president, and J. F. Gilmartin, secretary. The company will build a dam across the Pea River and furnish power for manufacturing plants.

PUBLICATIONS.

A well-illustrated booklet descriptive of Stiles power punching presses has been issued by the E. W. Bliss company, Brooklyn, N. Y. This company has recently completed a new forge shop and extended its foundry facilities, and is prepared to furnish its lines of Stiles and Bliss punching presses equipped for belt or electric motor driving, together with a complete line of parts.

The Chicago Pneumatic Tool company has ready for distribution an illustrated circular of about 50 pages devoted to views of the tools manufactured by it, as used in the industries. The circular contains very little text or descriptive matter, and is given up almost entirely to illustrations of the company's pneumatic hammers, drills, riveters, reamers, cutters and lifts in use on iron, steel, wood and stone work. Of especial interest is a view showing the use of the Boyer hammer for finishing the stone work of the Palmer Memorial Fountain at Detroit, Mich.

"True Transformer Talk" is the title of a neat pamphlet devoted to the interests of the Vindex Electric company of Chicago. This company is manufacturing a line of core-type transformers, which are well illustrated and described in the publication referred to, which is addressed "to central-station managers who are open to conviction," with the reminder that the transformer is an exceedingly important part of an alternating-current system. This company's method of core suspension is clearly shown in the illustrations, and efficiency curves and tabulated data of performance under service conditions are also given.

Three bulletins have recently been issued in pamphlet form by the Manhattan General Construction company of Newark, N. J., describing, respectively, the Manhattan multiple alternating enclosed-arc lamp, the Manhattan multiple direct-current arc lamp and the Manhattan series alternating enclosed arc system. The bulletins are well illustrated, those devoted to the lamp showing the mechanism in detail and the last one mentioned above being accompanied by diagrams for the installation of the system in addition to illustrations of the lamps and transformers used. Especial mention is made of the gas check perfected by this company and in use in its lamps, as well as of the fact that the current intensity of the circuit may be changed without affecting the operation of the lamps, as they are of the shunt type.

"Electric Locomotives for Mine Haulage" is the title of an artistic pamphlet recently issued by the Westinghouse companies' publishing department, describing the line of mining locomotives now being put on the market by the Westinghouse Electric and Manufacturing company and the Baldwin Locomotive Works. The pamphlet is profusely illustrated, showing a number of different styles complete, and in addition views of the component parts of the machines are given in a set of 15 plates, to facilitate the ordering of such as may be needed for repairs. The frames, wheels, drawbars, bumpers, journals, etc., are supplied by the Baldwin Locomotive Works, while the electrical equipment is of Westinghouse make. In the catalogue care has been taken to group the parts on the several plates in such a manner as to indicate plainly to a purchaser which company should receive his order. Valuable data upon the relation of power and weight to hauling capacity are given in a few well-arranged tables, and the text contains some timely hints concerning the selection of types of locomotive for various conditions of service.

SOCIETIES AND SCHOOLS.

Samuel W. Kintner, professor of electrical engineering at the Western University of Pennsylvania, read a paper on "Wireless Telegraphy" on March 19th, before the Engineers' Society of Western Pennsylvania. The address was illustrated by stereopticon views and by telegraphic apparatus.

The Journal of Proceedings of the ninth annual convention of the Northwestern Electrical association, at Milwaukee, January 16th to 18th, has been issued by Secretary Thomas R. Mercein. It forms a book of nearly 100 pages, and contains all of the valuable papers presented at the meeting, together with the discussions which followed them, as well as a list of the officers and committeemen of the association.

For the conversazione of the American Institute of Electrical Engineers, to be held at Columbia University, New York, on the evening of April 12th, current for exhibits is available as follows: Direct current at 115, 220, 400 and 500 volts and 115-volt alternating current (two-phase) at 60 cycles and (single phase) at 130 cycles. All exhibits must be ready at the university on Saturday, April 6th, and should be marked: "Conversazione, care Prof. F. B. Crocker, Engineering Building, Columbia University, New York City." In order to prevent any confusion or delay, it is essential that exhibitors should send a brief catalogue description of exhibit, and a list of what material, outside of that which will be furnished with the exhibit, will be necessary for the evening of April 12th, so that when the time for installing arrives, there will be nothing wanting to properly complete the work.

MISCELLANEOUS.

The shops of the East Indian railway and the Bengal-Nagpore railway in Calcutta, India, will soon be electrically equipped. Many electric elevators and motor-driven printing presses are in operation in Calcutta, and the cathedral organ is to be fitted with a motor-driven blower.

It is said that the bill providing for infliction of the death penalty in Illinois by means of high-tension electric currents is meeting with approval, and the appropriation committee has voted to report favorably upon the bill appropriating $3,000 for the "electric chair."

It is stated that Thomas A. Edison has perfected a method of ore separation applicable to the Norwegian hematite and magnetite, which has heretofore been considered impossible, and that separators are to be built in Norway with an annual capacity of 750,000 tons, to supply the British markets. This will open a large supply of iron and steel for the British manufacturers.

An electrotherapeutist, speaking of the widely advertised so-called "electric belts," says that tests of a number of the best appliances of the kind sold showed that they could not develop an electromotive force of one volt, and that, "taking the electrical resistance any current from such a belt would meet in the human body as 400,000 ohms, there would pass a current of not more than one-fourth of a thousandth part of one milliampere, an infinitesimal fraction of the smallest current recognized by electrotherapeutists, and less than may be obtained by dipping a needle and pin in a spot of ink."

Consul Nelson of Bergen, Sweden, reports what he says is a successful attempt to produce steel by electricity in that country. The consul says: "The experiments are being carried on at Gysinge factory, Sweden, and about 25,000 pounds of steel are produced in six drafts daily. The steel is of an excellent quality, and meets with ready sales at high prices. On account of the relatively cheap method of production, the profits are large, but as the electrical power is limited, the output is insignificant. To overcome this drawback, plans have been formed for the erection of a large electric plant near the Dalalfuen River, the waterpower of which will be utilized. This will enable the company to carry on the manufacture of steel by electricity on a large scale."

TRADE NEWS.

The Diehl Manufacturing Company of Elizabethport, N. J., has just filled a large order for ceiling fans and electroliers of unique and magnificent design to be installed in the imperial palace at Formosa.

The plant of Willis & Scott, manufacturers of electrical appliances and machinery, at Richmond, Va., has been completed and will be put in operation at once. About 600 employes will be required at the start.

The Electrical Inspection and Maintenance company, with a capital of $250,000, has been incorporated at Pierre, S. D., by J. H. Tomlinson, J. J. Post, Henry E. Leavitt, P. J. Knight, L. Taylor and L. C. Smith.

The fire at the works of the National Carbon company, Cleveland, Ohio, which was reported as having destroyed the works of the company on March 18th, was in reality of a much less serious nature than was indicated in the published accounts. The company states that only its laboratory was damaged and that the fire will not in any way interfere with the filling of orders.

The Electric Storage Battery company of Philadelphia, Pa., manufacturer of the Chloride accumulator, announces that a sales office has been established at Cleveland, Ohio, and Mr. E. V. Stebbins, formerly of the Philadelphia staff has been placed in charge as manager. The office will be located in the New England building and all business from this territory will be handled by Mr. Stebbins with promptness.

The American Electric Fuse company, Chicago, New York and San Francisco, announces that it has more than doubled its working capacity, and has installed new and complete machinery for the purpose of turning out its well-known specialties. This company expects to place on the market in the near future various improvements upon its standard line of fuses, fuse boxes, lightning arresters and connectors. It also manufactures a complete line of both silk and magnet wire, and carries a stock of all sizes constantly on hand. The eastern office of the American Electric Fuse company is located at No. 116 Nassau street, New York, and is in charge of W. B. McCurdy. The office is completely stocked with a full line of the company's goods. The western office, at San Francisco, Cal., will be conducted on the same line as the eastern office.

BUSINESS.

The Electric Appliance company, Chicago, states that it is making large shipments of Packard transformers, for which it is general western agent.

The Bois d'Arc Pin company, Beaumont, Texas, announces that it is prepared to furnish insulator pins in any kind of timber and oak brackets, all in large quantities. The company promises shipments on the day of receipt of order.

The Western Electrical Supply company of St. Louis is receiving orders for fans, both of the Peerless direct and Emerson alternating-current types, and has already secured a large number of contracts, which would seem to indicate that the coming season will be an exceptionally good one for fan motors.

Among the contracts recently secured by the American Bridge company are those for a large government warehouse at Progroso, Yucatan, for 28,000 tons of steel work for bridges on the lines of the New York Central Railroad, and for the erection of 12 spans of deck plate girders, 75 feet in length, for the Central Railroad of New Jersey at Weissport, Pa.

The Ball Engine company of Erie, Pa., has recently installed a 115-horsepower engine for the Marion Steam Shovel company, Marion, Ohio, and a 125-horsepower direct-connected engine for the Kentucky Wagon Manufacturing company, Louisville, Ky., and has also furnished the engine for the new electric power plant of the Caxton Building company of Cleveland, Ohio.

The Central Electric company of Chicago is sales agent for a new incandescent lamp called the Hylo baby filament lamp. This lamp has two distinct filaments, one giving one candlepower and the other 16 candlepower. Changing the light from one to 16 candlepower or vice versa is done by slightly turning the lamp in the socket. This does not introduce a resistance, as in other regulating lamps, but the changing mechanism is a part of the lamp and does not require a special socket. The lamps are made with Edison, Thomson-Houston or Sawyer-Man bases, and for from 50 to 125 volts.

W. C. Sterling & Son, pole dealers at Monroe, Mich., report that they have every reason to believe that this year's trade in their products

will excel that of former years. The demand during the winter has been good, and the spring trade has opened up early. The only drawback will possibly be the car supply. Sterling & Son do not fear that this will affect them greatly, however, as their sorting yards are situated so that they can get several lines of cars. The demand for telephone poles is increasing with the advance of spring, especially in the toll-line poles. The firm thinks it advisable for all telephone companies to get their orders in early to take advantage of the present prices and get their poles in time. The electric railroads are beginning to contract for poles and ties for spring delivery. This firm now has several large contracts with electric-railway companies for poles and cedar ties.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued March 19, 1901.

669,999. Electric Signaling Apparatus. Adolf Mensing, Berlin, Germany. Application filed May 25, 1900.

An hermetically closed casing has an exposed side adapted to receive a blow. Normally open-circuited circuit terminals are mounted within this casing. A block carried by one of the circuit terminals within the casing and normally in operative proximity to the exposed side of the casing receives the impact of a blow delivered against that side of the casing and closes the circuit by its movement.

670,006. Electric Exercising Machine. Nelson H. Raymond, Buffalo, N. Y., assignor to Albert W. Courtney, Buffalo, N. Y. Application filed August 14, 1900.

An electric generator has its armature shaft provided with driving pulleys. Actuating and conducting cords pass around the latter and are provided with electrodes included in the generator circuit. A shunt circuit contains a number of resistance coils, each having one of its terminals connected with a contact, and a switch lever connected with one of the terminals of the shunt circuit traverses the coil contacts.

670,022. Intercommunicating Telephone System. Newman H. Holland, Brookline, Mass., assignor to the Holtzer-Cabot Electric company, Brookline, Mass. Application filed November 12, 1900.

The signal-sending circuit is provided with a selective controlling device. A switch is placed in the signal-sending circuit independent of the controlling device. Means are provided for automatically operating the switch to break the signal-sending circuit when conversation is finished

670,026. Electric Cigar Lighter. Alfred B. Kittson, Boston, Mass. Application filed October 24, 1900.

A flattened coil of fine platinum wire is wound spirally around a thin plate of mica or other electrically non-conducting material. The igniting plate consists of a thin plate of mica in contact with the outer flattened side of the coil but disconnected from it.

670,059. Commutator Brush Holder. William D. Pomeroy, Akron, Ohio, assignor to the Akron Electrical Manufacturing company, Akron, Ohio. Application filed September 22, 1900.

This holder is to be mounted on a wrist pin parallel with the armature shaft and consists of a body arranged to be adjustably secured to the pin, a tension finger pivotally mounted in the body, bearing at one end a pivoted supporting plate and a carbon brush secured thereto, and having at the opposite end a notched flange and a spring wire to engage one of the notches to press the carbon brush on the commutator. The supporting plate and body are electrically connected.

670,119. Brush Holder for Electric Machines. John Trier, Chicago, Ill., assignor to Donald Grant, Faribault, Minn. Application filed April 26, 1900.

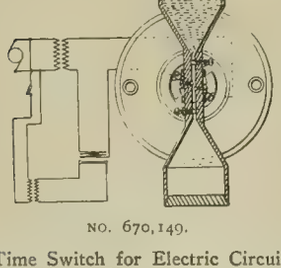
The casing of an enclosed motor is provided with openings and with a plate secured to the casing and having its ends projecting over the openings. Brush-holding levers are arranged in the openings and pivotally connected to the ends of the plates and a hinged cover is provided for the openings.

670,142. Electrolytic Current Interrupter. Arthur Wehnelt, Charlottenburg, Germany. Application filed May 16, 1899.

A vessel contains an electrolyte into which two electrodes dip, the electrodes being of unequal size. The anode serves as the active electrode and the terminal voltage is higher than the polarization tension.

670,145. Electric Switch. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction company, Utica, N. Y. Application filed June 7, 1900.

An approximately V-shaped, knife-receiving terminal of resilient metal has its upper ends bent toward each other and the lower ends bent and meeting each other, and a knife including spaced plates is adapted for contact with the exterior faces of the bent portions of the receiving terminal and slides into contact with the surfaces.



NO. 670,149.

670,149. Time Switch for Electric Circuits. Ethan I. Dodds, Avalon, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September 9, 1899.

In a system for operating electric lamps having glowers which require to be heated to be rendered conductive, a high temperature is electrically developed in the vicinity of the glower for rendering the glower conductive, and means are provided for automatically causing a cessation of the heating after a predetermined period, independently of the operation or non-operation of the glower. (See cut.)

670,172. Electric Water Heater. Waldo F. Follett, New Haven, Conn. Application filed December 10, 1900.

Tubes connecting spaced hollow heads are separated by interspaces. A resistance coil is wound between the heads and encircles the tubes. Covering plates secured to the heads enclose the coil, and the latter is held spaced between the tubes and covering plates.

670,174. Ammeter. Gustav Grabosch, Berlin, Germany, assignor to Gans & Goldschmidt, Berlin, Germany. Application filed October 12, 1900.

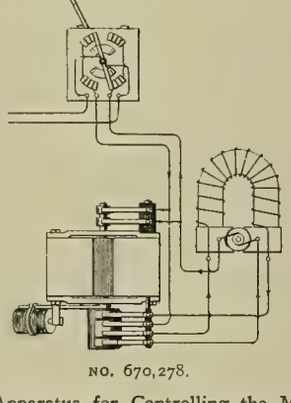
This instrument comprises a centrally bored bobbin of plug form wound with bobbin coils. A spindle is mounted in the bore, and a metal piece secured to it, with a spring-actuated pointer mounted on the spindle and deflected on a current passing through the bobbin coils. A safety fuse is located in the bore and connects one end of the bobbin coil to one pole of the circuit.

670,202. Apparatus for Controlling the Motion of Electric Switches. William Kingsland, London, England. Application filed August 9, 1900.

The switch described is operated by a shaft, receiving step-by-step rotative motion by the impact of passing tappets. A frictional brake is carried by and acts upon the shaft. Balancing devices support the frictional brake to prevent the latter completely rotating with the shaft, whereby the shock produced by the impact of the moving tappet is absorbed by the balancing devices, the latter after the tappet action returning the frictional brake to its normal position and the operating shaft to the required position, by the energy accumulated in the balancing devices.

670,203. Apparatus for Controlling the Motion of Electrical Switches. William Kingsland, London, England. Application filed August 9, 1900.

A disk is carried by the shaft, and itself carries locking bolts. A stationary ring surrounds the disk, and recesses in the interior of the ring receive the locking bolts when the latter are projected beyond the periphery of the disk. The bolts are projected by the rotative motions of the disk, and caused to enter the next set of recesses in the stationary ring, in order to stop the motion of the shaft. They are also automatically withdrawn from the ring recesses after the stoppage of rotation of the shaft, to free the shaft for the next tappet action.



NO. 670,278.

670,204. Apparatus for Controlling the Motion of Electrical Switches. William Kingsland, London, England. Application filed August 9, 1900.

Inclines are formed upon a wheel mounted on and rotated by the shaft. There are inclines on a locking ring held against rotation with which the inclines on the wheel coact to move the ring and wheel apart laterally. A spring opposes the moving apart of the ring and wheel, and thereby exercises a controlling action on the rotative motion of the wheel. The wheel is momentarily locked at the completion of each required amount of rotary motion, and automatically released to free the shaft for the next tappet action.

670,274. Switch for Suspended Electric Conductors. John Floyd, Washington, D. C. Application filed February 2, 1900.

A downwardly-projecting curve is formed in the main conductor. The branching conductor forms a loop on the main conductor, and the conductors extend parallel to each other. The branching conductor curves under the main conductor.

670,278. Reversing Apparatus for Electrical Devices. Robert J. Hughes and Alexander B. Shaw, Duquesne, Pa. Application filed October 13, 1900.

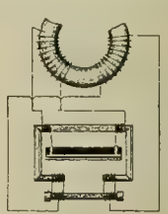
A reversing controller connects the terminals of an electric generator interchangeably with the line wires. A translating device is also connected with the wires. A rocking armature is placed in the field of a magnet and a shunt circuit includes the coils of the armature. Contact plates are held to turn in unison with the armature and brushes are arranged to engage them. Connections are made from the brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other. (See cut.)

670,316. Incandescent Lamp. Reginald A. Fessenden, Allegheny, Pa. Application filed November 27, 1900.

A heater is arranged in operative relation to a pencil. The pencil is included in the circuit of one of the secondary coils of a transformer, and the heater in the circuit of the other secondary coil, whereby the heater current is reactively regulated by the pencil current. (See cut.)

670,319. Underground Current Supply for Electric Railways. Hermann T. Hillischer, Vienna, Austria-Hungary. Application filed October 26, 1900.

Bolts of magnetizable material are provided with armatures carrying electrical contacts, all in circuit with the source of current supply. Another armature and a ground contact for it are provided, this armature being in contact with the ground and with the bolts only when the bolts are demagnetized.



NO. 670,316.

670,350. Electro-endosmotic Process of Freeing Materials from Fluids. Botho Schwerin, Munich, Germany. Application filed July 26, 1900.

This patent covers a process of freeing mineral, vegetal and animal materials from fluid, which consists in placing the disintegrated material in contact with electrodes of opposite sign, driving the fluid toward the negative electrode by passing an electric current through the material by means of the electrodes, and causing the fluid to discharge from the negative electrode as it is driven out of the material.

670,351. Apparatus for Electro-endosmotically Freeing Materials from Fluids. Botho Schwerin, Munich, Germany. Application filed July 26, 1900.

A vessel is constructed with electrically conductive side walls forming opposite electrodes of which at least the negative is permeable to fluid. A conveying device is located within the vessel between an inlet for the material to be treated and an outlet for the material treated, the inlet being placed at one end and the outlet at the opposite end of the vessel.

670,363. Electrical Coupling or Terminal. William Walker, Jr., Birmingham, England. Application filed September 15, 1900.

The body of the coupling has a bore at one end extending part way into it, the end being externally threaded. A longitudinally slitted tapered sleeve is fitted in the bore, and a nut with a contracted portion engages the tapered part of the sleeve in engagement with the threaded end of the body.

670,375. Contact Shoe-lifting Apparatus for Electric Cars. Joseph S. Morison, Richmond Hill, N. Y., assignor of one-half to John F. Bjurlund, Borough of Queens, New York, N. Y. Application filed April 20, 1900.

In an electric car receiving the electric current by the third-rail system, the support for the contact shoe is adapted to be raised to break contact with the conducting rail and is connected with a hand lever in the control of the operator on the platform. This is effected by means of a rock shaft suitably connected with the hand lever, and having an arm for each shoe support and connected with a head thereof having intersecting slots in transverse planes, one of which is traversed by the arm and the other by a pin carried in the extremity of the arm to have free play to a limited extent, to accommodate it to the inequalities of the conducting rail.

670,382. Trolley Wheel. John Caldwell, Providence, R. I., assignor of two-thirds to John S. Kellogg, Providence, R. I. Application filed June 9, 1899.

Two metallic coils are wound and set in reverse directions in a chamber formed in the hub of the wheel, and feed oil or lubricant into an annular groove in the chamber. The chamber has one end closed with a perforated cap integral with the hub, and its opposite end closed with a removable perforated cap, and a channel leads from the exterior of the hub to the interior of the chamber for feeding oil to the coils.

670,384. Trolley Rope Holder. John W. Clayton, Denver, Colo. Application filed November 1, 1900.

A bracket composed of a base plate adapted to be fastened to the car is provided with three projections, two of which have registering openings. A pin passes through the openings, and a spring surrounds the pin between the apertured projections, and normally holds one extremity of the pin against the third projection and closes a space between the pin and the bracket base plate, through which space the trolley rope may pass.

670,408. Signaling Apparatus for Telephone Stations. Thomas W. Loaring, Cleveland, Ohio, assignor to the Cuyahoga Telephone company, Cleveland, Ohio. Application filed October 27, 1900.

A source of electrical energy is connected by a number of signal-sending switches with a signal-generating coil. Electromagnetic apparatus completes the line circuit when the flow of current is established in the coil.

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Chicago Automobile Exhibition.

The automobile show held at the Chicago Coliseum last week under the management of the Motor Age of Chicago proved successful from every viewpoint, exceeding the expectations of even the most sanguine. The happy results obtained may be accounted for largely by the fact that preparations were begun by the promoters at a date sufficiently early to afford ample time for attention to the many details which are sometimes overlooked in undertakings of this nature. The management of the recent event had originally laid plans for a national exhibition to be held in November, 1900, and some preliminary arrangements had been made, when the Chicago Inter Ocean's automobile tournament and exhibition at Washington Park was announced. With the belief that this event would prove worthy of general recognition and that it would be successful, and feeling that two exhibitions so near together would not receive so much interest from the public nor produce results so favorable to manufacturers as could be expected if a longer interval separated them, the management decided to postpone the affair until this spring. The decision resulted in affording a still longer time for preparation, and active work for several months on the part of the promoters gave the exhibitors time to make extensive provision for showing their products to the best advantage.

CHICAGO AUTOMOBILE EXHIBITION.—INTERIOR OF THE COLISEUM DURING THE SHOW.

The general view of the interior of the building is taken from the north end of the balcony, showing the main entrance at the right. There were many exhibitors of accessories who engaged space, and as these required less room than was necessary for the exhibits of completed vehicles, they were allotted sections around the sides and north end of the building. The south end, where the carriage entrance is located, was reserved for the general accommodation of vehicles for cleaning and decoration, and at this end was placed a temporary charging switchboard, with rheostats, meters and attachment plugs, for the use of the exhibitors of electric vehicles

As shown in the picture, an oval track was laid out to permit the showing of the automobiles in operation. Between the track and the outer section mentioned there was a promenade, and within the enclosure bounded by the track were arranged the larger exhibits of the vehicle manufacturers.

In the immediate foreground of the general view is shown the space filled by the vehicles of the National Automobile and Electric company of Indianapolis. These machines were prominent on the track at all times during the exhibition, and attracted attention there both by virtue of their number and their individual appearance. Several styles of light runabouts and road wagons were shown, as well as a delivery wagon and several heavier four-passenger vehicles. This company builds and had on exhibition a combination business and pleasure wagon which attracted considerable attention. The vehicle was fitted with a conventional box top, such as is used for ordinary delivery wagons, extending forward, so as to enclose the operator's seat, as is usual in such wagons. This top, however, may be pushed back and removed, and a second seat substituted, making a very presentable four-passenger pleasure vehicle, which need bear no evidence of its identity with the carrier of parcels, as all lettering may be done on the sides and rear of the removable cover. The controller used on the vehicles of this company is of substantial design and is a marked improvement in this most important feature of the electric automobile.

Running the entire length of the central enclosure was a main aisle, and across this aisle, immediately opposite the National exhibit, was that of the Woods Motor Vehicle company of Chicago. The Woods company's display was noticeable on account of the variety of equipages shown, the number including vehicles of the wagonette, stanhope, runabout, dos-a-dos, hansom and brougham types, as well as an open omnibus carrying about 12 persons, which was often seen on the track. The high finish and artistic design of this company's products are well known to Chicagoans, and the exhibit proved especially productive of sales.

The Electric Vehicle company of Hartford, Conn., entered three electrically driven conveyances, noticeable in point of appearance chiefly for their large tires, the single-seated vehicle being fitted with heavy pneumatic tires and the surrey running on large tires of solid rubber. The Electric Vehicle company has greatly improved upon the battery placed in its vehicles, asserting now a mileage of 40 on a single charge, where formerly 25 miles was considered the safe limit for batteries which were to show good wearing qualities.

The Hewitt-Lindstrom Motor company of Chicago had on exhibition a closed passenger omnibus, besides a delivery wagon and several types of pleasure vehicles, among which was a runabout capable of making a speed of 30 miles an hour. These vehicles were all electrically driven.

A vehicle which attracted much attention for its excellent running qualities and general construction is that perfected by Otto von Bachellé of Winnetka, Ill. The electrical equipment consists of an American storage battery, a controller and two motors geared to the rear wheels. The motors are mounted directly upon a rigid running gear and are connected to their driving pinions by flexible shafts. Rawhide pinions are used, meshing with bronze gears. The designer of this vehicle has given especial attention to the elimination of noise in operation, and believing that the humming sound so often produced by these transmissions at high speeds is due to the tendency of the driving pinions to spring away from their corresponding gear wheels, he has enclosed the gear and pinion in a metallic case, placed ball bearings at each pinion, and connected the pinions to their motors through flexible shafts. This device, by keeping the gear and pinion wheels in their correct relative positions regardless of the power they are transmitting, greatly reduces the wear upon the pinions and makes running practically noiseless. It was stated that the vehicle shown at the exhibition has been in use for 15 months without renewal of the rawhide pinions. A brake of the friction clutch type is employed on this vehicle, requiring

only a slight movement of the lever for its application, and holding equally well for forward or backward movement of the carriage.

The two-wheeled vehicle built by A. B. Holson, which was described in detail in a recent issue of the Western Electrician, was on exhibition, and was one of the features of the show.

The Porter Storage Battery company of Chicago entered a vehicle equipped with the Porter battery. This vehicle was a light road wagon, and it was asserted that 60 miles could be made upon one charge, the company undertaking, for a small amount, to guarantee the maintenance of the battery for five years.

CHICAGO AUTOMOBILE EXHIBITION.—EXHIBIT OF THE HEWITT-LINDSTROM MOTOR COMPANY.

Sipe & Sigler of Cleveland exhibited a line of Willard automobile storage batteries, showing specimens of new and second-hand plates besides several assembled cells. A small charging switchboard formed part of this exhibit, which was a part of that made by Ralph Temple of Chicago.

An extensive line of steam carriages was shown by the Mobile company of America. Besides the ordinary stanhope type, this company had at the show a dos-a-dos, seating four passengers, which, on account of its attractive finish, novelty in design and smooth-running qualities, was one of the most popular vehicles on the track.

The Reading steam carriage, built by the Steam Vehicle company of America, was to be seen in operation throughout the week, and the novel engine employed to drive this vehicle was the object of much investigation. The type most used for light steam carriages is the two-cylinder, upright, double-acting, slide-valve engine, the cranks being on the same shaft and placed 90 degrees apart, and the two slide valves being driven through a link motion similar to that employed in locomotive practice for reversing the engine. This requires four eccentrics. In the Reading carriage the engine is a radical departure from the usual design. Arguing that with the high steam pressures commonly employed, a stuffing box is likely to be a source of constant trouble, the builders have adopted a four-cylinder, single-acting engine with trunk pistons. The cylinders are upright, arranged so that their centers constitute the four corners of a square, and the connecting rods operate upon two separate crank shafts geared together, the cranks upon each shaft being 90 degrees apart. A single rotating disk valve, containing three steam ports and three exhaust ports, distributes steam to the four cylinders, being placed upon the top of the engine, partly covering the four cylinder heads, in which are the cylinder ports. This arrangement eliminates all eccentrics for driving valves, and the engine is reversed by an angular displacement of the common valve. The vehicle was operated throughout the show without accident, and apparently required little attention.

Prominent among the exhibits of steam vehicles was that of the Milwaukee Automobile company. There were shown in this section a skeleton steam carriage, including merely the running gear, boiler, engine and air and gasoline tanks, a four-passenger surrey, several single-seated stanhopes, a light delivery wagon and a heavy steam truck, said to be the largest steam truck in this country. The exhibit also included a racing carriage which has a record of half a mile in 27 seconds. The surreys made by this company are controlled entirely from the rear seat, and the gasoline is fed to the burner under air pressure furnished by a small automatic air pump. Small electric lights are placed at the water glass, steam gauge and air gauge for use at night.

A Century steam carriage, with bevel-gear transmission, was shown in the exhibit of Ralph Temple.

Among the gasoline vehicles, the motorette made by the De Dion-Bouton Motorette company of Brooklyn occupied a prominent position. Several vehicles of this make were shown, and their graceful lines and ease of control excited favorable comment on all sides. The three-wheeled Knox and Friedman machines were also admired for the facility with which they were handled, and the Loomis gasoline vehicle deserves mention for its compactness.

On the evening of Tuesday, March 26th, the track was prepared for obstacle races, and it was here that the excellent steering qualities of the low three-wheeled machines were made evident, the Friedman gasoline vehicle winning easily. Thursday, March 28th, was the date of the floral parade, and prizes were offered for the best decorations. Roses, ferns and calla lilies were liberally used, and the line of vehicles, traveling slowly around the track, presented an extremely attractive appearance. The first prize was awarded to Albert Shaw, driving the steam dos-a-dos of the Mobile company previously mentioned, and the second to Mrs. M. E. Cook, who operated a Reading steam carriage.

In the northeast corner of the building a machine similar to a bicycle "home trainer" was erected for speed trials. Two platforms, side by side, were fitted with wooden rollers mounted upon Moffett roller bearings. These rollers were intended to support the vehicles and be driven by them. A large dial fitted with two pointers served to register the progress of the trials, the pointers being so connected with the supporting rollers that one revolution of the former represented a distance of 80 rods traveled by the carriages on the stand. Races and speed trials were held nightly.

A feature of the exhibition gratifying both to the exhibitors and to the management was the number of sales resulting directly from the opportunities of comparison offered by the many exhibits. As the show progressed favorable comments became more and more numerous, until at the end of the week it was stated that upward of 65 vehicles had been sold, and a petition sent to Manager S. A. Miles by several exhibitors, asking that the show be kept open on Sunday, March 31st, was granted. This was the last day of an entirely successful exhibition.

CHICAGO AUTOMOBILE EXHIBITION.—EXHIBIT OF THE ELECTRIC VEHICLE COMPANY.

Should Central Stations Furnish Incandescent-lamp Renewals Free?[1]

By C. A. Vallette.

This subject seems to have created a deep interest in central-station management in all parts of the country.

When municipal electric-light plants were first installed, promoters and contractors for this system of lighting generally adopted the method of free lamp renewals, but investors and owners of electric-light plants have begun to question the correctness of their theory by adding lamp renewals to the item of maintenance. When this subject was assigned to me I received shortly thereafter a number of pamphlets on free lamp renewals, the gist of which is about as follows: One system of supplying lamp renewals is to allow the customer to purchase his lamps where he would. Another system is to sell lamps to the customer at a small profit. Another was to sell them at a slight reduction of cost, at a price merely to control the lamp used by the consumer. Another system was to furnish the lamp renewals absolutely free when burnt out, or deteriorated to about 12 candlepower. A system in use in Bridgeport and New Haven, Conn., was to overhaul all lamps in use at regular intervals and change them, then pass them through a photometer to determine the actual candlepower, and those which were 13 candlepower and above were replaced among customers at the next overhauling, along with other new lamps. The object of free lamp renewals is principally to maintain the candlepower of the lights, to promote the use of light by new customers, and generally to increase the business of lighting by making it popular with the public, whose servants we are. All the pamphlets I have received are reprints of papers read before different associations and favorable to the manufacturers of or dealers in incandescent lamps. I have seen none who have argued from the standpoint of an investor or owner of electric-lighting plants.

With this object in view, I mailed circular letters to the most important central stations in this state asking the following questions: Do you supply lamp renewals free? What is your average number of renewals per month? What is the average load in amperes? What are your rates for lighting by contract, with number of lights on same; by meter with number of lights on same? Why do you think your plan for supplying lamp renewals the best for your city?

I take it that the question whether lamp renewals shall be free depends altogether on local conditions; that the East is not the West; that Connecticut is not Illinois; that the people of Bridgeport, Conn., and of any country town in Illinois are so different in their habits, manners, tastes, industry and energy, that the same rule cannot apply to both. Bridgeport, Conn., is an enterprising manufacturing town, and the country town of Illinois is made up of the plain, plodding farmer, and too much enterprise would confuse him. No number of free lamp renewals would

1. Paper read before the Illinois State Electric association at the recent convention in Champaign, Ill. Mr. Vallette is secretary of the Edwardsville (Ill.) Light and Power company.

extend the business of electric lighting in such a town. He would look upon it simply as so much money saved.

Besides free lamp renewals being an item of expense or maintenance of lines, it is part of the cost of furnishing lights and should be estimated in the rates for lighting. And rates for lighting depend upon the cost. And whether it is good policy to furnish free lamp renewals depends also on the fact of a comparatively full load of the machinery in operation, independent of the rates. For instance, a plant operating one 100-horsepower boiler with 100-horsepower engine and 60-kilowatt dynamo, with an average load of 40 kilowatts, could afford to make a lower rate and perhaps furnish free lamp renewals. On the other hand, if the average load is one-third or one-fourth the capacity with good rates for lighting, he might then furnish free lamp renewals. Or, if the lighting was all furnished by meter and not by contract, free lamp renewals might be furnished.

In response to my circular letters, I have received 17 replies, not many of whom answered all questions propounded. Four answered the first question in the affirmative; the remaining 13 replied that they did not furnish lamp renewals free. Two only gave an estimate of the number of lamp renewals per month, and two more only seemed to have kept an absolute record. One man who stated that he furnished lamp renewals absolutely free said that he had found it a bad practice. All who sold lamp renewals stated that they were satisfied, as well as their customers, with their arrangement and seemed to indicate that it was no detriment to their business. As a rule, to charge for lamp renewals was satisfactory, and free lamp renewals were demoralizing to the business. All corporations and individuals act for their best interests as well as the interests of the community in trying to extend their lighting business, but at the same time keep their operating expenses at as low a point as possible consistent with good business management.

There is one feature, however, to commend free lamp renewals, and that is the maintenance of candlepower and the popularity of the service, which the introduction of Welsbach gasoline lamps has somewhat disturbed.

In the question as to the number of lamp renewals, I have already stated, judging from the answers, none seemed to have kept an accurate record, but to get at some data, which I trust will be beneficial to you, I submit a conclusion from the Edwardsville plant, taking the month of October, 1900, as an average month for the year. The lamp renewals for that month, had they all been furnished free, would have cost the company 1½ per cent. of the total receipts from incandescent lighting and .9 of one per cent. of the gross receipts of all kinds. In Edwardsville customers who own their wiring pay for their lamp renewals; and to customers who do not own their wiring the company furnishes lamp renewals free. Had there been a system of free lamp renewals, after the lamps were either burned out or had deteriorated to less than 13 candlepower, the percentage would have been much higher—three or four per cent. of the incandescent receipts. In one city plant that furnishes free lamp renewals, the value of the same is 2½ per cent. of the incandescent receipts. By way of comparison, carbon renewals for the month of October amounted to 7½ per cent. of the receipts from arc lighting, or 2½ per cent. of the gross receipts of all kinds, and including the expense of trimming same, 36 per cent. of the receipts of arc lighting, or 12 per cent. of the gross receipts.

It has been assumed by some expert accountants that when the operating expenses of a country electric-light plant exceed 65 per cent. of the gross receipts, operating expenses should be curtailed.

I submit, then, a conclusion from a strictly business point of view: That 1½ per cent. of the receipts from incandescent lighting for free lamp renewals is not a heavy charge on the maintenance of lines. As we are in the business of lighting, and not dealers in incandescent lamps, if it is necessary to sell lamps to keep down expenses, the price per lamp should not exceed the actual cost, the object being mainly to control the apparatus to be used. In the item of maintenance of plant or lines is included the labor and material used in replacing them, and, in fact, all material of original construction and the carbons used for daily lighting and the labor of lamps.

Light is supplied through the carbons in the arc lamps and through the carbon filament in the incandescent lamp. It is not only your right, but your duty, to use a carbon that will supply the best and most economical service in the arc light, which should be within your control, so too with the incandescent lamp. It is a matter of supplying light, and it is to your interest to control the character of the incandescent lamp as well. The lamp is the vessel through which the current is measured, and the meter the instrument that records it. It is intended that a lamp should be used that will measure a uniform quantity everywhere on the circuit, both to prove the integrity of the meter and the wattage of the lamp. To accomplish these results the lamps should be supplied by the manufacturer of the current. For the reason that a grocer will use his own measures and weights over his counter, the manufacturer of electric current should have control of the arc and incandescent lamps that measure out the current to the customer who buys it.

Again, the manufacturer of electric current should control the lamps in use, in order to determine and maintain the candlepower of the lamp. If the customer be at liberty to purchase the lamps where he will, the electric-light company leaves the vessels of measuring current, as well as maintaining light, in the customer's hands, which you know is not good business policy.

To sum up, whether it is good or bad policy to furnish free incandescent-lamp renewals depends altogether on local conditions and on the operating expenses of the plant. Central stations should control all electrical apparatus, and if this control can only be obtained by furnishing free lamp renewals, then that practice should be adopted.

CHICAGO AUTOMOBILE EXHIBITION.—EXHIBIT OF THE WOODS MOTOR VEHICLE COMPANY.

CHICAGO AUTOMOBILE EXHIBITION.—EXHIBIT OF THE NATIONAL AUTOMOBILE AND ELECTRIC COMPANY.

Discussion.

W. E. Steinwedell, Belleville: A good 16-candlepower incandescent lamp should give about 600 hours' efficient service, and the cost of the current consumed in this time is more than 10 times the value of the lamp. There are several methods of furnishing free incandescent lamps by central stations, the chief of which are as follows:

1. Give a new lamp for every burnt-out lamp returned to the office.
2. Replace all the lamps connected two or three times a year, saving all over 13 candlepower.
3. Give one new lamp for every $3 worth of current consumed.

The last is undoubtedly the best method, as free lamp renewals can be most successfully furnished where the majority of current is sold by meter. A good practice is to renew one lamp for every $3 worth of current consumed. The flat-rate business can be taken care of according to the second method, and the first should not be practiced at all except in conjunction with either of the others.

D. Davis, Litchfield: I am in favor of free renewals. A company must go after and look after business, and the fewer bills presented to the consumer the better, since a company can generally afford to make renewals.

H. J. Pepper, Champaign: I do not believe that the public appreciates something that is given them all the time; they will not thank you even if you make a business of furnishing free renewals.

Traffic on Chicago Elevated Roads.

Traffic on the Chicago elevated roads was heavier during March than during any other month since the World's Fair. The Northwestern carried a total of 1,772,994 passengers during the month, or a daily average of 57,193, an increase of 1,937 over the daily average for the preceding month. March traffic on the South Side elevated showed a daily average of 76,269 passengers. Compared with 72,264 in March, 1900, it is a gain of 4,005. Metropolitan traffic in March amounted to a total of 3,048,500 passengers, a daily average of 98,338, as against 94,508 for the corresponding month last year. This is a gain of 3,830 a day.

Electrical Situation in Rochester.

Since the beginning of the year there has been much discussion of plans and rumors of plans relating to an extension of operations by the electric-light and power companies in Rochester, N. Y. This activity in Rochester electrical circles dates from the burning of the plant of the Citizens' Light and Power company last November. No sooner was the announcement made that the Citizens' company was engaged in installing new machinery in its reconstructed plant than the public was informed of the purchase of additional water rights on the Genesee River adjoining the plant of the Citizens' company by its rival, the Rochester Gas and Electric company. Then came the announcement of the purchase of a flour mill and the attendant water rights by the Citizens' company, followed by the news of the purchase of a mill

GEORGE W. ALDRIDGE, GENERAL MANAGER CITIZENS' LIGHT AND POWER COMPANY, ROCHESTER, N. Y.

and water rights by the Rochester company, and almost immediately afterward by the announcement that the Rochester company had thus secured 80 per cent. of the river water rights within the city. Then it was seen that the Rochester company was reaching out for even broader results when it became known that it had purchased water rights in the upper Genesee Valley in the vicinity of Honeoye Falls. The next move on the part of its rival, the Citizens' company, was the announcement of intention to construct a $2,000,000 power house on the site of the old Booth mills.

Close upon this announcement came the statement on March 25th that George W. Aldridge, former superintendent of public works of New York state, and very well known as a Republican politician, had been engaged as general manager of the interests of the Citizens' company in Rochester and other cities. The owner of the Citizens' Light and Power plant is the Young-Brady syndicate, which operates extensive lighting plants in Brooklyn and a chain of cities in Connecticut and New York state. It has close connections, it is said, with the Westinghouse interests of Pittsburg. Mr. Aldridge's duties are to look after the company's interests wherever they are found. His acquaintance and influence in political circles will, it is believed, be of much value to the company. In addition to a large salary, Mr. Aldridge is said to have acquired a considerable financial interest in the way of stock in the Citizens' company. His duties will not conflict with those of M. J. Warner, who has been in charge of the company's interests since the reorganization and during the re-establishment of the plant. Mr. Aldridge is not a technical man and will act as the personal representative of Messrs. Young and Brady in their electric-lighting deals throughout New York and other states.

Mr. Aldridge's connection with the extension of electric plans in Western New York is further shown in the announcement last week of the incorporation of the Batavia, Albion and Lake Ontario Railroad company, capitalized at $350,000, to construct and operate an electric railroad between Batavia and Point Breeze on the Lake Ontario shore, due north of Batavia, N. Y. Mr. Aldridge is the heaviest shareholder, with 60 shares.

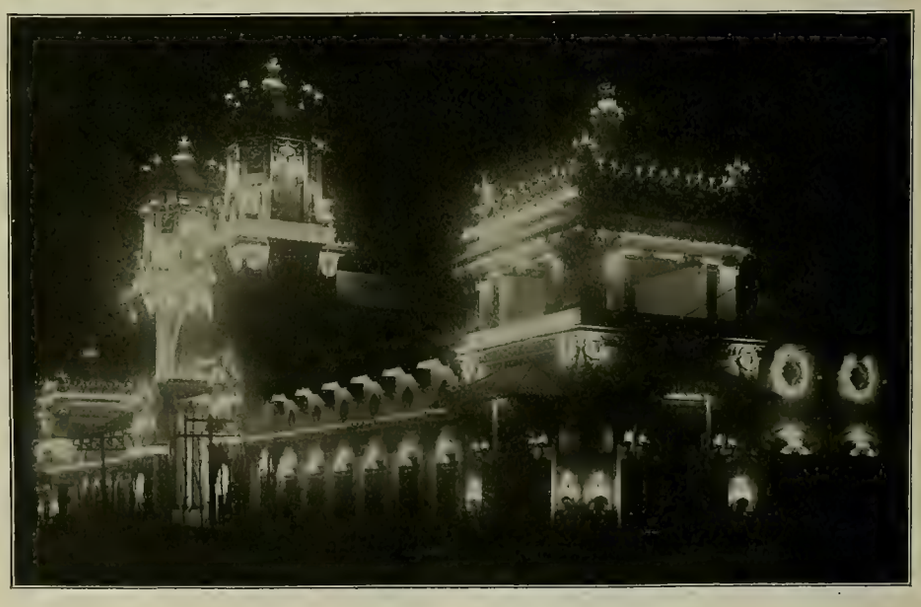
The Rochester Gas and Electric company, of which Mr. George A. Redman is the widely known superintendent, to meet the announcement of its rival that Mr. Aldridge had become general manager, allowed it to become known that it had concluded a deal by which a storage dam is to be built in Honeoye Creek for the purpose of increasing the waterpower in Rochester, of which this company says it owns 80 per cent. The situation has thus become interesting. Whether the outcome will be open warfare between the companies or an eventual consolidation seems to be yet undetermined.

Reynolds Elevator Patent Upheld.

In the case of the Otis Elevator company against Geiger, Fiske & Koop et al., Judge Evans of the United States Circuit Court for the District of Kentucky, sitting at Louisville, has granted a preliminary injunction restraining the defendants from infringing the Reynolds running-rope patent, No. 317,202, which was granted May 5, 1885, and is the basic patent on lever-device control of elevators. The defendants, like the plaintiff, are manufacturers of elevators, and the question at issue was whether the Reynolds patent was infringed when the lever device in question was attached to the rheostat of an electric motor rather than to the valve of a hydraulic elevator, as specifically mentioned in the patent. The defendants contended that inasmuch as the device was designed for attachment to a valve the patent did not cover its attachment to a motor controller. The judge thought differently, however, and issued the preliminary injunction sought by the plaintiff. The case is of considerable importance to manufacturers of electric elevators. Brown & Darby of Chicago appeared for the plaintiff and E. H. Hunter of Philadelphia and Augustus E. Wilson of Louisville for the defendants.

Pan-American Electricity Building Illuminated.

The Electricity building of the Pan-American Exposition has been under illumination, and the effect is represented in the picture. A correspondent writes: "The spectacle is one that thrills the heart and brings forth words of intense admiration. The beauty of the scene when the lights about the building are on is simply indescribable, and the few who have witnessed it were amazed at the effect of the turning on of the current. It is anticipated that the building under illumination would be a grand feature, but the splendor has surpassed all expectations, and the men who have had charge of it have built better than they knew. So grand is it that visitors to the exposition may anticipate looking upon the finest structural illumination they have ever seen. The lamps have been so cleverly placed that the staff effects and the rare architectural beauty of the building are brought out in magnificent shape. In this building a climax has been reached, which it will be hard to surpass, and all who see it will agree that it is well named the Electricity building."



PAN-AMERICAN ELECTRICITY BUILDING ILLUMINATED.

It is stated that the Utica (N. Y.) Belt Line Street Railroad company has been sold to a Cleveland (Ohio) syndicate, represented by Horace R. Andrews and Paul T. Brady. The syndicate is the same that has recently been acquiring street-railroad property in various parts of the country. The Standard Oil company and Senator Hanna are said to be behind the deal. The new owners of the local property will parallel the New York Central tracks from Little Falls, 22 miles east of Utica, to Sylvan Beach, 30 miles west. Nearly $1,000,000 will be expended in improvements.

Company Furnishing Electricity Not Liable for Fire from Faulty Wiring by Others.

"A case without a prototype," is the way the Court of Appeals of Colorado characterizes the action brought by the National Fire Insurance company and 10 or 11 other insurance companies to recover from the Denver Consolidated Electric company the amount of something like $60,000, which they had to pay for the loss from a fire that broke out in the Union depot, in 1894. The court remarks that, otherwise than by a sort of guess, there was nothing to show that the fire came from the electric current, but it says that, for the purposes of this decision, it is quite willing to assume that it did. But even then, it goes on to state, there were many reasons why the judgment rendered in favor of the electric-light company must be sustained.

There was no competent evidence which established any responsibility on the part of the electric-light company for the original wiring or for its inspection. The wiring was done by a concern with which the electric-light company had no connection. The depot company hired it and paid for the work, and the construction company, and it only, was responsible to the depot people for the character of what was done. Manifestly, under these circumstances, the electric-light company, the court declares, could not be held for any defect either in the character of the material used, or in the negligent and unskilful performance of the work. To state the evidence and to state the situation, it thinks, was to dispose of this proposition.

Nor does the court assent to the position which the insurance companies took—that the electric-light company had no business to deliver the current without informing the depot company of the danger attending its use, and particularly of the danger attending its use where the wiring was defective or its construction unskilful and negligent. To the contrary, it holds that where persons undertake to wire their own property, and then apply to a light company to deliver a current to light the building, they must be assumed to take all risks resulting from the character of the wire which is put in the building, and the method of construction which is adopted in putting it in. It is a matter of common knowledge that an electric current is dangerous, and must be discreetly and prudently handled in order to avoid danger either to life or to property. And the court is quite ready to concede that, when an electric-light company undertakes to supply a dangerous current to a dwelling house or to a building, it is bound to see that the wires it puts in and the connections it makes are properly insulated and protected, so that no harm will come to the property. But where the company is only employed to deliver the current by connection with wiring already made by the individual who owns the property, it seems to the court that the company's responsibility ends when the connection is properly made under proper conditions, and it delivers the current in a manner which will protect both life and property. It does not believe that any such responsibility rests on the company as to require it to advise the persons who apply for the connections that they must see to it that the wiring is of a certain class or description, that it is insulated in a particular manner, and that there is no connection between it and the woodwork, and, failing in this, that the company will be liable for any damages which may happen because of the negligent or unskilful nature of the construction.

When persons wire houses, they are supposed to have done it intelligently, and to have hired competent persons for the purpose, to whom alone they must look in case the work is improperly and unskilfully done. Wherefore, the court thinks that the affirmance of the judgment of the court below in

favor of the electric-light company can be very safely rested on the broad proposition that the company had nothing to do with the furnishing of the wiring which was put into the building, or with its attachment to the structure, and, if any injury happened or a fire broke out because of defective wiring or negligent construction, it was a matter for which that corporation could not be held responsible.

The Double-trolley Automobile.

Considerable attention is given in France to an electric automobile without storage batteries, operated over a fixed route from a double trolley. This rather curious system does not require the grading and

FIG. 1. DOUBLE-TROLLEY AUTOMOBILE.—GOING STRAIGHT AHEAD.

track construction of a railway, being operated over any ordinary road having the requisite overhead construction, and it has considerable radius of deflection in turning out for other vehicles or obstructions in the road. It is the invention of Mr. Lombard-Gerin, and the following particulars are taken from l'Industrie Electrique:

M. Lombard-Gerin's invention is not entirely new, inasmuch as the double trolley has been used before for the purpose; but his is a novel improvement upon what had been done previously. The problem which the inventor says that he has solved, of being able to deviate from the perpendicular of the trolley line 20 or 25 feet to right or left, was experimentally shown on a line along the left bank of the Seine, having a length of about one kilometer.

Fig. 1 shows the voiture on its direct line. Fig. 2 shows the same vehicle, having deflected to the left

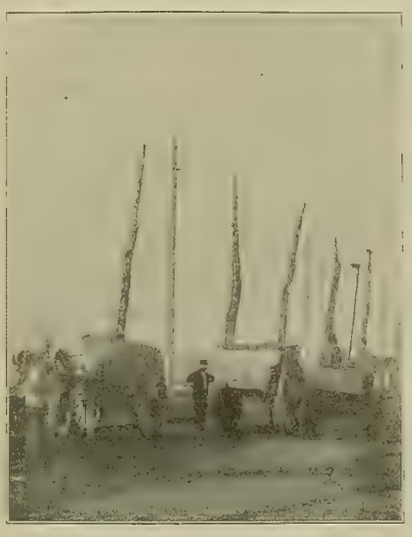


FIG. 2. DOUBLE-TROLLEY AUTOMOBILE.—TURNING OUT FOR ANOTHER VEHICLE.

to pass an obstruction. [The perspective in these pictures is deceptive. The vehicles are quite in the foreground.]

The initial idea of the invention consists in making the trolley an automotor. This he accomplishes by means of a small asynchronous induction three-phase motor of the squirrel-cage type. The three-phase currents are produced by the motor of the vehicle itself, through three rings, which are connected, as shown in Fig. 6.

The double trolley, with its motor, is, of course, governed by the motor proper, and its speed is proportioned directly to that of the governing motor. This double trolley has been named "mouton" (sheep).

Fig. 5 shows the mouton, while in Fig. 6 are shown the connections. Figs. 3 and 4 are longitudinal and lateral views of the mouton.

In the experimental test the aerial line was of two parallel, bare copper conductors of eight millimeters' diameter, between six and nine meters high, held by supports, as shown. These conductors were capable of making curves, angles and changes of elevation readily, and were held apart a distance of 30 centimeters. Special supports for the wire were so arranged as to readily permit the passage of the two trolley wheels.

The trolley wheels (G), Figs. 3 and 4, are of aluminum, and lead the current to the vehicle, through a cable eight or 10 meters in length, made up of six conductors, two of the largest of which carry the current to the motor, and the other four actuate the trolley automotor, or mouton. This cable is attached to an upright pole, the summit of which is four meters above the road. The contacts are so arranged that the pole can be instantly disconnected from the trolley wires, and in the event of meeting another trolley an exchange of poles requires but a momentary stop.

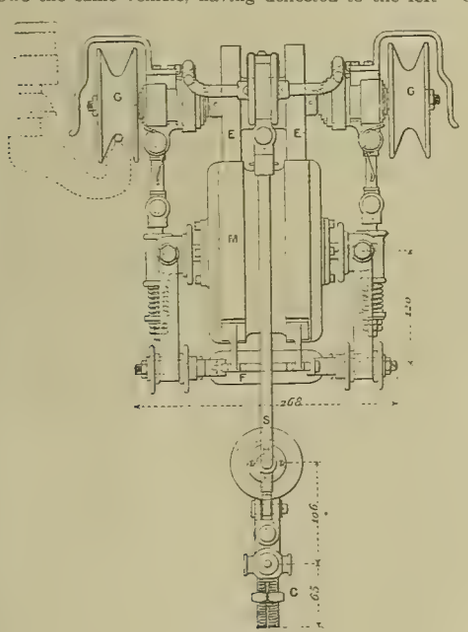


Fig. 3. Transverse View.

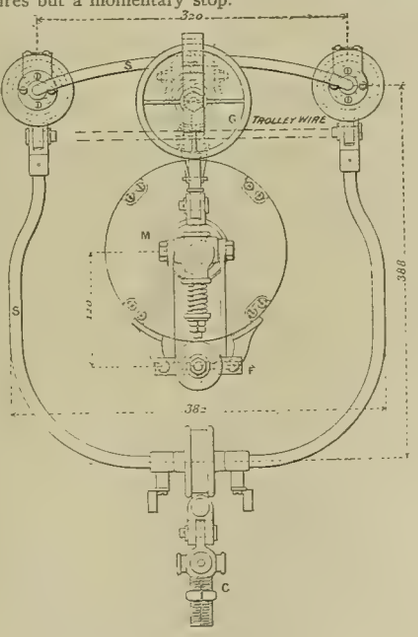


Fig. 4. Lateral View.

DOUBLE-TROLLEY AUTOMOBILE.—THE "MOUTON" OR TROLLEY.

The mouton is entirely constructed of aluminum save the magnetic parts, and is of but 18 kilograms in weight, while it absorbs hardly 500 watts at its highest speed. The vehicle is fitted with magnetic brakes (F), controlled by a foot pedal, which closes the circuit when depressed, and is capable of reversal and speed control.

It is claimed that there is a large field for the use of this form of automobile for the carrying of passengers and light freights from the terminals of trolley lines where the traffic is not sufficient to justify the construction of a street railroad. In this way the invention may prove a feeder, and in time create a demand for a street track connecting suburban communities.

Commissioner Allen Sworn In.

Frederick I. Allen, successor to Charles H. Duell as commissioner of patents, reported at the Interior Department on March 30th. He was sworn in and was presented to the clerks of the bureau. His attention was called to the resolutions adopted by the recent convention of the Independent Telephone association at Indianapolis, wherein the association protested against Mr. Allen's appointment on the ground that he was a Bell telephone man. Mr. Allen said he understands the resolutions were to be forwarded to Washington and he did not care to discuss them before they arrived. "But the idea that I am

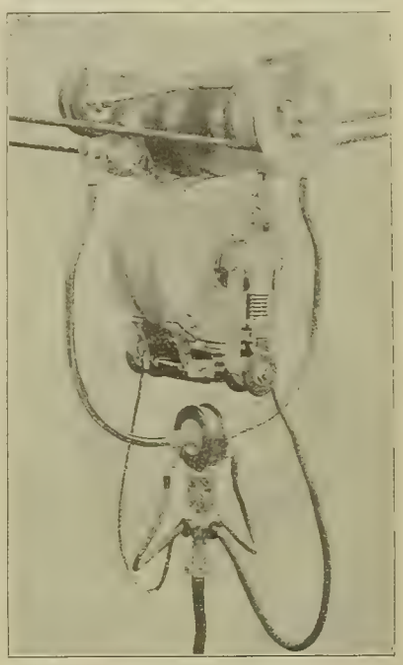


FIG. 5. DOUBLE TROLLEY AUTOMOBILE.—THE "MOUTON."

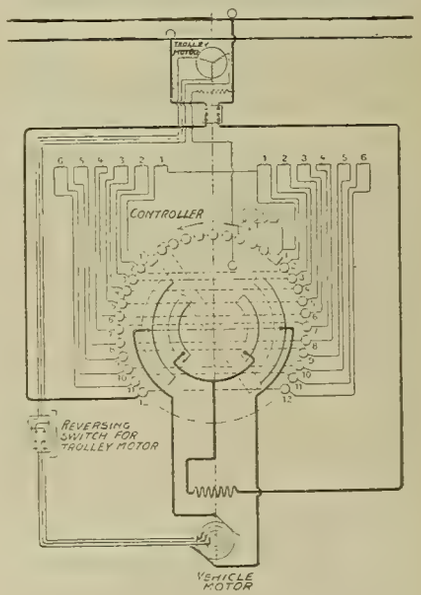


FIG. 6. DOUBLE TROLLEY AUTOMOBILE.—DIAGRAM OF CONNECTIONS.

in any way connected with the Bell Telephone company, is altogether without foundation," he said. "I am not now and never have been either an agent for or a stockholder in the Bell Telephone company, I should be ashamed to undertake the commissionership if there was any likelihood that any corporation should be favored at my hands. I was at one time a stockholder and director of the Empire State Telephone company of Auburn, N. Y., which was a subsidiary branch of the Bell company, but I have completely withdrawn from that concern."

The City Council of Columbus, Ohio, is considering an issue of $132,000 bonds for lighting purposes.

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CONVENTIONS AND EXPOSITIONS.

Southwestern Gas, Electric and Street Railway association, Rice Hotel, Houston, Texas, April 19th to 22d.

Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Boston, Mass., June 19th.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

It is rather amusing to see the proposed discontinuance of the electric-cab service of the Illinois Electric Vehicle Transportation company of Chicago attributed to the condition of the streets by some of our technical contemporaries as well as by many of the daily papers. The streets of Chicago have many things to answer for, but they contributed little, if anything, to the troubles of the company named. There were two electric-cab companies in Chicago, and one of them is about to go out of business for the assigned reason that the enterprise was not a paying one. The other company is still doing business, and although it is probably not making a great deal of money, it is certainly in existence and furnishing service. The streets of Chicago are dirty, but they are remarkably level, and in that respect favorable to the operation of electric automobiles. The fact of the matter is that the troubles of electric-cab companies in Chicago, Boston and other cities are largely due to inexperience in maintaining batteries and tires. The business is a new one, perhaps too zealously exploited at first with the ardor of over-confidence, and its promoters have learned a great deal by experience. With all the drawbacks of the storage battery, we believe that the electric vehicle supplied for hire has a future in Chicago. Possibly some mistakes have been made at the outset in maintaining the service and catering to the trade, but they will be retrieved. Prudence comes from knowledge and knowledge comes from experience. If, as Mr. Condict is reported to have said, the day is not far distant when horse-drawn vehicles will be forbidden the use of the streets of New York, Chicago will certainly continue to enjoy the benefits of the modern method of locomotion. The automobile has come to stay, and we believe that the electric cab will be perfected and play its part in the development of the horseless carriage. But while in the difficulties of the early stages, let us be candid and avoid heaping undeserved censure on the long-suffering streets of Chicago.

In a paper read before the New England Waterworks association last December by Mr. A. A. Knudson of New York, the writer took a radical position as to the remedy for the electrolytic action of stray electric-railway currents on underground piping systems. Mr. Knudson is a member of the American Institute of Electrical Engineers and has paid considerable attention to this subject. He says that the simple and drastic remedy of substituting the double trolley for the single trolley is the only one sure to be efficacious. "Partial relief may be obtained at acute points by careful attention to the track returns," says Mr. Knudson, "but it is apparent that the injury to water mains will continue so long as one side of the railway circuit is in contact with the earth, and any part of the current can find its way into the water pipes. A complete metallic circuit, entirely insulated from the earth, is the only real remedy. Such a system has been in successful operation for years, overhead or underground, in Cincinnati, New York, Washington and the District of Columbia. Nothing stands in the way of its general adoption except the hostility of the electric-railway companies and their political influence in municipal affairs." Mr. Knudson seems to overlook such objections as increased difficulty of operation at switches and crossovers and the decided repugnance of dwellers in cities to the multiplication of overhead wires, the tendency being, indeed, all the other way. "We are aware that it will entail more or less expense upon railway companies in making such a change," he continues, "and we are also aware that they will derive a benefit in increased economy in operating, which should mean a corresponding increase in dividends; hence there should be no great opposition on the part of the railway companies to making such a change." As a matter of fact, however, the companies will undoubtedly make great opposition to the change, while the existing esthetic objection to the overhead-trolley wires will be doubled. Mr. Knudson's remedy is a complete one—ideal in its efficiency, no doubt—but it can hardly be considered a practicable one.

Is it not true, however, that the danger from electrolysis is often overdrawn? We find that in the discussion of Mr. Knudson's paper Mr. Robert J. Thomas, superintendent of the waterworks of Lowell, Mass., said that his city was especially fortunate in not having any trouble "to speak of" from electrolysis. Said Mr. Thomas: "The first road was equipped with electricity in 1889, and we have found up to this time comparatively little trouble on account of electrolysis. In talking with the general manager of the road on several occasions, he has told me that the reason of it is the perfect or almost perfect bonding of the rails, and also the connecting of a return wire with the rails in various places along the line. Up to within two years ago we didn't have a single instance of trouble that I know of. Since then we have had a few cases where service pipes have corroded, which I could only account for as due to electrolysis. In every instance of that kind we have found that the pipe was eaten away under a conduit which was laid by the New England Telephone company."

A perusal of the discussion gives one the impression that the waterworks engineers were disposed to be more lenient with the electrical companies than the electrical engineer who was addressing them. Mr. F. N. Connet of Providence, R. I., made this point: "I think there is considerable danger that, with non-experts, plain corrosion will be mistaken for electrolytic action. I recall some photographs that I saw some years ago of rails that were taken up from a tunnel on the Lehigh Valley road in the western part of New Jersey. These rails when laid were about 60 pounds to the yard, and they had been corroded in a very few years, till the weight was only about 30 pounds per yard. Now, if that had happened to-day, everybody would have said it was due to electrolytic action, but I think there was no electricity within 25 miles of that tunnel. In that case it was due to the absorption by the moisture of the sulphur from the locomotive gases and the formation of a sort of weak acid solution. The photograph of those rails looked exactly like the photographs that Mr. Knudson has shown us this afternoon. I suppose that an expert can determine the difference between corrosion and electrolytic action, but I think there is great danger that some of the rest of us might mistake the one for the other."

So it seems that what looks like electrolysis is not always due to electricity and that proper bonding and return wires still work wonders in getting the current back to the power house. The adoption of the double overhead trolley is still some distance in the future.

Some zealous Independent telephone men object to the appointment of Mr. Frederick I. Allen of Auburn, N. Y., as commissioner of patents on the ground that he is interested in Bell telephone enterprises and therefore disqualified to be impartial in questions affecting telephone patents. Mr. Allen explains that, while he was at one time a stockholder and director in the Empire State Telephone and Telegraph company, he is no longer connected with that company. Moreover, he hints that his experience leads him to believe that local stockholders in subsidiary Bell companies are not especially friendly, as a rule, to the parent organization. This is undoubtedly true, and it may be further remarked that if the Independent movement were deprived of the services of former Bell stockholders and employes it would lose a very large proportion of its strongest men.

Of course, the commissioner of patents must be impartial in telephone matters, as in all others coming before his office. He must know neither Bell on the one hand nor Independent on the other. We are not qualified to speak of Mr. Allen's attainments and predilections—indeed, we think the appointment was something of a surprise to patent attorneys, inventors and others having business with the Patent Office—but unless there is a more valid objection to him than any that has been made public, we think that the Independents will do well to let the matter drop. It is unfortunately true that non-Bell telephone men have had unpleasant experiences with the Patent Office in days gone by. But it would be manifestly unjust to hold Mr. Allen responsible for the delays and vexations of former years.

Mr. Allen is now commissioner of patents, and as the Senate is not now in session his appointment will not come up for confirmation for several months. His selection was due to the two influential senators from New York, and it would probably be a difficult matter to secure enough votes to insure the rejection of the appointment. We trust that Mr. Allen will give an absolutely impartial administration of the Patent Office, and we have no reason at the present time to doubt that he will do so.

Training of Electrical Engineers.[1]

By John T. Nicolson, D.S.C.

Electrical engineering differs from the other branches of the profession of the civil engineer in being based on theoretical principles whose application gives predicted results, which closely accord with those practically obtained, and in this department we have not been so notably troubled with a division into the two camps, of which we have heard so often, of those who believe in theory and those who believe in practice. The reason for this difference from the civil, mechanical or mining branches of engineering seems to lie in the circumstance that, in electrical engineering, practice has been largely directed by a consummate theory, whereas in other departments theory has, at its best, only endeavored to understand and explain practice.

The other distinguishing feature of electrical engineering which must be carefully borne in mind in the same connection is the unparalleled growth of electrical industries in the last 10 or 15 years and their present increasing rate of development. So much is this the case that the task of keeping the professional training of the students of this branch of engineering abreast of current practice seems also a hopeless one. This raises the all-important question, whether it is within the province of engineering schools or colleges to impart technical instruction, properly so-called—to supply, viz., up-to-date information as to the practical details and processes of manufacture of machines, and to give instruction in such like mechanical arts—or whether it is their duty rather to confine themselves to the scientific principles that underlie engineering in general, and its several branches in particular.

I think the proper answer to this question has now been found in the general adoption of the laboratory as the proper adjunct and complement of every first-class school of applied science. Without the means of making experiments, the study of applied mechanics was closely analogous to and, in fact, was an extension of the study of rational or theoretical mechanics. There were then certain data conceded as founded upon professional experience, and the course of instruction was confined to the consideration of the results flowing from reasonings based on these data, and to the working of problems and exercises in the application of these theories which were intended to form an introduction to the actual office work of the engineer in practice. It must be allowed that much of this excellent work is still and will always be necessary. Resting on a strong foundation of mathematics, physics and chemistry, the knowledge of the engineer must always include such pure sciences as those of kinematics, dynamics, hydrodynamics, thermodynamics and electrodynamics. A sound elementary acquaintance with all of these is necessary, and a specialized knowledge of that one more particularly useful to the engineer in his own branch must be obtained. It is, for instance, quite hopeless to try to explain to a man who has no knowledge of dynamics upon what principles one proceeds in endeavoring to balance a locomotive. No amount of laboratory experiment will enable him to dispense with a knowledge of the mechanical principles involved. Again, the fundamental principles of thermodynamics may not be of much use in helping a man to fix the size of the cylinders of a steam engine, but they will at all events keep him from wasting his time in trying to design a perpetual-motion machine; and they will show him how far he can hope to go in the direction of the improvement of his heat motors or other energy transformers.

But the province of the laboratory in the scheme of engineering education is: First, to extend scientific knowledge by providing more experimental data; and, second, to show to the student the scope, value and limitations of the theories he has studied in the classroom. Without laboratory work, the young engineer is in danger of supposing that an engineering problem has been solved when a certain mathematical solution has been obtained from a basis of given physical assumptions. The critical or engineering sense is not developed in the classroom. The student cannot be expected to know which of the assumptions underlying his mathematical work is really close to practice, and which other, although the best that can be made, is far from being true. Since applied mechanics, or engineering, is not a complete science, but is constantly being revised as to its data and being added to as to its experimental laws, it is not sufficient to deal with it as with an abstract science having immutable laws and finally reasoned-out consequences; on the contrary, the young engineer must be trained to exercise a salutary scepticism as to all generalizations from experience, and, as far as possible, to prove things in detail for himself.

Reverting to the question of instruction in up-to-date engineering practice, it may be added as the third function of the laboratory—and more especially of the electrical engineering laboratory—that it should contain machines and instruments of the newest types procurable which may serve as object lessons on the general trend of electrical engineering design. To avoid becoming an old curiosity shop, it will be necessary in most schools to rely upon the assistance of manufacturers who are willing to lend their recent patterns of machines to the laboratory for testing and examination purposes for a reasonable time, in return for the supply of the experimental data and results obtained from the machine under test.

At the commencement of this paper reference was made to two features which distinguish electrical from other branches of engineering. From these it would appear that, of the three uses of the laboratory in the school of engineering just mentioned, obtaining new experimental data, and the exemplification of recent practice in design are of the greater importance in electrical engineering laboratories, inasmuch as the more closely a theory already seems to approximate to the actual phenomena obtained, the smaller is the need for overhauling this theory by checking its results by means of laboratory work. Yet one might argue that this close agreement only shows that the smaller and more intricate variations of the natural from the assumed laws are nearer to discovery, and that a closer examination and study of the phenomena and more refined experimental work have become necessary. In any case, the personal verification of the data of his subject is very necessary for every student as a good working foundation to build from, and as being the surest way of obtaining a real knowledge of and love for his adopted profession.

I am, I suppose, to-night expected to state what I should consider the best or ideal training one would give to a youth entering the electrical engineering profession, if the choice were open. In reply, I say, in the first place, that in the case of a really clever student whose heart is in his work, it is my experience that his course or mode of training matters very little. Even if he be trained on a very bad system, or not trained at all, he will acquire all the knowledge and experience he needs in spite of and in the teeth of the bad training. The desire to know and the love for his subject is enough for him. But for the ordinary youth of mediocre abilities, whose inclinations have to be carefully coached in the right direction, and his all too-easily flagging energies husbanded as much as possible, the sequence of his physical and mental treatment is of real importance.

In the first, place I hold strongly the opinion that, after leaving school, the boy who intends to become an electrical engineer should first spend at least two years in the workshops of a mechanical engineer. Here he will learn the elements of smithing, molding, pattern making, fitting, machine work and erecting. In this time he cannot help picking up the names and appearance of the common implements and processes fundamental to all kinds of engineering practice. A boy of 16, having just left school, has for a time had enough of bookwork, and will turn gladly, and with great advantage, to the complete change the workshop affords him. Here I may seem to be at variance with the views expressed by Professor Perry in his recent address; I would point out, however, that the workshop course here proposed is merely the preliminary or first part of the student's professional training. If he has left school with the usual stereotyped stock of Euclid, algebra and elementary physics and chemistry, I would have him take mathematics, physics and chemistry classes in the evenings, but more especially mathematics, during these two years of workshop practice. Classes ought to be everywhere organized to teach mathematics for engineers in the manner proposed by Professor Perry, so as to enable such a boy to learn as much useful mathematics as possible in the short time he has available. I should advise the addition of another year of workshop practice in the shops of a dynamo manufacturer, if time permitted; but this will more usually have to be supplied by the laboratory of the college through which he must pass.

I have always found it extremely difficult to arouse in the case of boys coming directly from school to the professional college, a lively and intelligent interest in their subjects of study. Even with the help of a large and well-equipped college workshop they cannot get the relation of their work to engineering practice properly established. They fail to realize the important bearing the theoretical work they are doing has upon their future careers unless their curiosity has been first stimulated by a period of probation in the workshops, and a spirit of inquiry fostered by long-continued contact with actual engineering practice. I have had some considerable experience in these matters, having served a four years' apprenticeship, worked in a number of drawing offices, studied in one and taught in two other universities, and my experience, both as a learner and a teacher, leads me to recommend most strongly that, whenever possible, a period of workshop practice should intervene between school and college.

Having then put in two years in a mathematical engineering workshop, our ideal student ought to enter an engineering college at about the age of 18, and he ought to study there for not less than three years. The first year of this college course will usually have to be spent on mathematics, physics, chemistry, dynamics, mechanical, geometrical and freehand drawing, and the study of French and German, which is so necessary for enabling him to read foreign technical literature. In the second year the electrical engineering student must specialize in the physical laboratory in the direction of electromagnetic theory. He must study the magnetic qualities of iron and the hysteresis loss, and in doing so he must learn the construction of the instruments, such as the galvanometers, voltmeters and ammeters he uses in his work, and the methods of their calibration. All this experimental work should, of course, proceed hand in hand with instruction in theory and numerical exercises in the classroom, where he should be working at electromagnetism and the theory of the direct-current dynamo. In this same year he must apply a considerable portion of his energy to the study of thermodynamics and hydraulics and their application to steam and waterpower plants, and he should devote great attention to the study of machine design and mechanical drawing. The electrical engineer must have a special knowledge of applied electricity, but he must be above all an engineer and not a mere electrician.

In his final year, three-fifths of the student's time should be spent in the laboratories, one-fifth in the electrical engineering designing room, and the other fifth upon lecture courses connected with his laboratory work. About one-third of his laboratory time should be devoted to experiments on the strength of materials, on the simpler hydraulic phenomena, and to trials of steam engines and boilers. I think that at least 30 days of eight hours each should be spent in this way in his third year. Another third of the time spent in the laboratory in his last year would be occupied in completing the elementary electrical laboratory course he began in his second year. He would, after completing his work on magnetic testing, begin a study of the dynamo. For this purpose the laboratory would probably be provided with a number of direct-current dynamos of various types and styles of construction, of from two kilowatts' to 10 kilowatts' capacity, which can be operated either as dynamos driven from a constant-speed prime mover, or as electric motors. Using the ordinary commercial instruments, such as voltmeters and speed counters, he should determine the strength of the fields of these machines when the armature windings are known and the speeds and pressures measured. He should compare the results obtained from the machines when running with those calculated from their dimensions. This will give the student an idea of the control which his classroom theories require from practical results, and to what extent uncertainty enters into his estimations. Tests of the magnetic circuit of dynamos, the regulation of dynamos and motors with different forms of field winding, characteristic curves and efficiency testing should naturally follow; and it is an excellent plan to make the student draw up tables and make curves of the variations in the principal proportions of machines of different types and sizes, in order that he may obtain an idea of the changes involved by particular conditions of service and output.

The data of this kind available in an engineering school are seldom of the latest, unless the teacher spends his summer in obtaining them. The instructor in electrical engineering has, as already mentioned, the special difficulty of the newness and constant development of his subject to contend with; but if he follows the practice of every year visiting the plants of the manufacturing companies and typical light and power stations, information is obtained which cannot be found in engineering literature, and which has the highest value for educational purposes. The cultivation of close relations between the college and the practicing profession should indeed be part of the duty of instructors, and ought to be eagerly reciprocated by the members of the profession as one of the surest ways of meeting foreign competition. The professional status of the teacher of engineering in this country is not by any means so high as we find it to be abroad. In the Electrician of February 1st I read: "It is announced in Electrotechnische Mittheilungen that Herr von Dolivo-Dobrowolski, chief electrician of the Allgemeine Electricitäts Gesellschaft, is shortly going to St. Petersburg, to take over the direction of the new government electrotechnical institute there." The same journal states that "Herr Görges is giving up his position as engineer-in-chief of the firm of Siemens & Halske to fill a professorship at the Dresden Polytechnic." I have yet to learn of any appointment in a college or technical school in Britain whose attractions could induce its acceptance by the engineer-in-chief of any of our great companies. The fact is, the Germans and Russians have come to realize the value of the scientific and technical training they provide in their polytekniкums to the national industry and well-being, while in Britain we are still content to muddle along in our honest but stupid old way.

To return to our third-year student. The remainder of the second third of his laboratory time will be filled up by work in electrochemistry and alternating-current work. The former subject seems now to demand a laboratory equipment almost on a par with that of the dynamo room itself in a first-class school. The latter is usually better represented, and the enormous importance of polyphase currents in power transmission renders it necessary that every effort should be put forth to give sound instruction in this field. The effects of inductance and capacity are at the root of a large proportion of alternating-current phenomena, and the fundamental studies in this department accordingly have reference to the study and measurement of these properties. The object of the teacher must be to convey to the electrical student as lively and practical a working conception of inductance and reactance as that usually given him of Ohm's law and its results. The student should have at his disposal a number of coreless solenoids for the direct measurement by ammeters and voltmeters

[*Continued on page 243.*]

1. Abstract of a paper read before the Manchester section of the (British) Institution of Electrical Engineers on February 2, 1901.

DEVELOPMENT OF THE TELEPHONE FIELD.

Annual Meeting of the American Telephone and Telegraph Company.

New York, March 26.—The American Telephone and Telegraph company's annual meeting was held here to-day. Less than a dozen stockholders were present, and by a vote of 357,803 shares, the following-named directors were chosen: Charles W. Amory, Thomas B. Bailey, Edward W. Bell, Francis Blake, Charles P. Bowditch, George L. Bradley, John H. Cahill, Alexander Cochrane, T. Jefferson Coolidge, Jr., J. Malcolm Forbes, Henry S. Howe, Charles Eustis Hubbard, Charles F. Perkins, Thomas Sanders and Moses Williams.

James Phillips, Jr., W. W. Crapo and William A. Read received votes representing 6,889 shares.

William J. Ladd, Charles C. Jackson and Louis Curtis were appointed an auditing committee, and it was announced that a meeting of the board of directors would be held on March 28th in Boston to elect officers for the fiscal year.

Tribute to Mr. Hudson.

The annual report contains a tribute to the late John E. Hudson, former president of the American Bell Telephone company, who had been the attorney, general manager, vice-president and president of the corporation, and of whom it is said in the report that "in all these relations he displayed exceptional ability and sound judgment. He gained the respect and confidence of all who were associated with him, as well as of the public, and contributed in large measure to the successful development of the corporation of which he was so long president."

Statistics of Operation.

Operations for the year make the following comparative showing:

EARNINGS.

Year December 31st.	1900.	1899.	Increase.
Dividends	$3,846,822	$3,044,909	$ 801,913
Rental instruments	2,427,037	1,714,527	712,510
Telephone traffic	3,027,172	2,668,359	358,813
Real estate	31,825	42,285	*10,460
Interest	201,643	217,301	*15,658
Total	$9,534,499	$7,687,381	$1,847,118

EXPENSES.

General expense	$ 746,259	$ 591,826	$ 154,433
Legal	85,134	103,748	*18,614
Interest and taxes	1,376,200	1,234,276	141,924
Telephone traffic	1,840,848	1,487,022	353,826
Total	$4,048,441	$3,416,872	$ 631,569
Net	$5,486,058	$4,270,509	$1,215,549
Dividends	4,078,601	3,882,945	195,656
Surplus	$1,407,457	$ 387,564	$1,019,893
Carried to reserve	937,258		
Net surplus	$ 470,199		

*Decrease.

Balance Sheet.

The balance sheet as of December 31st shows:

Assets:	
Construction, equipment and supplies	$ 16,152,020
Telephones	4,311,928
Real estate	1,567 018
Stocks and bonds	71,719,324
Patent accounts	24,101
Machinery and tools	31,477
Cash and deposits	1,078,071
Bills and accounts receivable	5,240,640
American Bell Telephone company	22,110,400
Total	$122,234,983
Liabilities:	
Capital stock	$ 89,100,500
Surplus	1,813,199
Bonds	10,006,000
Reserves	2,416,363
*Bills and accounts payable	2,928,700
Contingent	15,970,210
Total	$122,234,983

*Of this amount $1,282,277 was for the dividends payable January 15, 1901, to stockholders of record December 31, 1900.

Growth of the Business.

The annual report states that "The year just passed rounds out the quarter century within which is compassed the discovery and application of the art of transmitting speech by telephone.

"Twenty years ago there were 47,880 telephone subscribers in the United States, and 29,714 miles of wire in use for telephonic purposes. At the end of last year there were 1,961,801 miles of wire employed for exchange and toll in service.

"There were, at the close of last year, more than 800,000 stations connected with the exchanges of our licensee companies, which exceeds the aggregate number of subscribers in all the countries of continental Europe. The number of exchanges and toll-line connections in the United States now reaches almost 2,000,000,000 yearly.

"The investment in line construction, equipment and supplies for this system, up to December 31, 1900, amounted to $16,152,022. The gross revenue from the toll traffic upon these lines shows an increase of 13.45 per cent. over the amount earned in 1899.

"By a circular, dated April 18, 1900, this company offered for subscription by its shareholders one new share for each five shares held.

"Of the total number of shares so offered (103,545), 103,018 were subscribed for and 52,175 shares were issued on August 1, 1900, and 50,843 shares on January 15, 1901; those remaining (527 shares) were sold by auction and issued in February, 1901.

"Collateral trust four per cent. bonds to the amount of $10,000,000 were sold during the year."

Berliner Case to Be Appealed.

There have been intimations since the Berliner patent case was decided that the company might enter an appeal and the annual report contains the authoritative announcement that "an appeal will be taken to the Circuit Court of Appeals from the recent decision of Judge Brown."

Extensions of Existing Plants.

Alexander Cochrane, president pro tem., says: "The past year has been one of marked progress, the increase in number of exchange subscribers having exceeded that recorded in any previous year.

"During the last three years the number of exchange stations has increased from 384,000 to more than 800,000.

"The expenditure to provide for extensions of the business throughout the country has been larger than that of any previous year. The new construction completed in 1900 by this company and the companies operating under our licenses amounted to $28,862,970. Of this sum, $21,914,542 was expended upon exchange construction and equipment, and $6,948,427 upon toll lines. In addition to the above, $2,349,103 was invested in real estate. The entire expenditure for construction, including real estate, to the close of the last year, has been $168,474,517.

"Estimates already made indicate that the extensions of operating plant during the current year will require further expenditure on a large scale."

Increase of Capital Stock.

In connection with the meeting, it is stated that Mr. Cochrane, when asked as to whether the $32,000,000 of American Telephone and Telegraph company stock now in the treasury of the American Bell Telephone company could be issued to stockholders, replied: "It could be, but I don't think it will be."

Further increase of the capital stock of the corporation is contemplated, but this matter was not under consideration in the meeting. While it is not announced how much the increase will be, it is understood that it will be a large figure. A special meeting, however, will be called at some future date to determine the matter.

Officers Re-elected.

Boston, March 28.—At a meeting of the directors of the American Telephone and Telegraph company, held in this city, to-day, the board of officers was re-elected. For the president's office, apparently no change is contemplated at present, and Mr. Alexander Cochrane, who accepted the position, with the understanding that his incumbency was not to be considered other than temporary, continues at the head of the corporation. Until the directors can decide upon a successor, therefore, the situation will probably remain as it has been since Mr. Hudson's death. B.

Erie Company Passes a Dividend.

The directors of the Erie Telegraph and Telephone company held their regular quarterly meeting in Boston, on March 25th. They authorized the following statement: "The report of the auditors now engaged in examining the accounts has not been received. In its absence the directors are not in possession of information to enable them to take any action upon the question of declaring a dividend." This action was expected, and it is asserted that it will be some time before the stockholders will receive another dividend.

Stock of the T. T. C. Company Reduced.

The stockholders of the Telephone, Telegraph and Cable company of America held a special meeting in Jersey City, N. J., on March 26th, and approved a resolution of the board of directors to decrease the capital stock from $30,000,000 to $9,000,000 by reducing the par value of the shares from $50 to $15. The company was organized about 16 months ago and for a time controlled the Erie system of telephone exchanges.

The Austell Telephone company has been chartered in Georgia to place an exchange in Austell. B. H. Veal, R. B. Claud of Douglas County and others are interested.

Bell Company of Canada Asks Increased Rates.

Upward of 40 petitions from municipalities in Ontario have been presented to the Dominion House of Commons, praying that the Bell Telephone company of Canada be restrained from increasing its rates to subscribers. The company has applied for legislation permitting it to increase its capital stock, and the bill, which was intended to include other provisions seeking power to advance rates, now only asks power to increase the capital stock to $10,000,000.

The company has, for years, persistently sought to nullify the regulation of the Dominion Parliament, which prohibits any increase of the rates charged subscribers under the law of 1892. At that time, with a view to the prevention of stock watering and the inevitable demand that follows upon stock-jobbing operations for a greater income to pay interest on the inflated capital, the Canadian Parliament provided that the existing rates for service should not be increased without the authority of the railway committee of the Privy Council of Canada. On several occasions since then, however, the company has tried to free itself from this effective regulation of rates and regain its freedom of charge. The company, it is alleged, is now evading the clear intent of the law by charging higher rates for new subscribers, and municipalities throughout Ontario are therefore petitioning the Dominion Parliament to put a stop to this discrimination.

When the case in respect to rates was last argued before the railway committee, about three years ago, the company, in support of its contention, presented statements showing that in 1897 its revenue was $56,147 less than the cost of operation in the city of Montreal, while the Toronto business resulted in a loss of $44,900 and that of Ottawa, $10,000. But the fact was brought out that in this cost of operation there was included a large sum for plant renewal. The general financial statement, also, was against the company's plea, for it showed that outside the large cities the company earned $689,000 in 1896, on an expenditure for operation of $321,000.

In the company's annual statement for 1898 there were shown to be 32,082 instruments in use in Canada, the revenue being from ordinary exchanges, $935,703, from long-distance service, $264,455, and from all sources, including the above, a total of $1,302,944. According to the company's financial statement for last year, the instruments in use had increased to 38,360, the revenue from the exchanges to $1,125,911, that from long-distance lines to $359,800, and the income from all sources to a total of $1,614,262. The capital or the liability to stock and bond holders, has been increased from $4,497,000 to $6,200,000.

It is, however, upon the figures showing operating expenses that the company's officers base their argument for an increase in rates. It is claimed that the cost of operation is increasing in greater ratio than the revenue, and that, under a continuance of such conditions, the business must soon cease to be profitable. The cost of operation in 1898 was $897,138, out of $1,302,944 revenue, and in 1900 it was $1,146,852, with a revenue of $1,614,262, thus making an increase of operating expenses from 68.8 per cent. in 1898 to 70.1 per cent. in 1900. This is regarded as too trifling to warrant any increase in the rates charged to the telephone subscribers, and it is probable that any application having that purpose in view will not be entertained by the Canadian Parliament.

GENERAL TELEPHONE NEWS.

The city of Spartanburg, S. C., has decided to grant a franchise to the American Bell Telephone company to place its wires in the town, thus giving long-distance connections to New York and other points.

The Queen City Telephone company, operating an Independent system at Charlotte, N. C., has been sold to the Curtis syndicate at a receiver's sale for $23,000. The property is said to have cost between $40,000 and $50,000.

Henry F. Sundgren and Charles Paige have invented an individual party telephone by which any person on a line may be called without the knowledge of any other person on the same line. Mr. Sundgren is a machinist working in Worcester, Mass.

The employes of the Cincinnati and Suburban Telegraph association have presented the family of the late Captain George N. Stone a handsome memorial tablet, engraved on a silver plate 12 by 16½ inches in size, and surrounded by a two-inch border of black velvet and a white mat, the whole being encased in a Florentine frame in dull finish.

An order has been prepared in the office of the Chicago corporation counsel, which will be considered in the Council in connection with the ordinance of the United Telegraph, Telephone and Electric company. It will be made the basis of an attempt to compel a reduction of the rates charged by the Chicago Telephone company. The latter company claims that since the passage of the ordinance of 1889, the system has improved, warranting an increase in rates over the schedule provided for at that time.

Ohio Telephone Notes.

The Central Union Telephone company had some trouble with the men employed at Columbus recently. The men presented a scale to Manager Johnson for the year 1901, which made the working day eight hours instead of ten and the wages $2.50, the same as before. The men demanded that the scale be signed before they would do any more work, and Mr. Johnson notified them that those who did not go to work Monday morning could consider themselves discharged.

H. Louis Hoffman, who has been with the Michigan Telephone company at Saginaw, has been promoted to the position of superintendent of equipment for the state of Michigan. He spent a number of years in the employment of the Central Union Telephone company at Columbus, Ohio.

The Star Telephone company of Ashland has ordered a new 600-drop switchboard from the Kellogg Switchboard and Supply company, and also 400 new instruments, which will be used in rebuilding the plant. Three miles of cable will be put in also, and the pole system will be entirely changed. New wire, cross-bars and, other material have been purchased. It is thought the switchboard will be ready for delivery about May 15th.

Attorney-general Breckenridge of Kentucky has brought suit against the Cumberland Telephone company, to oust it from his state, on the grounds that it has forfeited its charter by purchasing a competing line, the Cumberland having recently purchased the property of the Richmond Telephone company, which has lines running to a number of places where it came in competition with the lines of the Cumberland system.

The Home Telephone company of Findlay has made arrangements to put in sub exchanges at Arcadia, Benton Ridge, Mount Cory, Van Buren and Arlington. All will be connected with the main office, and the farmers' telephones will be connected along the lines. It is the intention of the company to make a first-class county plant.

A telephone company is being promoted at Middlebourne and Hendrysburg to build to Barnesville, where it will connect with other Independent lines. O. V. Wells is president of the company; J. W. Rose, vice-president; E. B. Shipley, treasurer, and J. B. Giffee and B. F. Sheppard, general managers.

The Jackson County Home Telephone company, Jackson, Ohio, was incorporated, with a capital stock of $50,000, to build a system of telephones throughout the county. R. L. Grimes, Evan E. Eubanks, J. L. Gahm, Edward L. Sternberger and M. D. Jones are the incorporators.

H. T. Manner and N. C. Manner have brought suit to set aside the assignment of the Farmers' Co-operative Telephone company of Mansfield, alleging that no legal meeting of the stockholders or members was held to decide upon the matter, and that the assignment was made to defraud them out of a large sum, which the company owes the plaintiffs.

Frank H. Knapp and C. R. Callaghan of Bellevue have purchased the property and good-will of the Huron County Telephone company, which operates exchanges at Monroeville, Chicago Junction and Plymouth, having altogether over 600 telephones in use. Besides these over 50 miles of toll lines are in operation. It is the intention of the purchasers to incorporate a stock company with a capital of $30,000 to handle the property, and it is said that the stock has all been subscribed. Many improvements will be made in the exchanges already in operation, and others will be built. The farmers' service will probably receive attention also, as this is rapidly becoming an important branch of the Independent telephone business in this state. While the long-distance service will make great strides this summer, there are prospects of development in the country business that will be surprising. The country people are taking much interest in the matter.

The Belmont Telephone company has been granted a franchise in Belmont, and the work of building a plant will be begun as soon as possible. It is the intention of the company to connect with Barnesville, and secure a long-distance service as soon as possible.

The new exchange of the Central Union Telephone company was opened at Dayton recently. Many persons were present and refreshments were served. The new exchange is fully up-to-date, and equipped with all the latest improvements in the telephone line.

The Union Telephone company of Athens has increased its capital stock from $15,000 to $50,000. The president is A. B. Allen, and the secretary, D. Edwards. C.

Telephone News from the Northwest.

A. E. Whitney contemplates a local exchange for Volga, S. D.

A bill has been introduced in the Minnesota Legislature by Representative Stites to compel telephone companies to furnish long-distance connections with rival companies. The bill allows a charge of five cents when local connections over two or more companies are made.

Senator Grue has offered a bill in the Minnesota Legislature whereby private telephone lines shall have access to telephone poles already set on the public highway, by applying to the District Court for a commission to appraise the value of such use.

The Missouri River Telephone company plans to build a line from Platte, S. D., to Chamberlain, S. D., making it a trunk line from which branches will be run across the river and to other points.

An Independent telephone line is projected between Victor and Summit, Iowa, and a similar one between Victor and Guernsey. The rural telephone seems to be gathering great prestige in that vicinity, as there is also a third line projected, from Victor to the German and Lutheran settlements.

A telephone line is to be strung between Clarinda and Bethesda, Iowa, as soon as the weather will permit.

O. F. Blaiser of Greene, Iowa, contemplates establishing a local exchange at Rockford, Iowa.

The North Coon Telephone company of Glidden, Iowa, is arranging to construct its line. There will be 35 connections.

A writ of mandamus has been issued against the Sunset Telephone company at Seattle, Wash., ordering the company to show cause why it should not install unlimited telephone service for a law firm at the rate of $5 per month, as provided by the city ordinance.

The Independent telephone companies of Wisconsin are planning to arrange for a long-distance line through the state.

Ole J. Jensen has been granted a franchise for a local exchange in Stanley, Wis.

A bill has been introduced in the Minnesota Legislature providing for a telephone tax, the proceeds to be used to provide service of that nature, if the voters of a township so decide.

The Citizens' Electric Light and Telephone company of Clear Lake, S. D., has filed articles of incorporation, with $10,000 capital stock.

The Western Electric Telephone company has made a proposition to the citizens of Gann Valley, S. D., who desire telephone connections. The company offers to build a line in consideration of the purchase of a certain amount of coupons, to be taken out in telephone toll, or to give connection at Kimball, leaving the citizens to build the line themselves. The latter course will probably be followed.

The Lincoln Township Mutual Telephone company has been organized near Stuart, Iowa, and will serve the Mount Vernon neighborhood and connect with the Hawkeye Telephone company and the Stuart exchange.

The Maxwell (Iowa) Telephone company has been incorporated and will establish a local system of about 60 instruments.

J. W. Hill of Des Moines proposes a mutual exchange for Mitchellville, Iowa. A co-operative system is, however, being discussed by some of the business men.

F. B. Rowe of Hartington, Neb., the proprietor of the Sioux City and Black Hills Telephone company, announces a new tariff, effective April 1st. The charge for 10 miles or under will be one cent a mile, and half a cent a mile for additional distances up to 50 miles.

The Harlan and Avoca Telephone company has been granted franchises in both Harlan and Avoca, Iowa.

A stock company has been formed at Parkersburg, Iowa, by local capitalists and the Cedar Valley Telephone company, with $5,000 capital. The present exchange is to be rebuilt and modernized throughout. R.

Indiana Telephone Items.

The Commercial Telephone company of Warsaw announces that if a sufficient number of subscribers can be obtained, it will extend its lines into the country, and give to the farmers the same service it is giving to the city people. The lines will be connected with the city system, and the rates will be the same.

The Home Telephone company at Elkhart has ordered a new switchboard, as the capacity of the old board is exceeded by over 30 orders.

The strenuous competition which has prevailed for at least five years between the Bell and the Home or local telephone companies at Wabash has taken a new form. Notices were served on the Bell company by the members of the Grocers' association to remove their instruments by April 1st. The local meat markets have taken similar action. The tradesmen say they cannot support two exchanges and want one to withdraw, and naturally prefer the Home company. Officials of the Bell company say that even if all subscribers discontinue they will remain in the field. The Bell has 200 and the Home company 400 patrons.

Another complication has arisen in the adjustment of the financial difficulties of the Central Energy Telephone company of Frankfort. Twenty or more linemen and laborers employed in putting up the company's new cable filed mechanics' liens against the company's plant, and the aggregate amounts to a considerable sum. Each lien was filed as an individual suit. President Murphy had succeeded in staving off the suit brought by the Stromberg-Carlson company of Chicago, to appoint a receiver, but this new trouble will, no doubt, hasten the appointment of a receiver. Efforts are being made to raise the money and pay off the liens. In the meantime all work on the plant is suspended.

The Cooper anti-trust law, the only law passed by the recent Legislature in restraint of trusts, contains an emergency clause, and is in effect now. According to the opinion of the author, the law will work a widespread effect in the telephone business in Indiana. "It is a notorious fact," said he, "that the old telephone monopoly frequently cuts rates to squeeze out an Independent concern, or one company cuts rates to injure another. Under the law, the charter of the company that puts down rates for this purpose is subject to forfeiture." Mr. Cooper says he expects that under this law a good many charters of Indiana companies will be forfeited, unless they change their method of doing business.

Charles R. Stephenson of Rochester, and others of Wabash, have obtained control of the Independent telephone line connecting the Indiana oil fields with Momence and Kankakee, Illinois, purchasing it from the Standard Oil company. Mr. Stephenson has entered into a contract with the Home Telephone company of Wabash for the building of a line from Roan to Rochester, where it will be connected with the Kankakee line, giving it a through Independent line from Wabash to Chicago.

The United Telephone company has bought the copper wire for its extension from Huntington to Wabash, 18 miles, and President Blont of the Home company at Wabash has closed a contract with the New Telephone company of Indianapolis for a new copper-metallic circuit from Wabash to Marion. This will make the third line of the company between Wabash and Indianapolis, the two lines now in service being overcrowded. The new wires are to be devoted to the Indianapolis business exclusively.

The officials and representatives of 20 Indiana Independent telephone companies met at the Grand Hotel, Indianapolis, on March 28th, to take action against the appointment and confirmation of F. I. Allen as commissioner of patents, and sent a telegram to President McKinley, requesting a hearing on the appointment and assuring the president that the Independent men believed that if he had had the information they possess he would not have made the appointment. Mr. Allen is objectionable on the allegation that he is identified with the Bell telephone interests. The Independent men will fight his confirmation in the Senate if the appointment is not withdrawn. F.

NEW COMPANIES.

The Gladbrook Telephone company of Tama County, Iowa, has been chartered, with $10,000 capital, by S. B. Montgomery, J. A. Davis, Aldine R. Kroh and F. W. Browne.

The Callaway Telephone company of Callaway, Neb., has been incorporated by H. H. Andrews, A. L. Mathews, W. E. Shupp, J. D. Wieland and John Moran. The capital stock is $8,000.

The Iowa, Minnesota and South Dakota Telephone company of Sioux Falls, S. D., has been incorporated, with a capital stock of $100,000, by T. A. Way, T. A. Potter, E. P. Healy, B. C. Way, J. Kirby and J. E. McMahon.

MANUFACTURERS AND DEALERS.

The Williams Electric company of Cleveland has remodeled its entire output, making the different improvements that the last year's experience with the product has suggested. The company has also produced an entirely new high-power, long-distance bridging telephone, which it asserts to be over twice as powerful as anything in the generator line ever placed in a telephone box.

Independent telephone-exchange managers will be interested to learn that the Co-operative Telephone Construction company, Chicago, has been organized to do all kinds of cable work for telephone and electric-light companies. The Co-operative company states that it is in a position to install underground and aerial cables for companies in any part of the country. It is asserted that the company has associated with it some of the best cable splicers and cablemen in the country.

The Chicago House Wrecking company announces that, by special arrangement with various telephone companies, it has come into possession of a large quantity of overhauled telephones of standard make. While these telephone have seen more or less service, the company asserts that they are in first-class condition, having been thoroughly tested. The company can furnish a large number of these telephones, complete with batteries, magnetos, receivers and battery boxes, at attractive prices, and will be pleased to send further particulars to all interested.

Among the orders filled by the American Electric Telephone company recently are those for switchboards at Nelsonville, Ohio, 200 drops; Hartford City, Ind., 400 drops; Montpelier, Ohio, 200 drops; Manning, Iowa, 100 drops; Nicholasville, Ky., 300 drops; Timpson, Texas, 150 drops; Logan, Iowa, 200 drops, and Bluffton, Ind., 300 drops. In addition to these, important installations for both central-energy and express-type switchboards have been contracted for. The company reports that it has experienced a large increase in business since the Berliner decision.

The Eureka Electric company of Chicago states that its offices will be moved to the new Eureka electric building, 143-145 South Clinton street, Chicago, within a few days, when the company will be pleased to receive its old friends and many new ones. The company claims to be the only telephone manufacturing company operating its entire plant under its own roof. The company manufactures all of its parts from raw material and has a fine light and power plant of its own in its own building, allowing it to work overtime, whenever necessary, without taking power or light from any outside source.

Room for Improvement in Telephone-exchange Management.

By R. M. Lockwood.

The principal aim which has been kept almost constantly in view by telephone exchanges from their very inception has been the shortening, by various means, of the time required to make connections. To this end new and increasingly expensive switchboards have displaced old ones; subscribers' instruments have been simplified and perfected, until they almost work themselves; new and exceedingly rapid methods of handling calls have been devised and put into operation, until at last it seems an impossibility for either inventive genius or money to do more. Yet, in spite of all the great advances which have been made, the feeling of a great many subscribers toward the exchange is markedly hostile, and may be expected to continue so, both with Bell and Independents, until the demands of subscribers' nature are more tactfully met. The telephone people take it as a matter of course that the subscribers realize, or ought to, the efforts that have been made, and are continually being made, to give the very best service attainable. The subscriber, usually wrapped up in his business, does not comprehend at all those difficulties which are peculiar to telephone work. He has heard something about what the telephone experts have done for him, but, after all, the judgment that he forms is due partly to results as he sees them in practice and partly to his feelings. He has been led to believe that to communicate with anyone over the telephone is a question of only a few seconds, but whenever, for any reason, this fails to come true, he never seeks the true reason, but, giving way to his hostile feelings, puts the blame entirely on the service. The people at the "Central," in their enthusiastic pursuit of rapid and efficient service, seem to have forgotten or neglected one very important point—that to reach the very summit of success they must have the good will of their subscribers. It is true that they have assumed that through quick and efficient service this result will be attained. In this they have been in error, for while it is a necessary step, it is not all. The good will of the public must be sought directly along the lines of every-day human nature, with all its faults, peculiarities, biases and idiosyncrasies; and the system, wherever possible, should be modified to suit.

The writer has had occasion many times during the last year to call up a certain subscriber connected with the "Ashland" office in Chicago, but once in four times on the average he has been connected with "Harrison." This is an annoyance, and were he not familiar with telephone technique he would probably lose his temper and wonder angrily why those operators are not more careful and attentive to their duties. He realizes, however, that those who listen at the telephone depend to some extent on context, since the instrument is slightly poor in enunciative power. This is proved by the method of calling numbers in all large exchanges where wires are cabled and condensers are used. For instance, instead of "Twelve hundred and twenty-seven," we say "One, double two, seven," and even then we must speak very distinctly.

Now in the words "Ashland" and "Harrison" there seems at first sight to be no conflict; but on close examination it will be found that both words take the same time to pronounce, and that the accent in both cases is the same vowel sound and on the same syllable—the first one. If the "Harrison" station had been called "Van Buren" there would be no possibility of error, and as a result considerable bad feeling on the part of the subscriber would be avoided—certainly a desirable result to reach. As a matter of fact and of prudence, the names of no two stations in the same system should be of the same length, with similarly accented syllables.

Another annoyance to subscribers is the use of the words, "The line is busy," or, what is far worse, that series of buzzing noises known as the "busy signal." The latter, especially, to many men is akin to an insult to their dignity and position. They are not accustomed to being addressed in this sort of way. They look upon the telephone somewhat as they do upon their employes; in fact, they pay for the services of both. Suppose that an employe should notify his employer by a buzzing signal that he is busy; what would be the result? Of course, the subscriber ought to recognize this signal as a device tending to rapid service; but, as a matter of fact, being but a human being, he cannot help feeling that he has not been shown the proper consideration, no matter what may apply to other people. Even when the operator uses the stock phrase, "The line is busy; please call again," matters are not much more satisfactory. The writer has seen a subscriber, after being told this a second time—something which often happens—begin to rave: "I don't believe that line is busy at all; it's a lie; the operator over there doesn't attend to her business; that's what's the matter," or, "Their instruments are out of order and they ought to fix them," or, "That girl has forgotten to disconnect the previous call," and then, feeding on his own anger, he continues, "What in the blankety-blank-blank do they mean, anyhow? Here they take my good money for something that isn't worth a continental blank."

Now let us suppose that the operator uses the following phrase: "The party you want is talking to someone else." Here we have a reply which really means the same thing as "The line is busy," but which diverts the caller's mind from the service of the exchange to the particular subscriber with whom he wishes to talk. He will still fume, but not against the exchange. This will be doubly the case if the operator on the second call will make the remark, "Your party is still talking to someone else." This cannot always be done, it is true, but sometimes the operator remembers and recognizes the voice of the caller, and here it would apply. Naturally, in a large exchange, the amount of work at certain times is so great that a busy signal must be employed, but still there are other portions of the day where this is not the case, and at this time some courteous remark similar to that given should be used, simply as a matter of good policy.

It is customary in most, if not all, exchanges for the operators to repeat the call—a very good plan, theoretically, but, as carried out in practice, extremely unsatisfactory. The idea is to check up the numbers given, so the subscribers may make a correction if the operator has not fully understood. In actual practice, however, the girls are so dominated by the fetich of speed that it open happens that they cut off their talking circuit too soon. For instance, the call may be "Double four, eight, five," but the operator in repeating it will cut off the last "five," so that the subscriber hears "Double four, eight;" then, thinking that there is a mistake, he grows excited, and calls up the exchange to make the necessary correction, thereby causing the operator to lose more seconds than would have been the case had she not been so hasty in the first place, not to speak of the subscriber's ruffled temper, due sometimes to the girl's veiled but pert remark that she "got it right in the first place." If this system of repeating calls is to be followed at all, the switches should not be thrown too soon.

In a central-battery system, which we all know is absolutely necessary for rapid work in a large city, very often the snaps and cracks emitted by the receiver when the table switches are worked are extremely annoying and sometimes so loud and sharp as to make the ears ring for a time worse than a dose of quinine. Is it therefore to be wondered that in the ideas of some the ear is sometimes injured, and that the sufferer will remark: "I wonder what devilish device those telephone people will next impose upon a long-suffering community"? And yet, it should not be at all a difficulty to modify the apparatus in some way, so that the battery will be cut on slowly with a dull, prolonged note, instead of a rapid, sharp one. Not only out of consideration for the subscribers' tempers should this be done, but as a matter of business policy.

Under present conditions, when something goes wrong, and the subscriber wishes to make a complaint or report to the company, he, very naturally, calls up and begins to tell it to the operator, who, as soon as she recognizes the nature of what he is saying, will interrupt his story with the statement that she will connect him with the chief operator. Accordingly, he, in a moment, hears another woman's voice asking what he wants, and to her he will begin to tell his story again, only to be once more interrupted with the statement that she will connect him with the manager, or the wire chief, or someone else, as the case may be. By this time he is angry. He has started to tell his story a number of times, but each time was interrupted. As a business man he is not accustomed to this sort of thing, and feels that the exchange is lacking in respect. Naturally, if he does not already possess a feeling of ill will, he soon gains it. Of course, he ought to know better, but, as a matter of fact, he does not; hence, for the best interests of the exchange, he should, to some extent, at least, be accepted as he really is. Let us suppose, in a case of this kind, that as soon as the operator recognizes that the subscriber is making a complaint, report, or seeking information, she connect him at once, without comment of any kind, with a special employe, to be known as the "superintendent"—a man, not a woman, preferably with a masculine, not boyish, voice, no matter what his age—who will say to the subscriber: "This is the superintendent." In fact, there might be several of these "superintendents." Now the subscriber, instead of having his story cut off by one girl, only to have to tell it to another, finds himself assumedly in communication with real headquarters, and is gratified accordingly. In his daily life, whenever he goes to the headquarters of any business, he always meets a man, and when the telephone company turns him over to a woman head operator he may not stop to formulate his ideas, but he is not satisfied. He feels that he has only made an intermediate step, which naturally is a waste of time, and consequently annoying. He will be especially impressed with the word "superintendent," since in every-day life that should be the title to apply in cases of this kind. Man is a slave to custom, and a telephone exchange should recognize and accept the fact.

Now, when the subscriber is in communication with the "superintendent," he should not be turned over to anybody else. This official should listen to his entire story, make the necessary notes, give proper assurances pleasantly, and then investigate. Should it be necessary later for any of the employes to call up the subscriber, either for further information or report, they must not only be courteous, but must also be full in their explanations (not verbose), and preface what they say by some remarks such as follows: "The complaint recently made by you has been turned over to me by the wire chief [for instance], since it properly comes under my charge."

It may seem strange to have the table operator connect the subscriber in the above case with the "superintendent" without remark, but, on second thought it ought to be seen that interruptions are to be avoided wherever possible. The average man may not like to repeat his complaint, but it is far more satisfactory to do this than it is to be interrupted. In actual life common politeness requires that a speaker should not usually be interrupted in what he is saying.

Another cause of bad feeling, or, at least, annoyance, on the part of the subscriber toward the exchange, is the method used to make connections through branch offices. To do this necessarily takes a trifle more time than is the case where both parties are in the same office; but the subscriber, wrapped up in his own affairs, knows and cares nothing for this point. He notices the delay (which, indeed, is very small); often he hears one operator giving the order or otherwise discussing the matter with the other, and as a result will jump to the conclusion at times that he has been given the wrong number, with consequent annoyance. Let the detailed method be improved about as follows: Suppose, for instance, that the subscriber calls for "North, double one, naught, three." As soon as the operator hears the word "North," she, without saying a word, plugs the line immediately to the North station. This will give the operator at the latter point, for the time being, an additional subscriber, whom she will treat exactly as one of her own, and whom she will answer with these words: "This is North station; what number, please?" The subscriber, realizing that he is half way to his destination, is gratified, and feels that progress has been made. Next, the operator in calling up the subscriber wanted, should, in some way, through the table mechanism, shunt a small portion of the magneto current over the line of the caller, so that this latter may know from his own sense of hearing that the operator is doing her duty. Now, if the person called fails to answer, the caller will have no feeling of ill will toward the exchange. He has communicated definitely with the branch office; he has heard the person called without any response, and finally, when the operator notifies him that "The party you wish will not answer," he knows it is true, and, if he fumes at all, it will be at the other subscriber, who clearly is to blame. Meantime the operators at the central exchange, where time is of the greatest value, gain many precious seconds.

One more point. Night service in most exchanges is poor, at least irregular. The force, of course, is cut down, but is always too small for first-class service. Very little provision ever seems to be made for night rushes. As a matter of both policy and fact, the number of operators on service during the evening should not simply be that which from a scrutiny of the number of night calls seems to be enough, but twice or three times this number, so that when the rush comes, the operators can handle it properly, even though they have an easy time during part of the hours. Furthermore, night supervision should be just as thorough as day. That this is not the case is certain, since, while we can never say that the employes are ever really discourteous, still there does seem to be a slight tendency to veiled insolence and pertness of reply during the evening hours. Probably there is provocation for it, but, as a matter of business policy, supervision should be as thorough during the night as in the daytime.

The writer, in making the above statements, is not presenting any particular system, but is trying to show by some concrete examples how telephone exchanges have so far omitted one very great essential for the highest extension of their line of work. They have not properly taken into consideration human nature as applying to their subscribers, and as a result have not secured their good will and good opinion, something that they could readily get if they should seek it directly, instead of assuming that quick and efficient service, as they autocratically and arbitrarily arrange for it, covers the case. This is where there is room for improvement.

Another London-Yerkes Story.

[From the New York Sun.]

London, March 28.—It was learned to-day that Charles T. Yerkes has obtained control of enough of the stock of the Metropolitan and District underground railway to prevent the installation of the Ganz high-voltage, alternating-current system. Mr. Yerkes arrived in London after the directors had adopted the Ganz system, subject to the approval of the Board of Trade. The representatives appointed to interview the Board of Trade were interdicted by the influence of Mr. Yerkes. The matter is now in statu quo. The experts appointed by the London directors having pronounced in favor of the Ganz system, the matter will now be taken out of their hands, and the subject will become a question of financial negotiations between Mr. Yerkes and the London board. There is little doubt that Mr. Yerkes will succeed, his object being to establish a uniform American continuous-current system on the Metropolitan line in connection with London's "tuppenny tubes." Mr. Yerkes and the London directors are now working for a compromise, which, it is anticipated, will amicably result from the daily conferences which are now being held.

The Astoria Electric company of Astoria, Ore., has been incorporated, with a capital stock of $300,000, by S. S. Gordon, F. R. Stokes and C. H. Page.

Training of Electrical Engineers.

[*Continued from page 239.*]

of their self-inductances, using an alternating current of known frequency, and the comparison with their mathematically determined coefficients. He should also be able to make by the use of ammeters and ballistic galvanometers the direct measurement of mutual inductances, and to compare self-inductance and mutual inductance with capacity. He should then extend his measurements to circuits with iron cores. Carefully wound long and short solenoids having known constants, condensers of known capacity, bridges, alternating-current ammeters and voltmeters, the ballistic galvanometer and secohmmeter are the instruments he will employ most at this stage.

The student should then pass on to the study of the alternator and to single-phase currents. The wattmeter and the alternating-current curve tracer must be put in his hands, and the relations of the current and pressure waves in circuit must be studied from the curves, as well as from measurements of the true and apparent energy in the circuits. This study is finally applied to transformers of various types of construction. For the study of polyphase currents it would seem best to have in the laboratory a rotary converter, so that currents of variable frequency may be obtained. Induction motors of representative types of construction ought also to be available. A large part of the work here specified on alternating-current machinery must, however, be relegated to the next division of the laboratory work of his final year, when he will have more time for uninterrupted experimental work, and be left more to his own initiative. The great matter is to instill habits of personal investigation and critical study into the mind of the young engineer, so that his college course may form really a graduated introduction to the work of his whole life.

This last portion of his laboratory time should be devoted by our embryo electrical engineer to what is, in America, called "thesis" work. This is of the nature of an experimental research, carried out either by the student himself or by a small group of students of which he is one. Very much valuable information has been obtained in American colleges in this way regarding the various types of new apparatus continually coming out, and it is found that the students learn, in the course of such work, to assume responsibility by being in a large measure left to their resources. Such investigation usually requires either special apparatus or the loan of new types of machinery; but good work may also be gotten by making progressive tests of an operating plant, either in the college or elsewhere. The interest and even enthusiasm with which this part of the work is taken up and carried on by the students is very striking and encouraging, and was such as to lead the writer to adopt the "thesis" system in his late laboratories at McGill College, Montreal, although quite contrary to his preconceived prejudices against the utility of allowing undergraduates to undertake research work. With regard to the one day per week of the student's last year which was told off for work in the electrical drawing office, my friend, Professor R. B. Owens of McGill College, has found it an excellent plan to take up the design of a complete line of machines to meet given commercial conditions. Each student takes one, and the advantage of having all the students in the class working on machines of the same type, but of different dimensions, is that by comparing notes they are able to see clearly the change necessitated in the dimensions, as the output or conditions of running vary.

A set of both direct and of alternating-current machines should always be taken up. A good plan is then to submit the data compiled and the drawings prepared to the criticism of someone whose business it is to design machines for the maintenance of a reputation and the earning of an income on money invested in the manufacture of electrical machinery. In this way the attempt may be made to impart to the student information possessing a real market value without sacrificing the study of broad principles to unnecessary detail.

An important expedient for bringing the electrical engineering college into close contact with the ever-varying, practical development of the subject is to obtain the services of specialists in the several fields of current work, in giving courses of lectures on the status and probable development of their special line of activity. Courses of from six to 10 lectures each, upon which the student should be examined, as upon work given by the ordinary instructors, are best adapted for dealing with such special topics. One or two lectures by a distinguished engineer, although interesting, do not meet the requirements.

Another most important study which ought to be mentioned in this connection is what is called by the Germans "Wirthschaftlichkeit," and which may, perhaps, be rendered the "economics of engineering design." Its object may be most easily explained by taking an example from the work of an American college, which is due to my friend, Professor Owens.

It was required of every electrical engineering student in this college that, toward the end of his course, he should figure out the design of either a lighting or street-railway plant. A number of scale drawings of towns of various sizes were available, and from known or assumed conditions the position of the station was assigned. Then, in the case of a lighting plant, the locations of the individual customers were taken as given, with particular load diagrams for each. From these isolated diagrams the nature of the station was determined, and the machinery and circuits laid out. All the circuits were calculated and were shown on the map, together with poles and the more important accessories. Outline plans for standard machines were readily obtainable, and the station was arranged by their aid. Full specifications for the plant were then drawn, definite as regarded the results to be obtained, but impartial as regarded different types of plant. Lastly, a bill of material was made out and the costs estimated for some one type of standard machinery, using price-lists and allowing for labor, and the expense of operation and maintenance, together with the income necessary to render the installation a paying investment, was determined. Such plans and estimates were then checked by a constructing engineer, whose business it was to be in touch with such matters.

This department of study, which really constitutes the daily duty of the designing engineer, has been to my knowledge almost wholly neglected in all save one or two German and American colleges. Such a worked-out example as the above places in due perspective the relative value of the various portions of the pupil's whole curriculum. Hitherto we have mostly been content to discuss with all elaboration the design of our machines in regard to their general convenience and adaptation to their purposes, keeping in view simplicity and safety of operation, easiness of adjustment and facility of repair; we have also exhaustively treated the elements of strength and rigidity, and the balancing of the rotating or other moving parts; in some instances the ideas of harmony of proportion and of elegance of detail have even been entered into, but very seldom have the really vital questions of cost of construction and total cost of production of different designs, in relation to the respective expenses of their maintenance for operation and for repairs, and of their durability, been duly approached in the professional college or school. Yet these are the governing factors in the everyday settlement of engineering problems!

The course of training for an electrical engineer which has been somewhat hurriedly, and, I fear, incompletely, sketched in the above remarks nevertheless outlines the curriculum which a not inconsiderable experience in such matters leads me to recommend as being best adapted—not in any sense to produce a complete electrical engineer—but to impart to a youth of moderate ability and unflagging devotion the capacity to follow with success that arduous calling. It must be recollected that the British engineer of the new century will need not only to know and to be able to use that which has been perfected by his predecessors, but to be continually experimenting and improving upon what already exists, to be devising new lines of activity and to be discovering fresh fields of operation, if we are to maintain not merely our industrial supremacy, but even our national independence, in the tremendous struggle for commercial existence which is now impending.

In conclusion, I would press upon the members of this Institution the strong conviction I hold of the expediency, from the point of view just referred to, of at once establishing some arrangement whereby the more eminent young employes of our manufacturing houses may be enabled and encouraged to return, for periods of months at a time, to the laboratories of their schools or colleges, for the purpose of spending their whole energies in the prosecution of industrial research for the benefit of the firms employing them. This system is already partly in vogue in Germany and America, and has produced most gratifying results. But this and all the other questions in regard to the proper education of our young engineers is entirely in the hands of their future employers. If the leaders of British industry do not realize the national significance of such higher scientific training as is here proposed, it is futile for the heads of our colleges and technical schools to seek to thrust forward their projects in their despite.

Surveying for British Pacific Cable.

A dispatch from Victoria, B. C., dated March 30th, states that the first practical steps toward laying an all-British Pacific cable to connect Canada with New Zealand and Australian colonies have been taken. The steamer Quadra has been sent out to make a survey of a portion of the coast of Vancouver Island, "and to-morrow or next day she will be back in port from having completed the work." She has a small party aboard, including Peake, engineer for the Pacific cable, who arrived from the old country early in the week, after having spent some time at Ottawa. The coast for a distance of over 70 miles from Jordan River to Barclay Sound is to be explored and a site for the cable station to be selected, it is understood, on completion of the work. At the mouth of Jordan River is Sandy Beach, which extends out into the straits for some distance and which, in the opinion of many, would make an ideal landing ground for the cable. The contract for laying the cable, involving an expenditure of £1,795,000, calls for its completion next year.

The Richmond and Petersburg (Va.) Electric Railway company has had plans prepared for its proposed $15,000 power plant to be erected near Manchester, Va.

COMMUNICATIONS.

Automatic Exchanges Defended.

To the Editor of the Western Electrician:

We beg to criticize your short editorial of March 23d, referring to the "hello girl" being superseded and to the inference that the automatic exchange is in use only in small cities.

The city of New Bedford has a population of 65,000, and the exchange system is laid out for a capacity of 4,000. An automatic exchange is being constructed in Fall River, Mass., a city of 104,000 population, and we have never heard of any telephone expert who has investigated the present system who has not declared the system to be practical for the largest exchanges.

Referring to the absence of "hello girls" in automatic exchanges, we would say that there is always some attendant in such exchanges, either the manager, bookkeeper or some employe, who can and does receive any complaints which subscribers have to make, the same as in any other system.

EASTERN AUTOMATIC TELEPHONE COMPANY.

Boston, March 25, 1901.

A Question of Identity.

To the Editor of the Western Electrician:

We are in receipt to-day of the issue of Electrician for the 23d inst., on page 206 of which we note reference to the tenants of the new Electrical building, among which names appears that of the Anchor Electric company. We presume that the name of the Anchor Electric company has so long been associated with the present product of the Marshall-Sanders company that the mistake could readily be made, but we desire to call your attention to the fact that the Anchor Electric company is not represented in the West, but is doing a jobbing business only in the New England states. Instead of the Anchor Electric company, therefore, the name of the Marshall-Sanders company should have appeared in the issue above referred to.

MARSHALL-SANDERS COMPANY.

Chicago, March 29, 1901.

Telephone Apparatus Wanted.

To the Editor of the Western Electrician:

We are about to install two complete telephone exchanges and want bids on switchboards of 100, 200 and 300-drop capacity, central-energy or common-return system. We should also like prices on instruments. GEORGE A. HUGHES,

General Manager Hughes Electric Company.

Dickinson, N. D., March 29, 1901.

New York Electrical Society.

Through the courtesy of the New York Electric Vehicle Transportation company, the New York Electrical society held its two-hundred-and-thirteenth meeting at the new Main station, Eighth avenue and Forty-ninth street, Wednesday, March 27th. The society was welcomed by Mr. Henry Saunderson, president of the company. The meeting was held in one of the upstairs departments, where Mr. George Herbert Condict, consulting engineer of the company, mounted on an automobile as a rostrum, delivered a brief, practical address on automobile work in New York city, and gave various details with regard to the system. Mr. Condict stated that the company now had over 300 vehicles in operation, with capacity for at least 700, whereas only four years ago it had but 12 in operation. He attributed the great success and popularity obtained to the fact that when he himself was unable to reach New York from Philadelphia for three days, owing to the blizzard of 1899, and when none of the horse vehicles could ply the streets of New York, the electric automobiles were found able to plow their way through the snowdrifts with comparative ease. But for the performance of the electric automobiles on that memorable night, New York society would have been paralyzed, and, even as it was, the vehicles were busy till late the next morning, carrying home society people who had been stalled at balls, theaters and private residences. Strangely enough, the New York Electrical society visited the old stables of the company that same night, upon which occasion Mr. Condict was to have addressed it.

After Mr. Condict's remarks the whole of the large building, in all its departments, was thrown open to the visitors, numbering between 300 and 400, who roamed about freely at will, watching the machinery in operation, and taking a particular interest in the ingenious methods and appliances by which the batteries were taken to and from the charging room and inserted into and removed from the vehicles in service. After this examination, the company served coffee and other refreshments, and it was not until 11 o'clock that the members dispersed, the society having scored another emphatic success in its plan of visiting electric installations, so as to enable its members to see for themselves the processes and details of operation.

President Martin announced that, on April 25th, at Columbia University, Mr. Charles F. Scott, electrician of the Westinghouse Electric and Manufacturing company, would deliver a lecture, illustrated by apparatus and experiments, on "Alternating-current Motors." Mr. Scott's well-known ability as an in-

ventor and his gift of clear exposition will render this one of the most valuable meetings held by the society during its remarkably active and successful season, which, before it closes, will include one or two more very interesting evenings.

The secretary, George H. Guy, announces that the striking lecture on "Systems of Electric Transmission and Distribution," delivered before the society by Mr. C. P. Steinmetz, has been issued in a neat pamphlet, octavo size, which can now be secured from him by direct application or by mail for a small sum. This is one of the best popular treatments of the alternating current now available, and requests for it are already such as to insure its wide circulation.

E. H. Mullin, J. Lloyd Wayne and Franklin S. Holmes were elected to membership.

Glasgow International Exhibition.

The Glasgow International Exhibition will be opened next month. The buildings are situated in Kelvingrove Park, along the banks of the Kelvin, and cover part of the site of the exhibition of 1888. The principal temporary buildings are the Industrial Hall, Grand Avenue, Machinery Hall and Concert Hall.

The Industrial Hall, designed in the Spanish Renaissance style, has a frontage of 700 feet on the Kelvin, and a floor area of 26,000 square yards. It is surmounted by a dome rising to a height of 150 feet, with four flanking towers, each of 180 feet, and, like the remainder of the buildings, is constructed of staff on a framework of steel and wood. The Concert Hall is a circular steel-framed edifice, with a domed roof, and is only exceeded in size in Britain by the Albert Hall. On the top of the dome will be mounted a motor-controlled searchlight, by the British Schuckert company, operated by a current at 110 volts, transformed from the 500-volt supply of the Glasgow corporation. The Grand Avenue is 750 feet in length, and connects the Industrial Hall with the Machinery building, passing the art galleries and crossing Dumbarton road by a cantilever bridge. The Machinery Hall is a handsome piece of ironwork, 500 feet in length and 320 feet wide, having a floor area of 20,400 square yards, which, large as it is, has proved quite insufficient to meet the demands of those desirous of exhibiting. Two gangways, connected at the ends, rim the whole length of the building, at a height of 12 feet from the floor, and divide the floor space into three sections, at the same time forming a position from which a general view of the machinery can be obtained.

Comparatively few of the electrical exhibits are as yet in place, says Electricity of London, in its issue of March 22d, the engines of Willans & Robinson and the dynamos of the Schuckert company being alone visible. These, with the other generating sets, are situated in the southwest corner of the hall, adjacent to the boiler house, which forms a separate annex. It is a significant fact that of the 5,000 horsepower to be supplied by the boilers about 3,020 will be transformed into electricity, and principally used for power purposes. Over 50 electric motors will be in operation, of sizes up to 200 brake horsepower. One, of 100 brake horsepower, by D. Bruce Peebles & Co., will drive one of the two main lines of shafting, the other of which will be driven by a steam engine of 100 horsepower. The following are the most important generating sets which will be employed to supply current for lighting and power purposes, the total output being over 4,000 electrical horsepower at the terminals:

Builders of Engines.	Builders of Dynamos.	H. P.
Willans & Robinson	Crompton	1,200
Willans & Robinson	Schuckert	1,200
Robey	Scott & Mountain	150
Robey	Scott & Mountain	70
Robey	Mavor & Coulson	500
Ruston-Proctor	Ruston-Proctor	100
Scott & Mountain	Scott & Mountain	130
Alley & Macleilan	Mavor & Coulson	200
Browett-Lindley	Ediswan	500
Belliss & Morcom	Bruce Peebles	270
Sissons	Clark-Chapman	125
Davey-Paxman	Electrical Construction Co.	375
	Total	4,820

The steam mains for these are arranged on the ring system, and are carried in roller bearings in deep trenches, so that no overhead piping will be required. Electric cables are laid in wooden conduits beneath the flooring, while the arc-lighting circuits are mostly carried overhead on porcelain insulators. Illumination is effected by means both of arc and incandescent electric lamps, and gas is also employed for a part of the grounds. The arc lamps are supplied by the Brockie-Pell company, and are wired 10 in series in the 500-volt circuits and five in series in the 250-volt circuits.

The exhibition will be open for 26 weeks.

Among the large exhibits with buildings of their own in the grounds are the American International Pneumatic Tool company and C. Churchill & Son of London and Glasgow, who will show nothing but American machinery, mostly of the tool-making variety.

The Grand Rapids and Saginaw Electric Railway company is a new line projected between Grand Rapids and Saginaw, Mich., by way of Ada, Lowell, Belding, St. Louis, Ithaca and Alma. The promoter is Mr. Tucker of Sumner. A road from Ionia to Saginaw, via Muir, Matherton, Carson City, St. Louis and Alma, is in contemplation by local promoters of the Grand Haven, Grand Rapids and Ionia road.

CORRESPONDENCE.

New York Notes.

New York, March 30.—President Jacob L. Greatsinger of the Brooklyn Rapid Transit company has in mind extensive improvements of the system under his direction, and it is probable that several millions will be spent in the near future in carrying them out. He has announced that he expects the entire system to be electrically operated by July 1st, and preparations are now being made for installing the third-rail equipment. Mr. Greatsinger has also expressed his intention of making whatever expenditure is necessary to better the conditions at the New York terminal of the Brooklyn bridge, realizing that proper provision for handling the crowds must result in a large increase in traffic at that point.

At a recent meeting of the stockholders of the North Jersey Street Railway company the former directors were re-elected, with the exception of Henry Lembeck, resigned, who was replaced by J. E. Hulshizer, Jr. Edward L. Young and Joseph D. Bedle were elected directors of the Consolidated Traction company, now leased to the former corporation.

A strike among the structural workmen has tied up all work on the four power houses under construction to supply power for the Manhattan elevated railroad. The strike is a sympathetic one, and it is hoped that it will be adjusted soon.

Clinton L. Rossiter, former president of the Brooklyn Rapid Transit company, has started on an extended trip, which will include Mexico, South America and parts of Europe.

Announcement is made of the consolidation of the Consolidated Railway, Lighting and Refrigerating company and the Consolidated Railway Electric Lighting and Equipment company, plans for which have been progressing for some months. The stock of the Consolidated Equipment company has been acquired by private sale, so that the Consolidated Refrigerating company has now a majority of the Consolidated Equipment company's stock. The consolidation will, it is stated, work to the great advantage of the Consolidated Railway, Electric Lighting and Equipment company stockholders, who will receive the benefits of a system of refrigerating cars pronounced practical and economical. They also receive the benefits from the National Safety Third Rail company and the European Railway Refrigerating company business, the stock of both companies being in the treasury of the Consolidated Refrigerating company.

Secretary Corwine of the Merchants' association has been trying to obtain an appropriation for the building of the pipe galleries in connection with the rapid-transit tunnel. Members of the Merchants' association, in arguing for the galleries, have urged a public consideration of the present disorder of pipes existing under the city's streets, the leaky mains, that are only repaired with great difficulty owing to that disorder, and the lack of room for the new pipes that will necessarily be needed in a few years. In a speech recently made by Mr. Corwine before the Social Reform Club, he said that the galleries ought to be made to have such capacity as to accommodate 100 per cent. more pipes than are now under the streets, statistics showing that such would be the logical increase of conduits in New York. He ventured the prophecy that, besides the old uses of pipes, there would be found many new ones—that within 25 years people would be having cold air transmitted to their homes in pipes.

T. F. Merritt, E. F. Lockwood and Elizabeth M. Lockwood have filed articles of incorporation, under the name of Merritt & Lockwood, to deal in electrical supplies. The capital stock is placed at $10,000.

The Rapid Transit Commissioners have rejected the offer of Albert L. Johnson to build the Brooklyn extension of the tunnel, giving no reason, excepting that Mr. Johnson's revised proposition was disappointing. In his letter to the commission Mr. Johnson said, in part: "If my plans are adopted I am able and willing to put up the $1,000,000 cash deposit required by law, to give additional bond security not proportionately more onerous than was required of Mr. McDonald, to build and equip the tunnel and railroad at bottom bedrock cost to the city, and to wait for my reimbursement as to so much of the cost as may seem to be in excess of the city's constitutional debt limit, till the city can lawfully pay me; to carry passengers for three-cent fares within the city limits, to pay union wages in construction and operation, and to provide an adequate sinking fund for the cost of construction and equipment. I may make no prodigious profit within the city, but the profit from my outside connections will be sufficient, and upon that I will rely."

The rumor of a lease of the Manhattan system by the Metropolitan Street Railway company has been revived by an order from President Gould of the former company directing the abandonment of the plans for four sub-stations in connection with the new main generating station. M. L. G.

New England News.

Boston, March 30.—The Boston Board of Aldermen has refused to grant the Boston Transit company's petition for permission to run automobile omnibuses through Deerfield street and Bay State road. The company at present runs a line of electric vehicles from Scollay Square through the Back Bay district, to Deerfield street, accommodating the people formerly served by the Marlboro street horse-car line.

Beginning April 1st, the Edison Electric Light company will light the Boston end of Harvard bridge, heretofore lighted by gas. The Cambridge end of the bridge has been lighted by electricity for some time.

The salary of Frank Rice, executive secretary of the Boston Wire Department, has been increased from $1,300 to $1,800 per annum, since Consulting Electrician Brophy was dropped.

When asked regarding negotiations for the consolidation of the Edison Illuminating and the Boston Electric Light companies, President Edgar, of the Edison company, said that representatives of the companies were conferring, but had not agreed upon any definite plan. He said that if there was a consolidation it would not be made through a third company, but it would be confined to the interested companies, and that it would be on a basis that would yield about the same return to stockholders as that proposed by the plan which was dropped. It is believed that the companies will endeavor to effect a consolidation before the Legislature passes any measure to prevent it. At present the State Gas and Electric Light Commissioners have no power to prevent any electric-light company making any contract with another company, consequently they cannot prevent a contract of consolidation. Including the recently voted additional stock, the Edison company's capital amounts to $5,000,000, and the Boston Electric Light company has $2,500,000 capital. The so-called Morgan consolidation plan provided for the issuing of $3,600,000 additional stock, which would bring the capitalization of the combined companies up to $11,100,000. The Boston company has assets in real estate, etc., that will offset any extra value in the Edison company's balance sheet or earnings.

The directors of the Boston Electric Light company recently declared the regular quarterly dividend of two per cent. and an extra dividend of one per cent. The extra is to be paid from the earnings of the past six months and signifies nothing relative to future disbursements. Since January 1st the company's output of incandescent lamps has increased over 13,000.

A bill by which the Springfield (Mass.) City Council is given the power to have electric-power and street-railway feeder wires placed underground has been passed by both branches of the state Legislature. The bill stipulates that the city can compel the burying of wires on not less than three nor more than five miles of streets per year. The measure does not affect street-railway wires erected under existing contracts.

Owing to many breakdowns, the United States government authorities have refused to accept the engines in the new electric-lighting plant at the Charlestown (Mass.) navy yard, and the plant was practically abandoned on March 25th, when the big governor broke, the force being transferred to the old plant, which is now furnishing light. The builders of the new engines have been continually repairing them and have supplied many new parts. They have requested permission to replace them with others of a different type.

The funeral of General Charles C. Fry occurred in Lynn on March 25th. Services were conducted by the Knights Templar and they were attended by a large number of Masons.

It is reported that the existing electric street-railway companies in Vermont are to be consolidated and that several of the roads are to be extended to meet electric railways in New York state. It is said that the plan is under the charge of a syndicate, with headquarters in Albany, N. Y., which proposes to acquire power plants at various points and electric-lighting plants on or near the line of the railways. The plan includes a through line of railway from Albany, N. Y., to Montpelier, Vt. B.

Western New York.

Niagara Falls, N. Y., April 1.—The Niagara Railway Supply company has changed its name to the McPherson Switch and Frog company. The officers are: President, Charles R. Huntley of Buffalo; vice-president, Robert W. Pomeroy of Buffalo; secretary-treasurer, DeLancey Rankine, Niagara Falls.

The Castner Electrolytic company has awarded the contract for the electrical equipment of its proposed extension to the Stanley Electric Manufacturing company of Pittsfield, Mass., and the contracts for the buildings, it is expected, will be awarded this week. The contract for the electrical installation amounted to over $150,000, from which may be judged the extent of the expenditure the company will make in the big extension of its prosperous plant. Ground will be broken very soon.

The Niagara Electrochemical company has awarded contracts for the extension of its plant on the lands of the Niagara Falls Power company. These contracts call for an expenditure of over $30,000. The new building will be one story high, extending east and north. It will be of brick. It is expected to have the extension completed by July.

The fourth hearing on the petition of the promoters of the Buffalo, Niagara Falls and Rochester Railway company for a franchise was held in the County Court room in Rochester, on Friday. There was much inquiry as to the financing of the company.

If the latest proposition of the Rochester Railway company for a settlement of the paving claims is accepted by the Common Council of Rochester, it

will be necessary for both the city and company to get an enabling act from the Legislature. The proposition contemplates the payment to the city of $380,000, being the principal of all the paving claims of the city and interest thereon to May 15, 1901. The payment shall be made in an original installment of $100,000 down when the agreement is ratified, and the remainder in annual installments of $20,000, without interest. In this way the indebtedness would be wiped out in about 15 years. The city would receive all that is claimed, eventually, less the interest on the deferred payments, and all future cost of litigation, which would be discontinued, would be avoided. Further conditions on which the company makes the offer are that it shall not be assessed for street improvements for more than $100,000 during the succeeding four years, and not more than $450,000 for the next 10 years. On its part, the company agrees to expend $750,000 in betterments of roadbed and equipment, and pledges itself to reduce the fare for carrying passengers to four cents, if at the end of two years it has not expended the money as agreed.

Contracts for the five large buildings to be erected by the American District Steam company at North Tonawanda have been let to Calvin M. Jacobs of Tonawanda. Work of excavating has commenced. It is expected to complete them by July 1st. It is understood the company will use Niagara power.

The Cataract Chemical company (capital, $100,000) will soon erect a plant at Niagara Falls for the manufacture of nitric acid, under patents held by Charles S. Bradley and D. R. Lovejoy. Mr. Bradley is president of the company. The company has an office with the Ampere Chemical company. It is stated that the process to be employed will be startling from a scientific point, it being intimated that the nitric acid will be made from air. If this be true, the company will have a wonderful amount of raw material. Mr. Lovejoy worked with Professor Pupin in the development of the method which promises so much for long-distance telephony.

Work on the new plant of the Natural Food company is now progressing night and day. On top of the big chimney that is being erected 12 50-candle-power incandescent lamps have been placed to enable the bricklayers to work at night. The Niagara Falls Power company has been granted permission to carry a power line to the Natural Food plant. The Common Council has granted the Natural Food company permission to build a conduit, seven by eight feet, from its factory site to its grain elevator and wheat-cleaning plant, to be located on the east side of the hydraulic canal, near Port Day. The conduit will be 18 inches below the surface. The work will cost about $36,000. In the conduit there will be operated two conveyors, one to carry the wheat from the cleaning department to the factory, the other to carry the company's product to the shipping department. All telephone, power and light cables will also be placed in the conduit.

The Norton Emery Wheel company of Worcester, Mass., has made a contract with the Niagara Falls Power company for 1,000 electrical horsepower, to be used in the operation of a factory to be located on the old site of the Lead Reduction company's plant, which was destroyed by fire. This site is but a short distance from the power station. The first structure will be a two-story brick building, in which the electrical and other apparatus for the manufacture of the new abrasive will be installed. The company's output will be corundum, and thus another new and interesting electric-furnace process will be added to Niagara. A 1,000-horsepower transformer has been purchased for the new Niagara plant. D.

Canadian Intelligence.

Ottawa, Ont., March 30.—The City Council of Vancouver, B. C., has decided to grant a franchise to the Stave Lake Power company to supply light and power within the city.

Mr. J. M. Harris of the Recco mine, Sandon, B. C., purposes establishing an electric-light and power plant of 1,000 horsepower at Three Forks, B. C.

A by-law to provide for the installation of an electric-light plant for the town of Thessalon, Ont., will be submitted to the ratepayers on May 6th.

An act incorporating the London, Aylmer and North Shore electric railway of Ontario has passed the railway committee of the Ontario Legislature. This road will run from London, Ont., to Aylmer and Port Burwell. The capital stock is $850,000.

The Cape Breton Electric Railway company of Sydney, N. S., will shortly commence construction of an electric-tramway line between Sydney and Glace Bay. A representative of the company has gone to Boston, Mass., where all arrangements are being made for the building of the line. It is said the road will be completed in about six months.

The Niagara, St. Catherines and Toronto Railway company, which operates an electric railway between Port Dalhousie, Ont., and Niagara Falls, N. Y., has made an offer for the purchase of the St. Catherines, Merritton and Thorold street railway, which is the oldest electric railway in Canada, having been in operation since 1887. The death of Mr. H. C. Symmes of Niagara Falls, one of the owners of the railway, which occurred recently, prevents the deal from being consummated at present, but as soon as the Symmes estate is arranged, the sale will be completed. The figure named in the negotiations is $100,000. The road will, when acquired, be put in first-class condition.

The bill incorporating the big combine, known as the Montreal Heat, Light and Power company, has passed the Quebec Legislature, and has become law in that province. When too late to successfully oppose the passage of this bill, but before it had received the sanction of the lieutenant-governor of Quebec, the city of Montreal and the adjoining municipalities which will be affected by the bill awoke to the fact that its provisions were opposed to the rights and interests of the city, as well as of the towns and villages within a radius of 100 miles from Montreal. Accordingly, petitions and deputations were sent to the lieutenant-governor to urge him to withhold his assent to the bill. The governor was unable to act independently of the advice of his cabinet, and the bill was sanctioned. The premier of Quebec, however, has assured the petitioners that at the next session of the Legislature the bill will be amended to meet the objections of the municipalities. The organization of the new company will be proceeded with on the 5th of April. The company is to have a capital of $25,000,000, of which about $17,000,000 will be issued. Mr. Rudolph Forget is the chief promoter of the combine, which includes the Chambly Manufacturing company, the Royal Electric and the gas companies. The Lachine Hydraulic company is expected to be included, and the remainder of the stock may be utilized to buy out this company, if deemed essential to the success of the enterprise. The net revenues of the first three companies for the last year were over $1,000,000, and, as a result of the consolidation, a still more favorable showing is anticipated. Instead of 8,000 horsepower from Chambly, they would have 35,000, with an auxiliary steam installation of 20,000 horsepower. The first machinery for the additional power at Chambly will be installed by the 15th of April, and the whole completed by the middle of July. The placing of the company's wires underground would probably take three seasons, Mr. Forget says, and work has begun on the tunnel under the Lachine Canal for the Chambly wire coming into the Queen street station at Montreal. A. V. W.

From the Buckeye State.

Columbus, Ohio, March 30.—In the case of the State vs. the Dayton Traction company, the Supreme Court last week rendered a decision which is of great interest to those engaged in the electric-railway business. Citizens of both Dayton and Toledo have been objecting to electric roads hauling freight and carrying it along the streets of the cities. The matter was finally taken to the Supreme Court, and the decision has been rendered in favor of the road. Following is the syllabus of the decision: "An electric-railway company owning and operating a road upon a street of a city, and an interurban electric railway may, by favor of the provisions of section 3443-11 of the revised statutes, enter into a valid traffic arrangement for the carriage of merchandise for hire upon said street."

The Cincinnati and Eastern Electric Railway company of Cincinnati has filed notice with the secretary of state that the capital stock of the company has been increased from $10,000 to $500,000. George R. Scrugham is president of the company and James M. Kennedy, secretary.

P. J. Coleman of the Adams Express office at Columbus has been made superintendent of the Altamont Park, owned by the Steubenville and Mingo Valley Railway company.

The Cleveland syndicate which has secured extensive interests about Aurora, Ill., has financed the Aurora, Wheaton and Chicago Railway company, taking $3,000,000 of the bonds. This was accomplished in connection with three eastern houses. The bonds will be put on the market later on. The names of the Cleveland financial institutions interested in the matter were given in the Ohio letter in last week's issue of the Western Electrician.

Judge Reeves of Lancaster was elected president of the Columbus, Lancaster and Southern Railroad company last week, to fill the vacancy caused by the death of W. H. Stevenson of Hartford, Conn. He will also act as general manager.

The commissioners of Clark County have granted the Columbus, London and Springfield Railway company a 30-year franchise from the eastern county line to the city of Springfield. The company is either to locate the power house within the county or pay $15 a mile for the franchise each year. It is the intention of the company to locate the power house near Springfield.

The Postal Telegraph-cable company has moved its office at Cleveland into new quarters at the corner of Bank and Superior streets.

The Dayton and Troy Electric Railway company has increased its capital stock from $30,000 to $1,000,000; Valentine Winter is president, and Charles B. Clegg, secretary, of the company. This road will be one of the important branches of the cross-state line, of which the state papers have had so much to say of late.

The Strasburg Electric company of Strasburg, Ohio, has been incorporated, with a capital stock of $10,000, by Thomas Kemp, E. P. Hopitzky, E. R. Garver, G. A. Meyers, Jacob Denzer, C. C. Retzler, Jacob Boyer and J. C. Schultzbach.

At the annual meeting, held a few days ago, the directors of the Youngstown and Sharon Electric Railway and Lighting company, Youngstown, elected the following-named officers: President, A. M. Hyatt; vice-president, A. N. Whipple; secretary, Leighton Calkins; treasurer, O. W. Bright.

It is announced that a combination has been effected between the Rapid Transit company of Dayton and the Dayton and Xenia Traction company. The plan is to do away with portions of both lines and make a more direct line from Dayton to Xenia. Extensions will also be built to Wilmington and other places.

The suit of the Westinghouse Electric and Manufacturing company against the Dayton Fan and Motor company, involving the infringement of a patent on electrical transmission, has been appealed from the United States District Court to the United States Circuit Court. The patent in question is one granted to Tesla and owned by the Westinghouse company.

The State Board of Public Works has closed a contract with Thomas N. Fordyce, whereby he is allowed to build an electric line along the banks of the Miami and Erie Canal, from Cincinnati to Toledo, for use in the propulsion of canalboats. Mr. Fordyce is to furnish a bond of $25,000. A company has already been incorporated for the purpose of building a portion of this distance.

The annual meeting of the Columbus, London and Springfield Railway company was held at Springfield a few days ago, and the old officers were re-elected, as follows: President, John S. Harshman; vice-president, Fred J. Green; secretary, Hon. Emmett Tompkins; treasurer, John G. Webb; second vice-president and general manager, H. A. Fisher. The directorate is made up of these officers, A. E. Appleyard and C. A. Alderman.

W. B. Strang has purchased the Detroit and Toledo shore road and is now sole owner. Seventeen miles of the road has been graded and steel has been laid for five miles. It is stated that work will be resumed on it at once.

Charles Currie has been appointed general manager of the Detroit-Toledo electric railway, which is controlled by Cleveland men.

Trouble is threatened among the employes of the Cincinnati Traction company. The employes object to allowing the company to handle their benefit fund and have a grievance on account of the discharge of some of the men.

It is announced that the Newark and Granville Electric Railway company, Newark, will build a new power house. O. M. C.

Information from Indiana.

Indianapolis, April 1.—The work of removing the center poles from between the car tracks in this city has been completed, and the large interurban cars of the Union Traction company are now entering the city.

The town of Sweetsers has been incorporated and an electric-light and waterworks plant is to be installed at once.

The city authorities at Vincennes have notified the City Electric Lighting company and its sureties that the latter have failed to comply with their contract, and that the service is so unsatisfactory as to warrant action.

A new interurban mail service has been established between Terre Haute and Brazil over the electric line. A number of intermediate points are served to three mails a day.

The Town Board has awarded a franchise for electric lighting and power to E. H. Dugger and J. E. Meredeth. The plant must be completed by December 1st.

The interurban companies are still operating over the streets of Indianapolis without a franchise, a situation declared by citizens generally to be in contravention of the spirit of the city charter. For a year some of these corporations have been running cars over the streets of the city without permission from the Board of Public Works, and citizens have been forcibly expelled from many of them because tickets of the local company would not be accepted for fares. The Board of Public Works insists that it cannot get officers of the interurban lines and the local company together. Hugh McGowan, manager of the local company, is sick at Hot Springs, Ark.

A number of important movements in interurban railway affairs took place last week. The holders of a franchise for a road from Indianapolis to Crawfordsville by way of Danville, North Salem and Ladoga held a meeting at the Denison Hotel and took steps toward organizing a company with several hundred thousand dollars of capital.

The Indianapolis and Greenfield company completed its arrangements to extend the line from Greenfield to Knightstown, a distance of 12 miles. The contract for construction has been signed and the officials say that part of the line will be in operation in 90 days.

Efforts were renewed during the week by interested capitalists to build an electric road from Martinsville to Bloomington. Charles L. Henry of Anderson, a heavy stockholder in the Union Traction company, is interested, and met with the promoters at Bloomington recently. The latter expressed some doubts about the project being feasible on account of the rugged and hilly country, and intimated that a steam road might be more feasible. Residents of Bloomington, however, are anxious for an electric line, and say a route can be selected to skirt the hills and be one of the most picturesque in the country.

The Garrett, Auburn and Northern Electric Railway company has filed articles of incorporation. The directors are J. D. Hauseman, F. S. Mitchell, E. B. Johns, J. F. Cameron and F. D. Welshmeir.

The Union Traction company has closed and dismantled its power plant at Marion, and is now fur-

nishing power from the central power house at Anderson for the local systems at Anderson, Marion, Muncie, Alexandria and Elwood, and for the large cars running on lines from Anderson to Indianapolis, Marion, Elwood and Muncie. Only two of the 2,000-horsepower engines are running, but they have proven sufficient. The third engine is now being placed, after which the power plants in other cities, held in reserve, will also be dismantled. F.

PERSONAL.

Tom L. Johnson, the well-known street-railway "magnate," was elected mayor of Cleveland on April 1st.

Henry A. Everett, electric-railway and Independent telephone financier of Cleveland, is spending a month in California with his family.

John Kneeshal, representing the traffic department of the Victorian government of New South Wales, is investigating American street-railway practice, in view of the proposed equipment of the street railways of Sydney with electric motive power.

Thomas Herbert Minshall, electrical engineer in charge of the electric-lighting and tramway department of the city of Croydon, England, is in this country for the purpose of gathering information as to the methods employed in the electric-lighting and railways systems in America.

Charles Timberlake, who has for some time been in charge of the switchboard for the New Telephone company of Indianapolis, has been secured by the Eureka Electric company of Chicago, and will superintend the switchboard department of the latter company. Mr. Timberlake's training and experience make him a valuable addition to the Eureka forces.

J. C. Shaffer of Chicago, who is president of the Vicksburg (Miss.) Street Railway and Power company, also the Electric Light company, has appointed J. Z. George general manager of the Vicksburg plant, to succeed F. S. Mordaunt, who will remain with Mr. Shaffer's interests in the South. M. J. Mulvihill will continue as secretary and conduct the financial affairs of the company.

Mr. A. L. Schultz, formerly president and general manager of the Schultz Bridge and Iron company, Pittsburg, Pa., has been appointed to take charge of the operating department of the American Bridge company, covering the Pittsburg district, comprising the Keystone, Pittsburg, Schultz and Shiffler plants at Pittsburg, the wrought-iron plant at Canton, Ohio, the new Columbus plant at Columbus, Ohio, and the Youngstown Bridge company plant at Youngstown, Ohio.

Mr. M. H. Bentley, formerly with the Chicago Telephone company, and for the last two years superintendent of the New Telephone company of Indianapolis (Independent), has accepted a position in the engineering department of the Stromberg-Carlson Telephone Manufacturing company of Chicago. Mr. Bentley is a man of large experience in telephone practice and construction, and will undoubtedly prove a decided acquisition to the Stromberg-Carlson company.

The New York Sun of March 31st has this obituary notice: "Watson VanBenthuysen died in New Orleans yesterday, aged 68. He was born in Bedford, N. Y., and moved to New Orleans in 1851. He was president of the National Improvement company, and carried on a long and bitter litigation with the Bell Telephone company over the validity of the Bell patents. He was president for several years of the New Orleans and Carrollton Street Railroad company. He spent some years in New York, where he was president of the Poughkeepsie Bridge company."

The electrical fraternity of Chicago has been saddened by the serious illness of one of its best-known and best-liked members, Joseph H. Cooke. Almost without warning Mr. Cooke was laid low on Sunday, March 24th, by an acute attack of appendicitis. On Saturday, the previous day, Mr. Cooke was at his office, and although a trifle indisposed, did not consider himself a sick man. On Sunday he was about his home as usual, until suddenly compelled to take to his bed by the severe pains that accompany the manifestation of appendicitis. Since then he has been constantly under the doctor's care, and at this writing it is believed that he will recover. No man stands higher in the estimation of the electrical men of Chicago than Joseph H. Cooke, and the widespread hope that he will soon be in the enjoyment of perfect health is a real and earnest one. Mr. Cooke represents the Buckeye and Jandus Electric companies, with an office in the Monadnock building.

ELECTRIC LIGHTING.

An electric-light plant is to be installed at Newton Falls, Ohio.

A municipal lighting plant is to be established at Fairfield, Iowa.

A lighting system is projected for the town of Woodbury, N. J.

The electric-light plant at Millersburg, Ohio, is to be enlarged and improved.

The Camp Floyd Electric company of Provo, Utah, has been incorporated, with a capital stock of $20,000, to operate a lighting system in the Camp Floyd mining district and also at Mercur, Utah.

An issue of bonds for extensions to the lighting system at Dublin, Ga., has been decided upon.

The electric-light plant at Clyde, N. Y., was destroyed by fire, recently, entailing a loss of $25,000.

At the April election at Butler, Mo., an issue of $20,000 electric-light bonds will be decided by vote.

The Stone City Light, Heat and Power company of Bedford, Ind., has been incorporated, with a capital stock of $100.000.

H. Habler has applied for a franchise for the construction of a $75,000 electric-light plant and waterworks at Sheffield, Ala.

Legislative authority has been granted for an issue of bonds to establish a municipal electric-light and water plant at Crookston, Minn.

The California Central Gas and Electric company of Sacramento, Cal., has been incorporated, with a capital stock of $1,500,000, by J. Marvin, J. A. Britton, F. H. Pierson and H. U. Roeding. The company is to operate in Sacramento, Butte, Marin, Napa and Sonoma counties.

A committee of six North Side business men has been appointed to go to Springfield from Chicago to work for a law to prevent alleged discrimination in gas and electric-light rates. This action is an outgrowth of the movement directed against the Chicago Edison company by A. J. Sidder. Mr. Sidder is a member of the committee. The City Council committee on gas, oil and electric lights has recommended for passage the ordinance granting the A. J. Sidder company the right to construct an electric-light plant in North avenue.

ELECTRIC RAILWAYS.

The Steubenville Traction and Light company of Steubenville, Ohio, has increased its capital stock from $500,000 to $700,000.

The Alpena, Gaylord and Western Railway company of Alpena, Mich., has been incorporated, with an authorized capital of $1,280,000.

The power station of the Memphis Street Railway company of Memphis, Tenn., is to be enlarged. F. G. Jones is president of the company.

A strike of street-railway employes in Marseilles on March 22d resulted in the crippling of the service and some destruction of railway property.

The proposition to grant a franchise to J. S. Polk, president of the Des Moines City Railway company, for the construction of an interurban street railway over streets of Indianola, Iowa, was carried at a recent election.

The directors of the Louisville, Mount Washington and Fairfield (Ky.) Electric Railway company have decided to begin construction work on the new railway soon. The road will be 29 miles in length and will be built from Louisville to Fairfield, Ky.

The Genesee and Orleans Railway company was incorporated last week, to operate a street surface road 27 miles long, from Batavia, N. Y., to Point Breeze, on the south shore of Lake Ontario, on the east side of Oak Orchard Harbor. The company is capitalized at $350,000, and the directors are George W. Aldridge, John H. Gregory, Houston Barnard, George Wilder, Frederic P. Allen, Charles H. Babcock and John F. Kinney of Rochester, Charles E. Hart of Albion and James M. Aiken of Barre, Orleans County. The principal office of the company will be at Albion, N. Y.

AUTOMOBILES.

The daily newspapers have revived the rumor that Thomas A. Edison is at work on a storage battery especially adapted for automobile use, which shall not have the excessive weight of the present type of accumulator.

The management of the Illinois Electric Vehicle Transportation company of Chicago has received more than enough proxies from stockholders to carry through the plan to liquidate the concern. There are 158,620 shares of stock outstanding, and a majority of two-thirds, or 105,746 shares, had to consent to retire from business in order that the recommendation of the directors might be concurred with. Considerably more than this number have assented.

The directors of the New England Electric Vehicle Transportation company of Boston have voted in favor of a recommendation to the stockholders advising the discontinuance of the business. A special meeting of the stockholders will be held in Jersey City on April 29th, to vote upon the recommendation of the directors that the company be dissolved. This course was decided upon some time ago, the statement being made that the business could not be conducted at a profit.

In an address delivered before the New York Electrical society, at a recent meeting, Mr. G. Herbert Condict, according to the New York Times, made the following prediction: "There are now in New York about 400 vehicles of the automobile type and about 400,000 horse-drawn vehicles. I will predict that in a few years notices will be posted to the effect that no horses are allowed upon the streets of New York, street cars will disappear, and the sidewalks will be elevated, so that pedestrians will not be in the way of the electric, gasoline or steam vehicles that will then be in use."

PUBLICATIONS.

The Standard Welding company of Cleveland, Ohio, has issued an illustrated catalogue of automobile parts, showing rims, tubing and cylinders of seamless steel and cuts of electrically welded tubing and rings.

"Electrical Investments" is the title of a semi-monthly journal, sold at the modest price of one penny a copy, which made its appearance in London last month. It is published by the proprietors of "The Manual of Electrical Undertakings."

Vol. I., No. 1, of Insurance Engineering, an illustrated monthly magazine "devoted to the science of diminishing hazards to property and life," has made its appearance. The initial issue has 96 pages and presents a good appearance. One article is on "Some Characteristic Electric Burn-outs." The Insurance Press, 120 Liberty street, New York, is the publisher.

Machado & Roller of New York have issued a catalogue for 1901, descriptive of Whitney electrical instruments. The makers of this apparatus have adopted the plan of making all ammeters uniform in respect to the difference of potential required to produce full scale deflection of the pointer, thus making all shunts interchangeable and permitting of the speedy checking up of a number of switchboard instruments by simply disconnecting the instruments from their shunts and connecting them all in parallel with a standard instrument.

The National Board of Fire Underwriters has issued the 1901 edition of its "National Electrical Code," together with new editions of the rules and requirements for the construction and installation of chemical fire extinguishers, and the regulations governing the installation of fire doors and shutters. In revising the electrical code a list of the changes made has been kept and published as an insert to the pamphlet, forming a feature most convenient to foremen and others who are required to be thoroughly familiar with the requirements of the code. The booklet dealing with fire doors contains 53 illustrations from drawings prepared by B. H. Glover and Dean Harvey of the Underwriters' Laboratories, Chicago.

The B. F. Sturtevant company of Boston has issued an illustrated catalogue of its disk and propeller fans. Descriptions, dimensions and prices of several types are given. The company says: "The field of usefulness and highest efficiency for disk and propeller fans is that in which resistances are slight and velocities low. Then, and then only, are fans of this type in any sense competitors of the cased fan with centrifugal discharge. For the forcing of air through extended piping systems, for the production of mechanical draft or for the conveying of light material, the latter type is necessary. But within their own somewhat limited field the disk and the propeller fan cannot be excelled for efficiency, although the centrifugal type can be used to advantage where the conditions demand."

ELECTRICAL SECURITIES.

Transfer books of the Westinghouse Electric and Manufacturing company will be closed on April 9th and reopened on April 20th to allow the stockholders to subscribe for one share of additional stock at $55 in proportion to each five shares of existing stock. The present additional issue is $3,000,000 of the $10,000,000 authorized February 20th. A syndicate has underwritten the entire amount. Subscriptions must be made by April 20th at the office of August Belmont & Co. and accompanied by a payment of $25 a share. The balance, of $30 a share, is payable June 15th, at which date the stock will be delivered. Transferable receipts will be given upon receipt of the first payment. The new stock will participate in all dividends after May 15th. Fractional amounts will be adjusted by the bankers.

TELEGRAPH.

It is stated that an agreement has been reached between the Chicago Board of Trade and the telegraph companies by which the quotation service will be resumed this month on the terms noted in the Western Electrician of March 2d.

SOCIETIES AND SCHOOLS.

The University of Wisconsin offers for this year a summer school, embracing courses for artisans and apprentices in steam engineering, applied electricity, machine design, materials of construction and transmission of power, and shopwork in wood and metal. This class of work is at present to be given only during the summer months, the courses extending from July 1st to August 9th. The requirements for entrance are merely the ability to speak and write the English language and a fair knowledge of elementary arithmetic, and the fees charged are $15 for entrance and a laboratory fee of five cents an hour for the time actually spent in any shop or laboratory.

MISCELLANEOUS.

A Copenhagen chemist claims to have discovered a material which can be successfully substituted for rubber in the manufacture of linoleum, overshoes and insulators. The material is made from asphalt, and is said to have high insulating and waterproofing qualities.

Suit has been brought by the Automatic Switch company of Baltimore, represented by Brown & Darby of Chicago, against Louis M. Knaus of Detroit, for alleged infringement of the patent covering the Whittingham automatic switch for electric motors. This patent is No. 396,791, and is dated January 29, 1889.

A large brickyard just north of Hudson, N. Y., is to be remodeled and equipped with electrical machinery for power purposes. Mills, sanders and pumps will be driven by electric motors, and an electric locomotive will take the place of the teams now employed. Power will be furnished by the Albany and Hudson Railway and Power company.

It is of some interest to note that the Brotherhood of Electrical Mechanics, numbering 300, has returned to the Building Trades Council of Chicago. The union was suspended several months ago under a fine of $300 because of its refusal to abide by the decision of the council that it surrender conduit work on the Illinois Theater to the gasfitters. An appeal to the National Building Trades Council caused the reinstatement, the $300 fine being remitted.

Coroner Traeger of Chicago, in his report on the disastrous boiler explosion at the Doremus laundry, calls attention to the fact that the men in charge of boilers are often required to attend to other duties, which render a careful watch over the boiler room impossible. He condemns this practice and recommends an increase of the penalties for violation of the boiler laws. A special committee appointed by the council is reported to be in favor of abolishing the use of longitudinal lap seams in boiler construction.

TRADE NEWS.

The National Mining and Development company of Waterbury, Vt., has been organized, to market large deposits of asbestos said to exist at Eden, Vt.

The Crescent Electrical Manufacturing company of Rochester, N. Y., has been organized and incorporated, with a capital of $2,000, by C. R. Elliott, A. L. W. Miller and H. W. Russell.

The Electrical Appliance company of Indianapolis has been incorporated. The authorized capital stock is $15,000. and the directors are E. E. Rine. S. E. Rine, C. C. McCauley and J. E. Booth.

The St. Louis Electrical Supply company announces that it has secured commodious quarters at 1118 Pine street, St. Louis, and is now doing business at that location, with a full stock of general electrical supplies.

The Automatic Trolley Catcher and Controller company of Syracuse, N. Y., has been incorporated, with $100,000 capital, by H. D. Milloy of Buffalo and J. H. Devire and W. S. Farmer of Syracuse.

The Southern Electric company of El Paso, Texas, has been incorporated, with an authorized capital of $10,000, for the purpose of erecting electric-power plants. B. L. Berkey, G. A. Andrews and others are the organizers.

A. Louis Kuehmsted, general manager of the Gregory Electric company of Chicago, has just returned from an extended purchasing trip, going as far South as Birmingham, Ala. He reports great activity in the electrical field, there being an especially heavy demand for street-railway generators and large alternators. He succeeded in closing several large deals.

Bergtheil & Young, electrical engineers and contractors of London and Manchester, announce that they have taken Mr. Robert O. Ritchie into partnership. Mr. Ritchie for many years acted as manager of the electrical department of Greenwood & Batley of Leeds. He will now devote his attention principally to Bergtheil & Young's business in the North, taking charge of the Manchester branch.

According to a financial paper, the gross earnings of the Electric Storage Battery company for the year ended December 31, 1900, were $3,309,443, an increase of $1,186,764 over the amount in 1899. The net profits were $1,149,759, an increase of $540.574, and the net income was $1,317,865, a gain of $393,-342. During the year 13,361,000 pounds of plates were manufactured, and 11,688,151 pounds were shipped.

At the recent annual meeting of the National Electrical Trades association, held in Chicago, the following-named officers were elected for the ensuing year: President, W. M. Carpenter, of the Western Electric company, Chicago; vice-president, Charles B. Price, of the Pettengill-Andrews company, Boston; secretary and treasurer, F. P. Vose, Chicago; directors, W. M. Carpenter, Charles B. Price, R. E. Gallaher, of the New York Insulated Wire company; C. M. Wilkins, of Partrick, Carter & Wilkins, Philadelphia, and F. D. Lawrence, of the Standard Electric company, Cincinnati. The next meeting of the association will be held in Philadelphia in March, 1902.

The American Bridge company reports that its foreign trade is developing very rapidly. Within the last few days it has received a contract for 20,000 tons of bridges for the Guayquil and Quito Railroad company in Ecuador, South America, and a large group of buildings for the Cananea Consolidated Copper and Silver Mining company of Mexico; also several large contracts for manufacturing buildings, to be shipped to Australia, and a large railroad bridge to go to the Sandwich Islands. It is also announced that the company's tender for a large foreign contract exceeding in size anything which it has taken has been accepted, and that one of its engineers sailed last week to consummate the arrangements. The officers of the American Bridge company decline to say anything about this matter until the contract is definitely consummated, but admit the facts substantially as above stated, and say that it is the most important foreign contract that they have yet taken.

BUSINESS.

The Electric Appliance company, Chicago, is carrying a full stock of swinging ball lightning arresters. Orders can be shipped the day they are received.

The Western Electric company, Chicago, is sending out bulletins on speaking tubes, annunciators and combination letter-boxes. This company manufactures a large line of this material.

Two large exhaust heads, one 30 inches and the other 36 inches in diameter, were recently installed by the Edison Electric Illuminating company of Boston, Mass., in the new Boston power station. They are of the Sturtevant centrifugal type, built by the B. F. Sturtevant company of Boston, Mass.

The enclosed fuse is rapidly coming into general use among electricians of experience, who readily appreciate its points of merit. A full line of D. & W. enclosed fuses, motor cut-outs and safety devices of all kinds is carried in stock by the Central Electric company of Chicago, which is selling agent for all D. & W. material. These devices reduce the danger of fire through blowing of fuses to a minimum, and are a great protection to life on high-tension circuits.

Theodore Smith, manufacturer of Smith's patent lamp-adjusting and controlling devices, 151 Throop street, Chicago, announces that his devices have been submitted to the National Board of Fire Underwriters and have been approved. Mr. Smith states that his specialties have met with favor by all those who have had difficulty in placing incandescent lamps where they are most desired. There is a demand for a device which will permit an incandescent lamp to be placed where light is most needed, and this seems to be accomplished by the Smith device.

The Electric Storage Battery company of Philadelphia has recently closed a contract with the Hamilton, Grimsby and Beamsville Electric Railway company of Hamilton, Ont., for the installation of a battery of Chloride accumulators at Grimsby, a point 10½ miles from the power house of the railway company. The installation consists of 229 elements, to give a discharge rate of 160 amperes, and is to be used to regulate and maintain the voltage on the line. The containing jars for this battery are sufficiently large to allow a future increase of 50 per cent. by the addition of extra plates.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued March 26, 1901.

670,415. Electrically Operated Brake. George D. Burton, Boston, Mass. Application filed April 13, 1899. Renewed August 13, 1900.

Two solenoids are disposed apart from each other with a piston having its opposite ends extending into them. Two levers are fulcrumed at corresponding ends, one to the piston between the solenoids and the other to a stationary pivot. A link connects the levers, and the brake mechanism is connected to their opposite ends with means for energizing the solenoids alternately for applying or releasing the brakes.

670,419. Railway Brake. Anton Duppler, Jersey City, N. J., assignor to Phoebus H. Alexander, New York, N. Y., and the Compound Magnet Brake company of New Jersey. Application filed October 17, 1900.

A lever operates an electrically actuated braking mechanism. The movement of the handle first applies a moderate braking effort by means of a hand-operated brake, and then cuts into operative circuit the energizing coils of the electrically operated braking mechanism, and gradually increases the braking effort of the latter without adding to the effort of the hand brake.

670,420. Railway Brake. Anton Duppler, Jersey City, N. J., assignor to Phoebus H. Alexander, New York, N. Y., and the Compound Magnet Brake company of New Jersey. Application filed June 12, 1900.

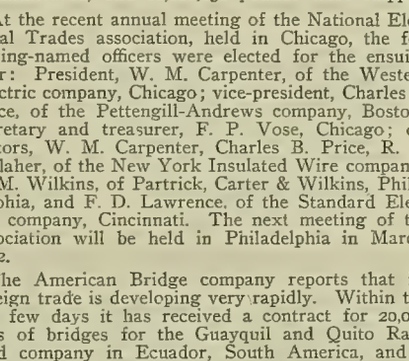
A number of magnets have their armatures arranged at increasing distances from the corresponding poles, and means are provided whereby the efforts exerted between the magnets and their armatures are applied to the brakes. As the brakes are moved under the influence of the attraction of the magnets for their armatures, the latter contact with their corresponding magnets progressively in such a way as to constitute a magnetic ratchet, whereby there is opposed to the return of the braking mechanism to the zero point the effort tending to maintain the practically closed magnetic circuit between such armatures and their corresponding magnets as are in contact.

670,425. Switch Mechanism for Surface-contact Railways. George T. Hanchett, Hackensack, N. J., and John M. Murphy, Torrington, Conn., assignors to the Murphy Safety Third Rail Electric company, New York, N. Y. Application filed July 27, 1900.

A solenoid switch mechanism has a high-resistance winding and a low-resistance winding including an external spiral winding and an internal core, one terminal of the circuit connecting to the spiral winding and the other to the core. Counteracting eddy currents are set up, tending to retard the magnetic action and make the solenoid a slow-acting magnet. (See cut.)

670,440. Electric Ore Concentrator. Henry M. Sutton and Walter L. Steele, Dallas, Texas. Application filed July 18, 1900.

A screening device capable of electrical repulsive action is disposed adjacent to an electrified surface. Means are provided for conducting non-metallic particles which may pass through the screen. Hoods extending from the conducting devices are disposed adjacent to the screen, and a feeding device discharges upon the surface.



NO. 670,425.

670,441. Process of Concentration. Henry M. Sutton and Walter L. Steele, Dallas, Texas. Original application filed July 18, 1900. Divided and this application filed August 23, 1900.

This patent covers a process of separating a conductive substance from a non-conductive substance, or from one of relatively inferior conductivity, which consists in electrically charging the mass and exposing the same to a screen which is capable of electrical repulsive action upon the conductive substance, and removing the non-conductive particles by an extraneous force.

670,454. Commutator. George W. Nistle, Chicago, Ill. Application filed January 29, 1901.

A commutator formed of a disk of insulating material has an opening substantially parallel with and independent of the shaft opening and an opening passing from the periphery of the disk to the aforesaid opening. A segment carrying a bolt or screw enters the peripheral opening, and a nut is placed on the bolt situated within the horizontal opening.

670,474. Storage Battery. Justus B. Entz, Philadelphia, Pa., assignor to the Electric Storage Battery company, Philadelphia, Pa. Application filed July 9, 1900.

The electrode consists of a laminated combined separator and support, internally provided with openings forming wells and externally provided with projections. Active material or material adapted to become active is applied to the faces of the separator support, and conducting plates are applied to the active material or to the material to become active.

670,475. Storage Battery. Justus B. Entz, Philadelphia, Pa., assignor to the Electric Storage Battery company, Philadelphia, Pa. Application filed July 9, 1900.

This battery consists of a series of fluted sheets, whereof alternate flutes are perforated and intermediate flutes are imperforate, arranged in such manner that the imperforate flutes abut. Active material or material adapted to become active is located in the imperforate flutes of one sheet and held to place by the perforated flute of the adjoining sheet. Conductors extend into the active material, and the electrolyte contained in the wells is bounded by the perforated flutes of adjacent sheets.

670,476. Electrical Distribution. Justus B. Entz, Philadelphia, Pa., assignor to the Electric Storage Battery company, Philadelphia, Pa. Application filed September 1, 1900.

A shunt field coil for the booster acts as a secondary to the main field coils, and an impedance is placed in series relation to the shunt coil to diminish the currents which would be induced by the action of the main field coils.

670,538. Subscriber's Telephone Circuit. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply company, Chicago, Ill. Application filed April 28, 1899.

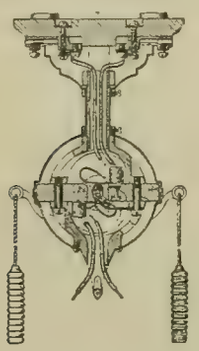
The telephone circuit includes a Wheatstone bridge in which a transverse arm extends between the parallel paths and is connected between the junction points of the two arms of each path. A microphone is placed in one arm of the bridge. Primary induction-coil windings are contained in several of the arms of the bridge, and the secondary coils are joined together so that the induced currents are added.

670,547. Electrical Connecting Device. John S. Schenck, Brooklyn, N. Y. Application filed January 20, 1900.

The subject of this patent is a rosette consisting of a main portion and a fuse-carrying portion, with means for joining the parts by a relative lateral movement in one direction, and for pressing the two portions together so as to resist lateral movement in the opposite direction.

670,552. Handle and Adjuster for Electric Lights. Ellis E. Brown, Reading, Pa. Application filed October 16, 1900.

The device described combines a lamp support and cord adjuster, and consists of a handle provided at one end with means for attaching a lamp, and having a passage extending through it from end to end through which the lamp cord is adapted to pass. A lateral passage connects the first passage with the outside of the handle, so that the cord can be deflected from the longitudinal groove and wrapped around the external surface of the handle.



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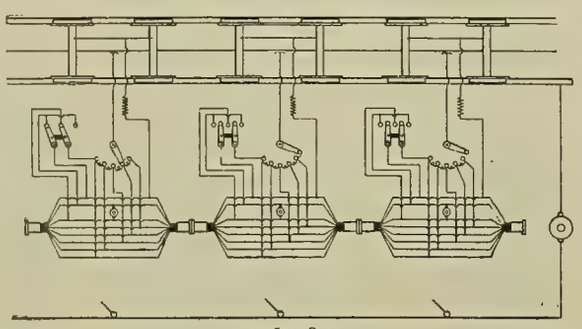


NO. 670,897.

670,557. Continuous-current Machine and Apparatus. Max Déri, Vienna, Austria-Hungary. Application filed March 24, 1900.

The series winding has an axis at an angle with the brush axis, producing a field which combines with the shunt-excited main field to form a resultant field, variable in strength and position according to the main current, whereby one component effects sparkless commutation, while the other effects regulation of the pressure.

670,564. Telephone Receiver. Charles H. North, Cleveland, Ohio, assignor to the North Electric company, Cleveland, Ohio. Application filed September 27, 1899.

The casing consists of a body and a cap screwing directly thereto by internal threads on the cap and external threads on the body. A cup within the casing has a flange extending between the cap and body with screw-threads on its exterior, these screw-threads forming a continuation of the screw-threads on the body, so that the same internal threading on the cap may mesh with both the cup and body. A diaphragm is held between the cup and cap, and a magnet is carried by the cup.

670,573. Suspension Cut-out. James J. Wood, Fort Wayne, Ind. Application filed December 19, 1900.

A rotatable switch spindle carries contacts which connect the line terminals with loop terminals and open the line circuit through an independent conducting member. A bent spring bears on a projection from the spindle to impart a snap movement to the spindle, and to hold the latter in the position to which it may have been moved. (See cut.)

670,583. Primary Electric Battery. Jean P. Fontaine, Paris, France. Application filed January 9, 1900.

This invention comprises a double fluid battery having active elements consisting of zinc, and of soda lye on the one hand and nitric acid on the other. A porous vessel of cardboard and fabric placed together contains a rigid internal substance permeable by the acid solution. A perforated receptacle above the nitric acid contains naphthalene for absorbing the nitrous vapors. A layer of linseed above the soda lye renders stationary the surface of the soda lye.

670,648. Element for Secondary Batteries. John T. Storey, Philadelphia, Pa., assignor of two-thirds to Henry B. Gross and Claude S. Jarvis, Philadelphia, Pa. Application filed June 25, 1900.

The frame is composed of frame bars arranged in quadrangular form, and of confining bars extending diagonally in opposite directions, the outer faces of the confining bars being flush with the side faces of the frame bars. A flat coil of tape formed of suitable metal is mounted within the frame bars and between the confining bars, the convolutions of the coil embodying recesses or notches which receive the confining bars, and the tape being of a breadth corresponding to the thickness of the frame bars.

670,651. Electric Railway. William T. Van Dorn, Chicago, Ill. Application filed April 27, 1900.

An electric conductor rail is located at each side of the track at points higher than the axle of a car truck. The car-truck frame is supported on axles projecting laterally beyond the track wheels and provided at their outer ends with electrically insulated wheels. The wheels are normally out of contact with the conductor rails, but are adapted to engage them by elevation a distance less than the height of a track-wheel flange. Electric contact devices are yieldingly supported on each side of the truck frame and adapted for engagement with the conductor rails.

670,658. Electric Arc Lamp. Edgar A. Beck, Los Angeles, Cal. Application filed May 7, 1900.

The joint of the upper end of the inner globe with the cap is maintained by an extension of the cap plate at either side, each extension having a vertical rod rigidly attached to it, so that the cap and these rods always maintain a constant relationship of rigidity with respect to each other, while the cap at the lower end of the globe is carried and pressed vertically upward by a transverse bar, elastically suspended by springs and by adjusting nuts upon the rods. This transverse bar has a central adjustable projection bearing upward against the bottom cap of the lamp, and is carried upon pivots or studs forming part of a sliding block on each of the rods.

670,667. Electric Heater. William S. Hadaway, Jr., New York, N. Y. Application filed September 24, 1898.

Conducting abutments are provided for the resistance, one of which includes a wedge. A connecting screw travels transversely over the outer surface of the wedge.

670,668. Apparatus for Baking. William S. Hadaway, Jr., New York, N. Y. Application filed February 1, 1899.

The oven in which the baking is done is surrounded by an electric heater, which is in turn enclosed in a steam space. A heat-insulating jacket surrounds the entire apparatus.

670,669. Electric Stove. William S. Hadaway, Jr., New York, N. Y. Application filed February 1, 1899.

A hollow heat-confining support has an opening at the top, and a heat generator is suspended therefrom so as to leave an air space around the edge of the generator, and a heat insulator fills the support. A hood surmounts the heat generator within the air space.

670,670. Electric Stove. William S. Hadaway, Jr., East Orange, N. J. Application filed June 30, 1900.

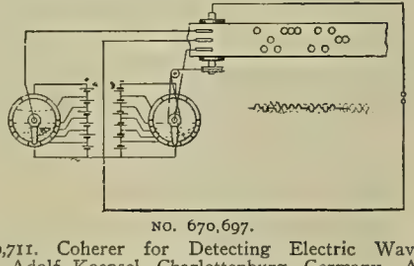
An annular body having a flat top contains an annular chamber and means for supplying the chamber with heated fluid. An electric heater is situated within the opening in the annular body, having its upper surface in substantially the plane of the flat top.

670,671. Electrical Heating Resistance and Method of Making Same. William S. Hadaway, Jr., East Orange, N. J. Original application filed September 24, 1898. Divided and this application filed December 1, 1900.

The process described consists in fusing magnesia, separating the crystallized portions of the resultant mass after cooling, reducing it to powder, powdering and baking graphite at a temperature higher than that intended in practice, and mixing the two powders.

670,697. System of Telegraphy. Frederick Bedell, Ithaca, N. Y. Application filed October 20, 1899.

Several sources of sustained electromotive force are used, one point of the series being connected to one terminal of the circuit. The other terminal of the circuit is connected to the series so as to include without reversal a periodically increasing and decreasing number of the sources to produce periodic impulses of electromotive force. The transmitter applies to the line certain determined ones of the impulses according to a prearranged code and thus transmits over the line circuit to a receiver connected thereto corresponding current impulses. (See cut.)



NO. 670,697.

670,711. Coherer for Detecting Electric Waves. Adolf Koepsel, Charlottenburg, Germany. Application filed August 25, 1900.

The electrodes have their acting faces made of hardened steel or iron. Metallic comminuted material is located between the electrodes and in contact with their acting faces.

670,774. Apparatus for Forming Elements for Electric Accumulators. William Gardiner, Chicago, Ill., assignor to the Helios-Upton company of New Jersey. Application filed April 28, 1900.

A tank contains temporary negative electrodes and a means for securing a series of unformed plates midway between the fixed negative electrodes. An electrical conducting bar is suspended above the tank, to which the inactive plates are attached. A guide at each end of the tank supports the bar.

670,808. Method of Electric Welding. John C. Perry, Clinton, Mass. Application filed September 15, 1899.

This patent covers a method of electrically welding parts having a coating of a relatively low melting temperature, which consists in applying to the parts a relatively heavy pressure, applying a current of electricity to the parts at their point of contact of relatively large volume and arranging the pressure to force the parts together automatically after the material softens, and thereafter break the circuit to volatilize the coating at the point of contact, so as to form an envelope about the weld and complete the weld before the heating action extends beyond the point of the joint sufficiently to destroy the coating surrounding it.

670,855. Safety Trolley Device. Charles W. Diamond, New Orleans, La., assignor to Moise Levy, Jr., New Orleans, La. Application filed July 18, 1900.

The pivoted trolley arm has an extension from its pivotal point and a tension spring connected to the extension. A block to which the spring is connected moves along a horizontal guide. A pair of toggle levers have at one end a fixed pivotal point and at their opposite end are pivoted to the block. A stop arrests the downward swing of the toggle levers at a point slightly below their central line. A flexible connection is made between the trolley arm and the toggle levers, the latter being arranged while in their extreme downward limit to maintain a working tension on the spring, but to respond to an excessive upward pull on the trolley arm connection and relieve the tension.

670,873. Railway Brake. Alfred Green, Rochester, N. Y., assignor to the Compound Magnet Brake company of New Jersey. Application filed March 1, 1901.

An operating handle applies a braking effort through a hand-operated mechanism, and is also arranged to apply a braking effort by means of electrically operated mechanism during a portion of its movement. Means are provided for varying, as desired, the point in the movement of the handle at which the braking effort from the electrically operated mechanism reaches its maximum.

670,877. Primary Battery and Process of Regenerating Same. Henry K. Hess, Philadelphia, Pa., assignor to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed December 21, 1900.

The process described for the treatment of battery fluids consists in reducing with water the density of a concentrate battery fluid, and employing the fluid in a battery cell in the production of an electric current, then regenerating the fluid and vaporizing out the excess water to restore it to its original density.

670,895. Unit-multiple System of Electrical Train Control. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction and Signal company of West Virginia. Application filed August 2, 1898.

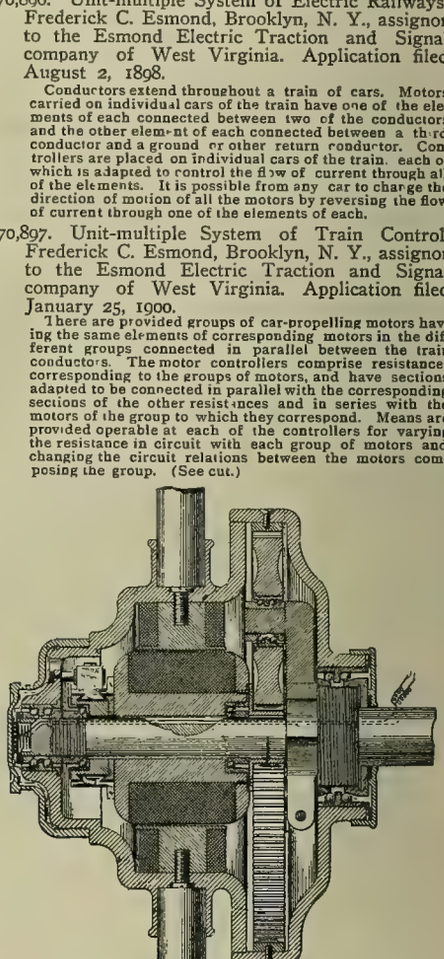
Two conductors extend through the train. Motors are carried by individual cars of the train, each motor having one of its elements connected between the conductors and its other element connected between one of the conductors and a ground or other return conductor. Motor controllers on individual cars of the train are electrically connected with a supply conductor, and electrical connections are made between the controllers and the pair of conductors mentioned.

670,896. Unit-multiple System of Electric Railways. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction and Signal company of West Virginia. Application filed August 2, 1898.

Conductors extend throughout a train of cars. Motors carried on individual cars of the train have one of the elements of each connected between two of the conductors and the other element of each connected between a third conductor and a ground or other return conductor. Controllers are placed on individual cars of the train, each of which is adapted to control the flow of current through all of the elements. It is possible from any car to change the direction of motion of all the motors by reversing the flow of current through one of the elements of each.

670,897. Unit-multiple System of Train Control. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction and Signal company of West Virginia. Application filed January 25, 1900.

There are provided groups of car-propelling motors having the same elements of corresponding motors in the different groups connected in parallel between the train conductors. The motor controllers comprise resistances corresponding to the groups of motors, and have sections adapted to be connected in parallel with the corresponding sections of the other resistances and in series with the motors of the group to which they correspond. Means are provided operable at each of the controllers for varying the resistance in circuit with each group of motors and changing the circuit relations between the motors composing the group. (See cut.)



NO. 11,899.

670,898. Unit-multiple System of Train Control. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction and Signal company of West Virginia. Application filed April 10, 1900.

Each car is provided with a pair of conductors and a motor which is connected with one of them, the conductors being also coupled throughout the train. There is an electrical connection on each car between the supply conductor and one of the pair of conductors, and a switch in each of the connections.

REISSUE.

11,899. Means for Propulsion of Vehicles by Electricity. Frederick J. Newman and Josef Ledwinka, Chicago, Ill., assignors to the Hub Motor company of New Jersey. Application filed February 11, 1901.

For an electrically propelled vehicle with a non-rotatable axle, a wheel having a hollow hub is provided with field-magnet coils and with an annular, internal gear journaled on the axle. The armature is provided with a pinion and also journaled on the axle. A bracket is secured to the axle and supports a gear wheel meshing with the internal gear and the pinion, the hub completely enclosing all of the other parts. (See cut.)

DESIGN.

34,277. Carbon Anode. Max Mauran, Niagara Falls, N. Y., assignor to the Mathieson Alkali Works of Virginia. Application filed January 10, 1901. Term of patent, 14 years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

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Power Plant of the Northwestern Elevated Railroad.

The Northwestern elevated railroad, being the latest of the Chicago elevated roads to be completed, and representing, as it does, the results of experience gained in the course of work on the previous undertakings, embodies many features, both mechanical and electrical, which are of much interest as illustrating the rapid progress which has been made in methods of design and construction within a few years. Among these may be mentioned in passing the design of the elevated structure itself, which provides for the transmission of longitudinal thrusts directly to foundations in the immediate vicinity, doing away with the longitudinal vibration which was often produced in elevated-railway structures to a marked degree by the starting of a steam locomotive drawing a heavy train, before the adoption of the third-rail system. Another unique feature is the use of aluminum feeders throughout. At the time of the installation the market price of copper was so high that the substitution of aluminum resulted in a substantial saving in the cost of feeders.

The power station of the Northwestern system is in keeping with the high order of engineering shown elsewhere by the designers of the road, and for a plant of such size is remarkable for its simplicity, flexibility and convenience of arrangement. The building, which is of brick, with concrete roof and checkered steel-plate floors, is situated on Fullerton avenue, near the corner of Southport avenue, and convenient to the tracks of the Chicago, Milwaukee and St. Paul railway. The property extends north to Dunning street, making a plot about 600 feet deep by 132 feet wide, on which are situated the power house, cold-storage house, ash-receiving bins and fuel track. The building itself is approximately 255 feet in length by 112 feet wide, and is divided longitudinally into an engine room, 57 feet seven inches wide, and a boiler room, 50 feet two inches in width. The height of the roof trusses above the floor varies from 36 feet to 38 feet.

Engines and Generators.

A general view of the engine room is given in Fig. 1. The unit in the foreground consists of a Siemens & Halske 750-kilowatt, internal-armature, railway generator, direct-connected to a Reynolds-Corliss cross-compound condensing engine built by the Edward P. Allis company of Milwaukee, Wis. The three large generating sets, of 1,500 kilowatts capacity each, are similar in general design to the smaller one, but differ in a few details. The generators of the two middle units, No. 2 and No. 3, are the first machines of the internal-armature type built by the Siemens & Halske company, while No. 4 and No. 1, the latter being the small generator, are of later design. One of the principal modifications made is the substitution of a much heavier commutator spider for the comparatively light construction employed in the earlier machines. The design is greatly simplified, and provides for readily removing the commutator for repairs, the shaft being lengthened to allow the spider to be shifted toward the main bearing after disconnecting the armature leads.

All the engines are of the Reynolds-Corliss type, with hollow-forged shafts of fluid-compressed, open-hearth steel made by the Bethlehem Steel company. The small engine has cylinders 23 and 46 inches in diameter, with 48-inch stroke, and runs at 80 revolutions a minute. It is fitted with a 20-foot flywheel. The larger engines have cylinders 30 and 60 inches by 60-inch stroke and are designed to run at 75 revolutions a minute. The flywheels are 25 feet in diameter. Each engine has two governors, one regulating the working cut-off in both cylinders in the usual manner and the other connected with a trip which releases the closing mechanism of a cut-off valve in the steam pipe, shutting off steam entirely when a safe speed is exceeded. The steam and exhaust piping, together with the separators and receivers, is all under the floor of the engine room, giving the latter a neat and trim appearance, as shown in Fig. 1. The engine room is spanned by two 35-ton hand-operated cranes.

In the operation of this station by far the heaviest duty falls to the 750-kilowatt generating unit. During the winter months this unit runs 46 hours out of every 48, being shut down for two hours every other day for cleaning and removal of dirt from the armature, compressed air being employed for the latter purpose. The load during the winter is heavier than during warm weather, owing to the large demand for current by the heaters. The heater load in cold weather amounts to as much as 20 per cent. of the maximum demand on the station, and in the early morning hours, when the trains are being prepared for service, may run up to 50 per cent. of the output at that time. The service required from the three larger units averages about 13 hours out of every 24.

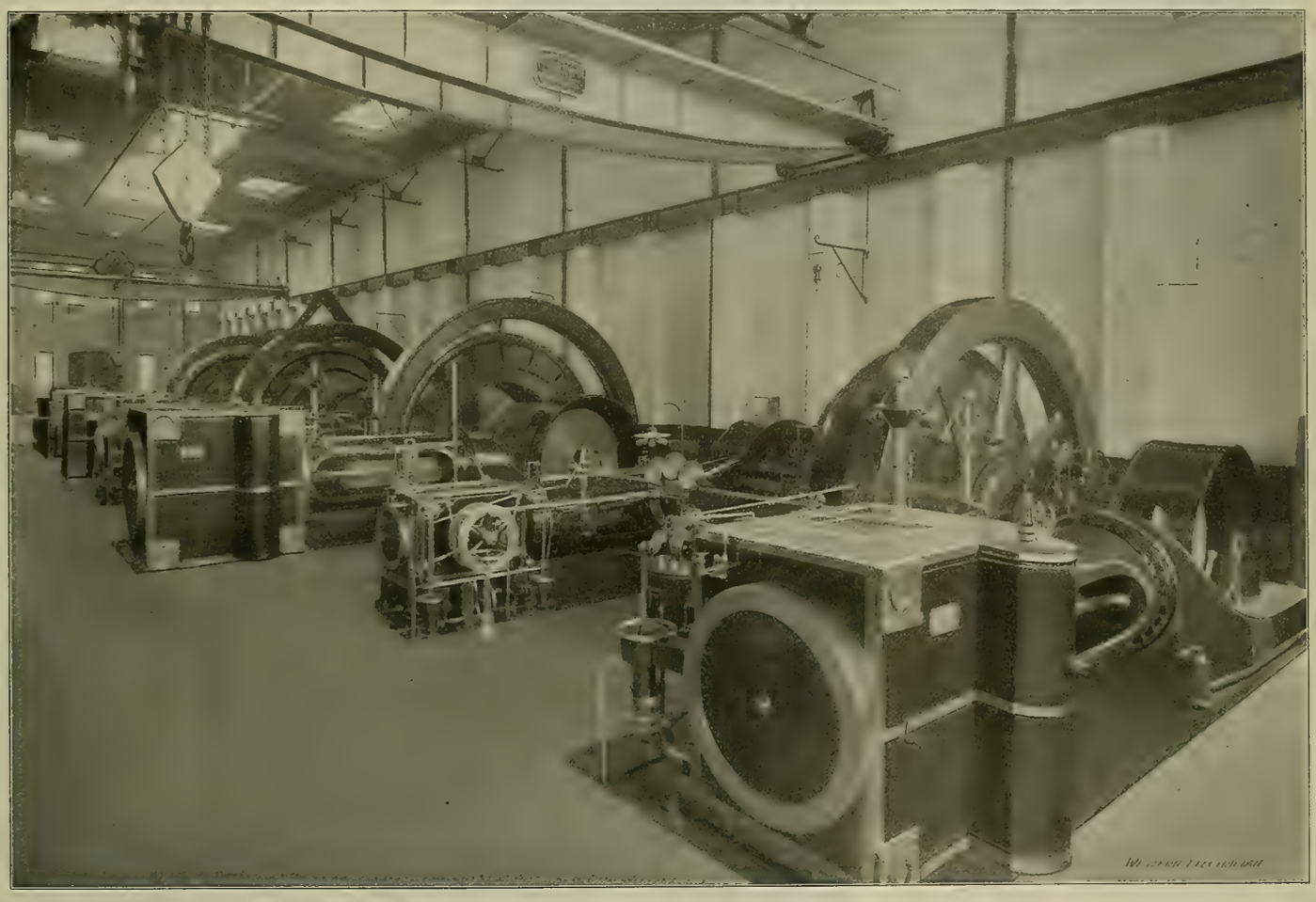

FIG. 1. POWER PLANT OF THE NORTHWESTERN ELEVATED RAILROAD.—GENERAL VIEW IN ENGINE ROOM.

Condensing System.

Contrary to custom in plants of this size, individual condensers for the four engines are not provided, but instead the entire engine exhaust is handled by a single Weiss counter-current condenser built by the Southwark Foundry and Machine company. Running along the east side of the partition wall, underneath the engine-room floor, is the exhaust main into which the exhaust steam from each engine is discharged through a 22-inch pipe. This main varies in size, being built up of lengths of pipe of diameters of 22 inches, 36 inches, 46 inches and 55 inches, and joins a 65-inch elbow and pipe after passing the fourth engine. The two smaller sections are of cast-iron pipe; the larger of wrought-iron. The 65-inch pipe is carried up and opens into the head of the condenser, which is about 10 feet in diameter and cylindrical in shape, with a conical top, situated about 35 feet above the overflow from the hot well. From the head of the condenser a pipe extends down al-

most to the bottom of the hot well, forming a water leg or barometric tube. The condensing water is supplied by a Bibus rotary pump and delivered to the condenser about six feet above the steam inlet. The discharge flows by gravity from the bottom of the condenser to the main hot well. From the top of the condenser a pipe is carried down to the bottom of a smaller well, where it opens under water, forming a second barometric tube. Near the top of this smaller water leg is placed a separator, from which a nine-inch suction pipe leads to the air pump. A small pipe connecting the main condenser vessel with the small water leg insures sufficient water in the auxiliary hot well to seal the tube. The water from the small hot well overflows into a bucket provided with a hole in the bottom, which allows the normal flow to escape. But in case of a sudden increase in load, when the supply of water has been adjusted for a light load, causing the temperature of the discharge to reach the boiling point, an abnormal quantity flows down the small water leg, causing the bucket to fill. The increased weight of the filled bucket opens a free air valve into the condensing chamber, reducing the vacuum sufficiently to stop the boiling, and maintains this condition until the quantity of injection is adjusted to meet the increased demand. The vacuum is thus slightly lowered, but not destroyed.

It has been stated that the installation of this central condenser resulted in a saving of over $10,000 in the cost of piping over that required for the installation of an independent condenser for each engine. The advantages of the plan adopted as claimed are, aside from the simplification of the piping and the saving in room, the reduction of head on the circulating pump, a lessened quantity of cooling water and a higher hot-well temperature. Since the supply of injection water is constant and independent of the vacuum, a sudden increase of load or a leak does not act to reduce the vacuum when it is most needed, and the condenser has given very good service.

On the floor of the engine room, near the north end, is placed a small horizontal engine connected in tandem with the condenser air pump. The latter is a Weiss dry-air compressor, and works entirely free from water. From this engine a belt is run to the Bibus rotary circulating pump in the basement of the engine room. The entire condensing apparatus is thus controlled by this engine, which runs "under" instead of "over," as is customary for machines of this type. With the type of condenser used only a small air pump is necessary. The city of Chicago has a 12-foot brick tunnel in Fullerton avenue, built for the purpose of supplying water from Lake Michigan to flush the North Branch of the Chicago River, and the circulating pump draws the injection water from this tunnel through a 30-inch pipe, and delivers it to the condenser, whence it returns through a 36-inch overflow to the tunnel.

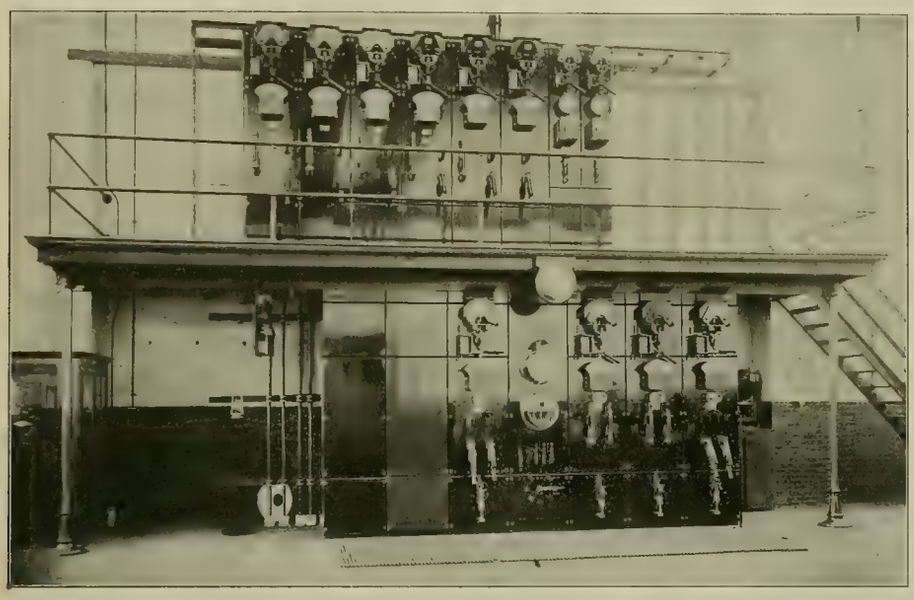

FIG. 2. POWER PLANT OF THE NORTHWESTERN ELEVATED RAILROAD.—SWITCHBOARD.

Switchboard.

Fig. 2 shows the switchboard, which is double-decked, the generator and load panels being in the lower tier and the feeder panels on the upper level. Weston station ammeters and voltmeters, Thomson recording wattmeters and General Electric circuit-breakers are used. The large single-pole, quick-break switches on the generator panels are connected to the terminals of the respective generators and the equalizer switches are mounted directly on the machines. The negative terminals of the machines are led to a round bus-bar at the back of the board, which is in turn connected to the return feeders. The lead-sheathed positive feeders and bare negative or return cables are carried below the engine-room floor and led out to the elevated structure, half a mile away, where the former are connected to the aluminum feeders running along the structure.

Upon the generator panels, near the floor, may be seen carbon-break field switches, designed to break the field circuits of the generators without injury to the windings, by absorbing, in a carbon resistance and finally in an arc, the energy stored in the field by virtue of its excitation. The panels are mounted upon an iron framework, as shown, and the latter has been completed to allow for the ultimate capacity of the station, 13,000 horsepower. An auxiliary bus-bar connects all the feeder panels, including an emergency panel. In event of an accident to a circuit-breaker or other apparatus, the panel affected is disconnected from the main bus by opening one of the switches shown, connected to the auxiliary panel by closing the other switch, and the single switch on the auxiliary panel is closed.

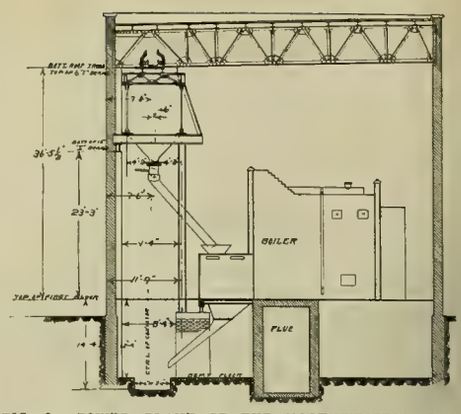

FIG. 3. POWER PLANT OF THE NORTHWESTERN ELEVATED RAILROAD.—SECTION THROUGH BOILER ROOM.

Boilers and Steam Piping.

The boiler room, of which a transverse section is shown in Fig. 3, contains 12 Babcock & Wilcox boilers, arranged in six batteries and equipped with Murphy extended-front smokeless furnaces. Fig. 4 shows the general appearance of the boiler room as seen from the floor level, and illustrates the type of stoking apparatus used, the latter being driven by small double-cylinder engines

Fig. 5 is a view of the boiler room taken from a platform near one of the roof trusses, and gives a good general idea of the steam piping and its arrangement. Steam at 160 pounds' pressure is led from the boilers to a 28-inch, lap-welded, wrought-iron header, the flanges on the lengths of pipe being welded on. The header is divided into three sections, each about 50 feet long, and each section is anchored near its middle point, a distance of about 14 feet being left between adjacent sections. These 14-foot spaces are bridged by expansion connections, each consisting of four U's of eight-inch steel pipe, in contrast with the copper bends commonly employed. The steam mains leading to the engines are 12-inch for the three large units and eight-inch for the smaller one. For the feed pumps, air pump, stoker engines and other auxiliary machinery an auxiliary six-inch header is provided, tapping each section of the main header. The boiler-feed pipes are carried on top of the boilers. Water is supplied to the boilers by three vertical Worthington duplex pumps, being passed through two Berryman feed-water heaters, into which the exhaust steam from the auxiliary machinery is taken.

Coal and Ash Handling.

Above the passageway in front of the boilers is placed a continuous coal bin, eight feet wide by eight feet in depth and about 200 feet long, with a capacity of about 350 tons. Coal chutes leading from this bin supply coal to the furnaces, as shown in Figs. 3 and 4. The bin is kept supplied with coal by an endless conveyor, which appears above the bin at the right of Fig. 5.

The coal and ash-handling system in use at this plant is of especial interest and deserves mention in detail. A single conveyor handles both coal and ashes. Coal is delivered in cars upon a track situated at the rear of the plant and hidden from view by the high board fence appearing in Fig. 6. Directly beneath the skeleton framework shown in an

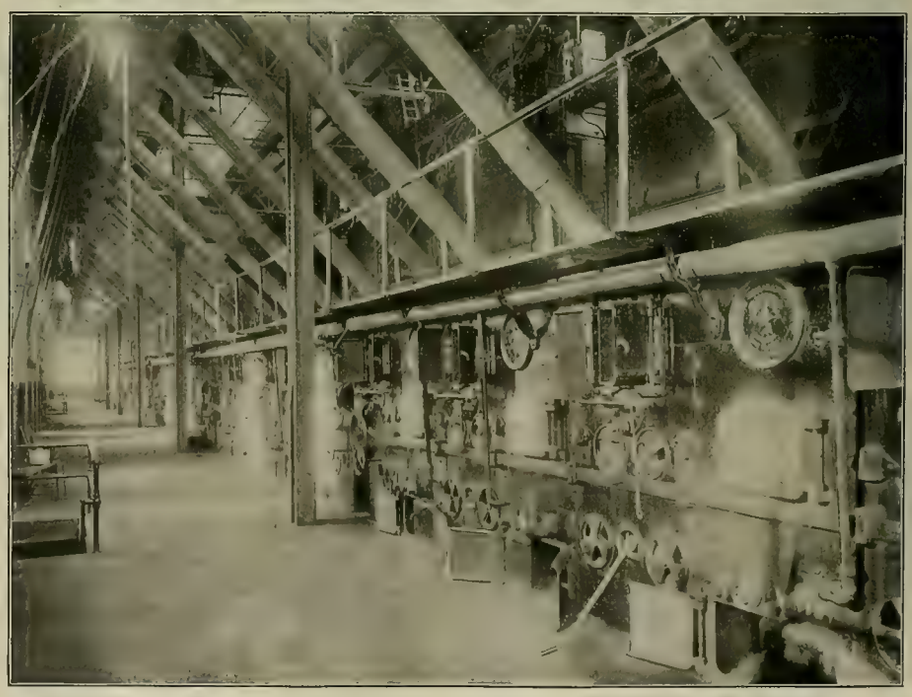

FIG. 4. POWER PLANT OF THE NORTHWESTERN ELEVATED RAILROAD.—BOILER ROOM.

unfinished state in this illustration are placed two large hoppers, into which the coal is passed from the car on the fuel track. The hoppers guide the coal into two crushers placed directly above the lower course of the conveyor in a tunnel running from the north end of the power house to the coal-storage building at the left of Fig. 6. After passing through the crushers, each of which is driven by a 25-horsepower General Electric motor, the fuel is discharged into the conveyor buckets and carried to the storage building. The buckets may either be tripped here, and the coal reserved for future use, or they may be allowed to convey the fuel back through the overhead structure shown and deliver it into the bin in the boiler room.

The floor of the storage building is provided with chutes for delivering the stored fuel to the conveyor in time of need. In Fig. 3 are shown ash chutes from the furnaces, which deliver the furnace refuse to the conveyor in the basement of the boiler room. From there the ash is carried under the coal crushers and through the coal-storage building and discharged into two cylindrical receiving bins built of one-fourth-inch plate and situated about 70 feet north of the power house, as shown in Fig. 6. It will be seen that neither coal nor ashes is handled within the power house, and that in all neither need be handled more than once. The conveyor is driven by a 25-horsepower General Electric motor, with a second similar machine installed as a reserve, and its total length is not far from 1,300 feet. The coal-storage building is 80 feet long, 24 feet wide and about 45 feet in height, and has a capacity of about 1,500 tons.

Chimney.

A prominent feature of the power station is the brick stack, which extends upward through the boiler room about 215 feet from the south wall. Its base, 27 feet square, rests on a foundation of piling carrying a concrete footing 31 feet square and five feet thick. At 35 feet above the ground the cross-section of the stack becomes octagonal. The total height above the bottom of the smoke flue is 217½ feet, and above the street level, 203 feet. For the first 110 feet there is an internal shaft of fire-brick, with an internal diameter of 16 feet, and with walls decreasing in thickness from 17 inches at the base to nine inches at the top. The wall of the stack is 44 inches thick at the bottom and 13 inches at the top, the internal diameter of the stack at the top being 16 feet.

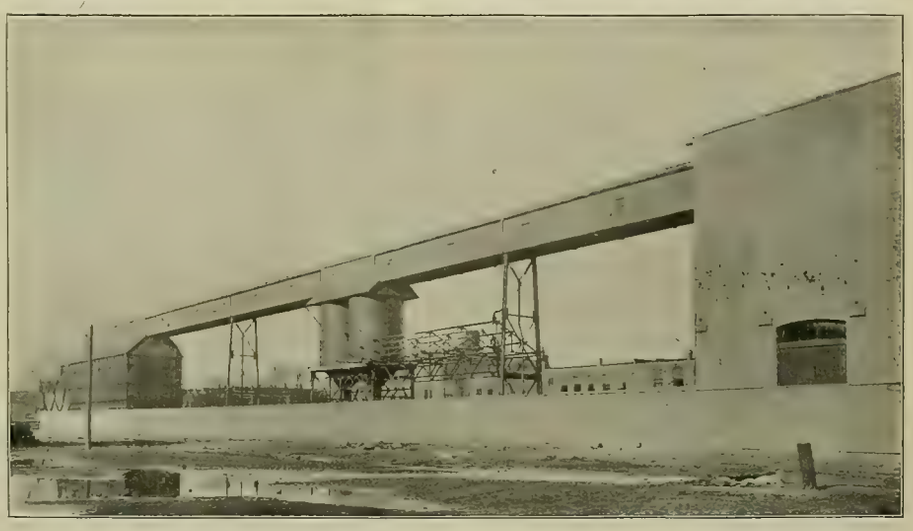

FIG. 6. POWER PLANT OF THE NORTHWESTERN ELEVATED RAILROAD.—COAL-HANDLING APPARATUS.

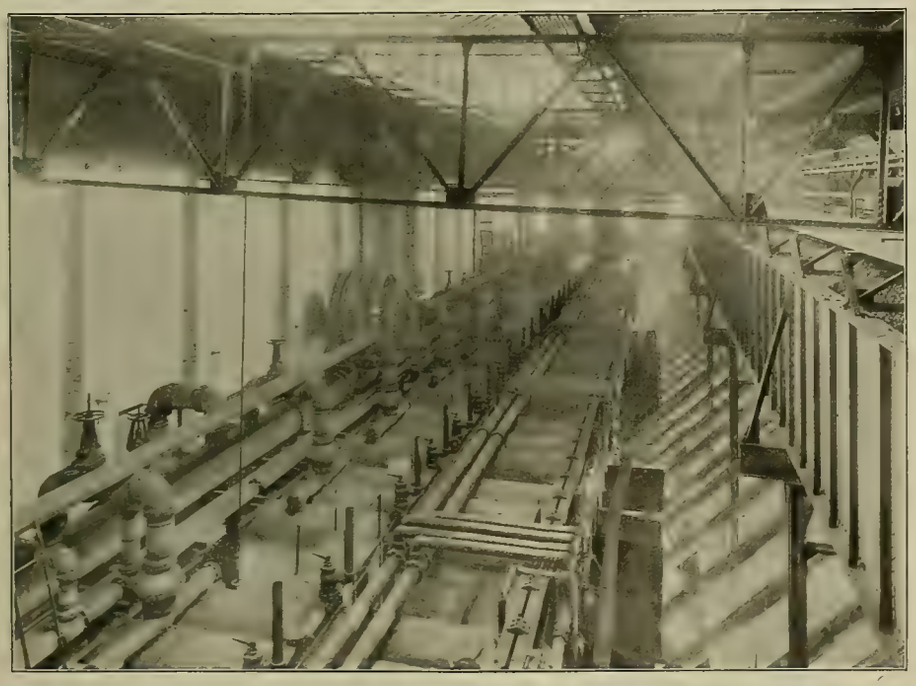

FIG. 5. POWER PLANT OF THE NORTHWESTERN ELEVATED RAILROAD.—PIPING OVER BOILERS, WITH COAL CONVEYOR ON THE RIGHT.

Conclusion.

The final revision of the plans of the mechanical part of this plant was made by James R. Chapman, formerly electrical engineer for the Yerkes roads, and the electrical equipment was entirely designed by him. The station is in charge of John Wright, chief engineer, who kindly co-operated in securing the data and illustrations herewith presented.

The Graves County Water and Light company of Mayfield, Ky., will convert its present arc-lighting system to the series enclosed-arc alternating system this summer, and is in the market for equipment. W. E. Playter is chief engineer of the company.

Large Combination of Lighting Companies.

It is said that a movement is on foot to combine the existing gas, electric-light, waterpower and traction companies now operated in different cities by the McMillin syndicate, making one central company having a capital of $35,000,000. Such a corporation would undoubtedly absorb new companies in addition to the ones now controlled. Emerson McMillin of New York, one of the prominent stockholders of the East River Gas company, which is now a part of the Consolidated Gas company, is credited with the project. The companies already under consideration are given as the Detroit Gas company, the Binghamton gas works, the Columbus (Ohio) Edison company, the Grand Rapids (Mich.) Gas company, the Jackson (Mich.) Gas company, The Laclede Gas company of St. Louis, the Consolidated Gas company of Long Branch, N. J., the Madison (Wis.) Gas and Electric company, the St. Joseph (Mo.) Gas company, the St. Paul (Minn.) Gaslight company, the Western Milwaukee Gas company, the Denver Gas and Electric Light company, the Southern Light and Traction company of San Antonio, Texas, the Montgomery (Ala.) Light and Power company, the Jacques Cartier Water Power company of Quebec, and the Winnebago Traction company of Oshkosh. All, or nearly all, of these are now known as McMillin companies.

It is said that the new company will be known as the American Light and Traction company, and that a New Jersey charter has been applied for.

The Boothbay Harbor Light, Heat and Power company of Lewiston, Me., has been incorporated, with $10,000 capital stock, by K. H. Richards.

Electric Lighting in Massachusetts.

In their report to the Legislature for the year ended December 31, 1900, the gas and electric-light commissioners of the state of Massachusetts state that the assets of electric companies in that state aggregated $20,648,766, against $19,086,783 the previous year, and that their liabilities amounted to $19,128,326, against $17,778,555 the previous year.

The commissioners recommend some provision for state testing of electric meters whose accuracy may be disputed by consumers. They also suggest legislation by which gas and electric-light companies shall be required to pay reasonable interest on deposits made by their customers to secure payment of bills. A bill of this description has been reposing on the table of the House of Representatives since March 14th.

The commissioners call attention to the fact that they have no power to prevent or control combinations of corporations, referring particularly to the proposed consolidation of the Boston electric-light companies. The report contained the following financial statement of the business of the electric-light companies doing business in the state:

	1900.	1899.	1898.
Gross earnings	$5,678,111	$5,092,113	$4,821,779
Net earnings	2,132,879	1,813,995	1,782,435
Dividends	724,109	632,182	567,235
Surplus	262,475	99,540	256,113

Professor Van't Hoff Coming to Chicago.

Dr. J. H. Van't Hoff, professor of physical chemistry at the University of Berlin, will deliver a course of lectures at the University of Chicago during the summer. He will arrive about June 16th, and will be a guest at the decennial celebration. Then, beginning June 19th, he will give a course of daily lectures on physical chemistry during the first part of the summer quarter. Professor Van't Hoff is a Hollander, and for many years was a professor at Amsterdam. The enunciation of his theories and discoveries 15 years ago originated the research work in the borderland between chemistry and physics which is now being pursued by scientists in Europe and America. He is 52 years old, and a man of interesting individuality. Van't Hoff ranks with Arrhenius, Nernst, Ostwald and Helmholtz as one of the founders of the science of electrochemistry.

Electric Train Operation in Cascade Tunnel.

The Great Northern Railway company recently completed an immense tunnel through the Cascade Mountains. Since using it, however, a great deal of trouble has been met from gases, smoke and heat through the big bore. Recently a train stalled in the tunnel and the engineer was overcome by gas and died. Others of the train crew suffered, but were revived. As a result, it is understood the company is now preparing plans for two electric-power plants to operate trains through the tunnel. It is proposed to build a large power station at each end of the tunnel, and trains will be taken through by electric motors. Fans are to be provided also to keep the air pure and to keep the temperature down.

The electric-light company of Aberdeen, Wash., contemplates putting in additional equipment which will double its present capacity and involve an expenditure of about $10,000.

Edison's New Storage Battery.

It has been known for some time that Thomas A. Edison has been at work on a new form of storage battery, with the idea, as stated in the Western Electrician last week, of producing a cell of much less weight and greatly increased efficiency over existing types. It is difficult to obtain exact information about Mr. Edison's work in this line, as no American patents have been issued—or had not been, at any rate, up to April 8th of this year—and the great inventor and his associates are naturally reticent until their plans are perfected. However, an English patent (No. 20,960) was granted to Mr. Edison on November 20, 1900, for an interesting form of battery, and some of the journals are assuming that this is substantially the battery that Mr. Edison purposes to bring out in this country. This is quite likely to be true. At any rate, a brief account of the battery described in the English patent will now be of interest. The following particulars are translated from a German journal, the Centralblatt für Accumulatoren und Elementenkunde of March 15th:

In the new cell the electrolyte remains unaltered, so that a small quantity suffices. Copper oxide is used as a depolarizer. In the older cells soluble copper salts are formed, copper precipitates on the zinc, and so, through local action, quickly brings on dissolution. It has been attempted to prevent the circulation of the salts by surrounding the positive electrode with porous material, but the efforts were not successful, because in the first place the porous material did not entirely prevent circulation; secondly, it was destroyed in time by the strong alkali; thirdly, much fluid was necessary, and, finally, the resistance of the cell was thus rendered very great. It is now found that very finely divided copper forms copper oxide, dehydrated and insoluble in alkaline lyes, while if only a minute piece of coarse copper is present, or if that which is finely divided is pressed together, soluble copper hydrate results. Finely divided copper is artificially prepared by reduction of the carbonate with hydrogen. Finely divided cadmium serves as the negative element. This and the copper are held in a containing vessel of nickel or other metal, such as nickel-plated iron.

Fig. 1 shows a plate in perspective and Fig. 2 in plan, while Fig. 3 gives a vertical section through a cell with four plates. The plate marked (1) is formed of comparatively thin sheet-nickel. The plates are secured together by insulated bolts (4') passing through the lower eyes (4), while the upper eyes (5) serve for electric connection, which can be made by bolts (5'). On one side of the plates are fastened the receptacles (6) for the electrode

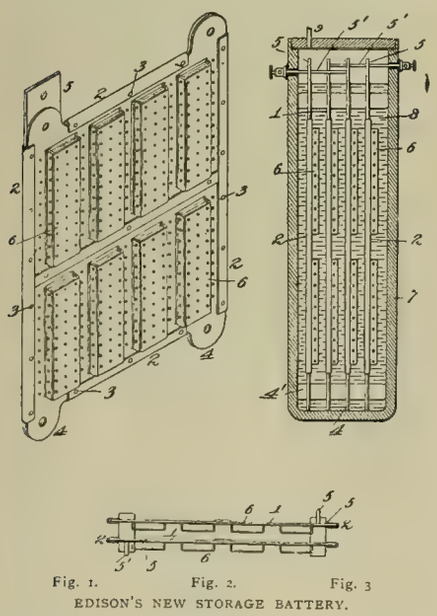

Fig. 1. Fig. 2. Fig. 3

EDISON'S NEW STORAGE BATTERY.

metal. They are best made of sheets of nickel or nickel-plated tin. The plates are cleaned most advantageously by heating them to a red heat in a closed oven, and then reducing the oxide with hydrogen.

The cadmium is obtained in a finely divided, fibrous and very pure state by electrolysis of a weak solution of sulphate of cadmium between a thin platinum wire as a cathode and a sheet of cadmium as an anode, a strong current being necessary. The precipitated cadmium is removed from the cathode from time to time and freed of the sulphate by washing in water. Then it is packed in the pockets. In recovering copper from the carbonate the temperature must be maintained as low as the completion of the reaction will permit, because otherwise the density of the copper is raised to a harmful degree. The copper thus obtained is molded under light pressure into thin blocks, which fit tightly in the pockets. The molds must not dent or scratch the plates, in order that the density of the copper may not be locally increased.

The plates are then heated in a closed oven for six or seven hours at not over 260 degrees, until the copper is transformed to the black oxide. At higher temperatures the density is greatly increased. The blocks of copper oxide are thereupon reduced to metal electrolytically and finally changed by charging into the red oxide. The copper first obtained could be filled directly into the pockets, but as it is not fibrous, as the cadmium is, the particles are not connected sufficiently intimately, and it is not as efficient as after going through the process described.

After the pockets are filled and the plates bound together they are placed in a vessel (7) which contains as electrolyte (8) preferably a 10 per cent. solution of pure sodium hydrate. Since in charging the cell only water is decomposed and in discharging is regenerated, only a little fluid is needed, so that it is sufficient to moisten with the electrolyte thin sheets of asbestos or other alkali-resisting material placed between the plates. The internal resistance of the cell is very small. The materials are not attacked, and local action between the cadmium and nickel does not take place. The containing vessel may be made of nickel or of other metal nickel-plated inside. A vent is provided for gases which are produced by overcharging.

The voltage is given as 44, which is probably an error for 0.44. No figures are given upon the cost of the battery, but a reference to the market prices of cadmium and its compounds shows that at wholesale cadmium sulphate brings from two to 2½ cents a pound, while metallic cadmium is listed at $1.40 a pound, or thereabouts. Cadmium's specific gravity is about 8.5, while that of lead is 11.7. If the production of cadmium by electrolysis of cadmium sulphate presents no difficulties it is probable that the demand for the metal will eventually result in the adoption of methods for its production which may be expected to effect a material reduction in its cost.

Express Service on the South Side Elevated Railroad.

The South Side Elevated Railroad company of Chicago is planning improvements which will cost about $1,500,000 and result in a material betterment of the service in respect to the present crowded condition of the cars in the morning and evening. It is proposed to acquire the use of the public alleys which adjoin the right-of-way of the road north of Forty-third street, straighten out the bends in the track and add a third track to the system, to be used for express service from Forty-third street, northward in the morning and southbound in the evening. An express station would be established at Congress street and Victoria alley. With this addition to the structure, during express hours all northbound trains would be switched to the express track at Forty-third street and run through from there, while the locals would take care of the traffic between Forty-third street and the loop. This plan would relieve the trains from the southern terminal of all the traffic north of Forty-third street and enable them to make better time, while the local trains would be better able to give accommodation to passengers from that section of the city. The company proposes to pave a thoroughfare under its structure in return for the use of the alleys, the type of pavement used to be determined by the city. Such an increase of service would necessitate additions to the rolling stock. As to the means of raising money for the proposed work, it is stated that it has always been against the policy of the directors to issue bonds, and that an additional issue of stock would probably be made. The present bonded debt of the road is $750,000.

Smelting and Refining Combination.

A New York dispatch states that a combination which will control practically the entire silver and copper product of the country was authorized on April 8th by the stockholders of the American Smelting and Refining company. The capital stock of the company will be increased to $100,000,000, according to the decision of the shareholders. The $40,000,000 added to the stock of the company will be used to purchase M. Guggenheim & Sons' properties, the only important competitors of the larger corporation. The minority stockholders agreed to withdraw their suit enjoining the majority owners from increasing the capital to take in the rival.

Citizens of Howell, Mich., have voted to bond the town for $15,000 for a municipal lighting plant.

Death of Charles A. Munson.

Among the electrical business men of Chicago none was more cheerful, more kindly or more generally esteemed than Charles A. Munson, Chicago manager of the Fort Wayne Electric Works, who died on April 4th, after an illness of two weeks' duration. Mr. Munson was an open-hearted, generous, affable man, with an unaffected warmth of manner that

CHARLES A. MUNSON.

made every casual acquaintance his friend and bound his more intimate friends to him with ties of close esteem. He was ever ready to extend a helping hand to others, and his unfailing kindness made him a very large number of friends throughout the West who will learn of his death with deep regret.

Mr. Munson was taken sick on March 21st with an intestinal disorder which shortly assumed alarming proportions. He was removed from his apartments in the Lexington Hotel to Mercy Hospital and an operation was performed, on April 3d, from which he rallied but temporarily, dying on the succeeding day.

Charles A. Munson was born in Fort Wayne, Ind., March 27, 1843, and until the close of his life he called Fort Wayne his home and maintained a voting residence there, although doing business in Chicago for the last 11 years. His father was James P. Munson of Connecticut, and his mother was born in Ireland. When Charles was 10 years old his father died, and the boy soon had to contribute his mite to the support of the bereaved family. He became a telegraph messenger, and afterward "clerked it" in several stores in his native town. He was a bright, industrious boy and did not lack for employment. At the age of 19 he enlisted in the United States navy and served in the river campaigns during the Civil War until after the fall of Vicksburg, when he resigned with the rank of lieutenant.

After the war young Munson engaged in mercantile pursuits, becoming a very successful salesman in the wholesale-grocery line. He traveled a territory covering parts of Ohio, Indiana and Illinois for Huestis & Hamilton of Fort Wayne, in which firm he eventually became a partner. About 1875 Mr. Munson became interested in politics. He was elected an alderman in Fort Wayne on the Democratic ticket, and from 1876 to 1880—two terms—served as sheriff of Allen County. When he ran the second time he received the largest plurality ever given to a sheriff in Indiana up to that time. His next political honor was the nomination for auditor of the state in 1886, but he suffered defeat, with the rest of the Democratic ticket, by a small majority. In 1888 he was renominated, but his zealous work for the party again proved unavailing. The nominations, however, served to show Mr. Munson's popularity throughout the state. As an officer of the county he displayed courage and discretion and was never lacking in the performance of his duties.

After closing his political career Mr. Munson again engaged in business. He was intimately acquainted with the late R. T. McDonald of the Fort Wayne

Electric company, the two having been fellow travelers selling merchandise, and at Mr. McDonald's earnest solicitation he entered the service of the Fort Wayne company in the spring of 1889. After spending a brief time in the factory and general office at Fort Wayne, Mr. Munson became connected with the Chicago office of the Fort Wayne Electric company. After a few months he became manager of that office, which position he held for the Fort Wayne Electric company and for its successor, the Fort Wayne Electric corporation, and also for the Fort Wayne Electric Works, in whose employment he was at the time of his death. Mr. Munson was a successful sales manager and did much to uphold the business of the company through all the changes in management at Fort Wayne. He was active in concerted efforts for the good of the industry, and last fall was one of the marshals of the electrical division of the sound-money parade. He was generally called Colonel Munson, but on many occasions he laughingly disclaimed the title.

The deceased was a prominent Mason, and the Knights Templars took charge of the funeral services, which were held in Fort Wayne on April 7th. Mr. Munson was a bachelor, and the surviving relatives are a sister, Mrs. Diedrich Meyer, and a half-brother, Mr. W. P. Cooper, both of Fort Wayne.

Patent Commissioner Allen.

Frederick Innes Allen, the new commissioner of patents, was born in Auburn, N. Y., January 19, 1859. He comes from New England stock, being a direct descendant of George Allen, who landed with the Weymouth party from England in 1636, and settled at Weymouth, Mass. Mr. Allen's father was William Allen, who, for many years, was actively engaged in the practice of patent law. He was contemporary and associated with such patent practitioners as Blatchford, Gifford, Harding and other authorities upon patent law a generation ago. William Allen was born in Saratoga County. The family settled in Ledyard town, Cayuga County, in 1817. In 1843, Mr. Allen removed to Auburn, where he resided until his death, 20 years ago.

Commissioner Allen has always resided in Auburn. He was educated at the Auburn High School and Phillips Academy, Andover, and was graduated by the Sheffield Scientific School of Yale, with the class of '79. He then took up the study of law and was admitted to practice in 1882. His natural inclination was to patent law, in which his father had achieved such signal success, and he at once began

FREDERICK I. ALLEN, COMMISSIONER OF PATENTS.

the study of this special branch of his profession. He has been successful in his practice, his natural liking for machinery and his knowledge of the law combining to qualify him for his chosen specialty.

Mr. Allen has been a special student upon naval and ordnance construction, and he has given a number of instructive addresses upon these subjects. Mr. Allen also excels as a mineralogist. While at Yale he took the class prize for geological and mineralogical study. He has never lost interest in the subjects and his private collection of specimens is large and complete. The new commissioner is a son-in-law of General William H. Seward, and he has a charming home in Auburn.

The Cooper Electric company of Cooper, Texas, has been chartered, with a capital stock of $12,000, by Charles Tuttle, W. R. Evans and E. S. Kelley.

High-potential Discharges in Sign Work.

By Orrin E. Dunlap.

An apparatus invented by C. E. Skinner, insulation expert of the Westinghouse Electric and Manufacturing company, and which is being experimented with at Niagara Falls by Paul M. Lincoln, resident electrician of the Niagara Falls Power company, is attracting much attention from the fact that, while it furnishes the basis of a striking electric-sign display, it also produces artificial thunder and lightning in quantities and quality that form earnest competition with the genuine article.

Mr. Lincoln has the sign, which is lettered on a heavy plate of glass, erected in the transformer station at the Falls, where there is plenty of current of high voltage to operate it, and when it is working it is the liveliest electrical feature Niagara has ever seen.

HIGH-POTENTIAL SIGN WORK.

When the current flows to the sign at a low potential each letter appears surrounded by a violet fringe of light, and then, as the tension is increased, wriggling, rootlike streamers of light shoot out in a manner that is beautiful in the extreme. These vary in length as the voltage is raised, and soon each letter is surrounded by a dazzling halation of strange light. When the voltage is still further increased long streamers of light are seen. As each one of these is produced it is accompanied by a sharp report, which, with the flashes of lightning, gives a true storm effect. The sign is seen at its best when the current is at about 40,000 volts, and it makes a really wonderful exhibition. It is understood that the sign will be shown at the Pan-American Exposition. If so, it will be one of the most attractive electrical features shown there.

Lighting Combination in Montreal.

The Montreal Light, Heat and Power company was formally organized at Montreal, on April 4th, with the following-named directors: Mr. H. S. Holt, president; James Ross, first vice-president; Rodolphe Forget, second vice-president; Hon. L. J. Forget, Hon. Robert Mackay, Hon. H. B. Rainville, H. Montague Allan, Lieutenant-colonel F. C. Henshaw and Charles E. L. Porteous. Mr. H. H. Henshaw was made secretary-treasurer of the new company, which is launched with a capital of $17,000,000. Four of the directors are also directors of the Montreal Electric Street Railway company. Mr. Forget, being asked the meaning of this close affinity, said he did not know, except that perhaps "coming events cast their shadows before." Mr. Holt, the president-elect of the big company, was president of the Montreal Gas company. Mr. James Ross is the well-known street-railway magnate who is heavily interested in the Montreal and Toronto street-railway companies. Mr. Forget was the president of the Royal Electric company. All the other directors are leading capitalists of Montreal. The president's salary will be probably placed at $25,000 per annum. It is announced that the holders of the Royal Electric and the gas companies' stock will receive 2½ of the new company's shares for each one formerly held, while the holders of the Montreal and St. Lawrence Light and Power, formerly the Chambly company, will receive share per share. The Montreal Gas company has 75,000 shares, the Royal Electric company, 26,000, and the Chambly company, 30,000, forming 170,000 shares of the new stock at $100 per share, or a total capital of $17,000,000.

Artificial Light in Mexico.

Electric lights are coming into more general use all the time in the City of Mexico, says Modern Mexico, as the various companies add to the capacities of their plants. Three companies are now furnishing electric light and power. An American company is preparing to erect a modern gas plant. Several gasoline-lamp companies are operating in the Republic of Mexico through local agents. Candles, however, remain in very general use among all classes. Petroleum costs from 60 to 70 cents a gallon, while tallow candles of local manufacture can be purchased as low as one cent each, this price naturally for a small taper. Mexican workmen can get along with less light, apparently, than any other class. In some of the old-fashioned offices of important commercial houses no other light is ever known than tallow dips. A bookkeeper may be seen making his entries in a great ledger with the light of a single candle, and the wealthy proprietor may be found bending over his big mahogany desk flanked by two tall and stately candelabra. A Mexican printer can work with a candle stuck carelessly into one of his boxes, and two tailors in the small shops can be seen sharing the rays of a single dip. The opportunities for the sale of better lighting apparatus in Mexico will be great when it can be provided cheaply and of simple construction.

Electricity and the Coming Race.

[From the Milton News.]

Thomas Edison, the greatest inventor the world has ever known, has made another invention that is going to play thunder with everything in general. He has invented an electrical storage battery which will work. All one will have to do hereafter will be to buy a little storage battery, and when the clerk has wrapped it up, take it home under one's arm, put it in the cellar, tap it with wires as one would tap a keg of hard cider with a straw, and the storage battery will do the rest. One wire will run through the cook stove and heat it; then it will continue to the bathroom, where it will run a pump to elevate the water; from there it will run into the parlor, heat that room and operate the electrical piano player, light the room and run a couple of fans. From the parlor the wire will run to the sitting room, where it will furnish light and heat, run the sewing machine and carpet sweeper, and kick the cat into the kitchen and larrup the kids. There is no use talking, it won't be long until we will be eating liquid electricity like oatmeal, and our farmers be out of a job. Electricity will be the motive power as well as the sustenance of the coming race of people, and all the use we will have for the old-fashioned electrical poles now in use will be to hang ourselves to them for being born so soon.

Consolidation of Cincinnati Lighting Companies.

The directors of the various Cincinnati lighting companies have formally accepted the terms of the North American company submitted through a board of arbitrators. The companies entering into the combine and the percentages allotted them by the arbitrators are as follows: Cincinnati Gas Light and Coke company, 68.80 per cent.; Cincinnati Edison Electric company, 27.65; Jones Brothers Electric company, 3.20; Brush Electric Light company, .05; First Cincinnati Edison Electric company, .30; total, 100. In monetary value the amounts are: Cincinnati Gas Company, $19,264,000; Cincinnati Edison company, $7,742,000; Jones Brothers company, $896,000; Brush Electric company, $14,000; First Cincinnati Edison company, $84,000; total, $28,000,000.

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CONVENTIONS AND EXPOSITIONS.

Southwestern Gas, Electric and Street Railway association, Rice Hotel, Houston, Texas, April 19th to 22d.

Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Boston, Mass., June 19th.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Of course, everyone will hope that Mr. Edison has really solved the problem of making a light storage battery of high efficiency. If he has done so, impetus will be given to many forms of electrical industry, for the accumulator as it is has many and diverse applications, and this usefulness could certainly be increased by cells of less weight per unit of output and of longer life. Following his usual custom, Mr. Edison has made no rash predictions; but an actual demonstration of the new battery will be awaited with great interest.

In a recent financial publication some interesting facts about the slow-but-sure electrical development of England are given. The capital invested in electrical undertakings in that country exceeds £123,000,000, and of this nearly one-half represents lighting and traction investments made during the last 10 years. The average return on the aggregate capital—debentures, preferred and common stock—is stated to be 5½ per cent. There are 470 miles of electric railways and 500 more in course of construction. In the application of electricity to the working of underground railways, London takes a prominent place. There are now 14 miles of such railways in operation in London. There are 40 miles under construction, or authorized, and no less than 17 bills for electric railways in London are being promoted. Altogether, electrical undertakings of all kinds, but particularly railway projects, seem to be looking up in England.

Electric heating makes way but slowly. It is good, but expensive. It is very convenient—almost indispensable, in fact—on large electric cars; but what a demand it does make on the power house! In the article presented in this issue describing the power plant of the Northwestern elevated railroad it is shown that in severe weather from 20 to 50 per cent. of all the current sent out on the line is used in heating the cars. So if electric heating and cooking could be generally introduced it would be a fine thing for the central stations, but rather hard on the householders. However, special appliances for utilizing electric heat continue to be brought out. Thus a German company announces an apparatus for the heating of goods exposed in show windows and for the prevention of the settling of steam or ice on the window panes. The device consists of an iron frame, in which a number of wires are fixed in such a manner as to prevent a short-circuit. The heating resistance is so calculated as to exclude superheating, even by maximum load. The contrivance has the advantage that it is not necessary to disturb the goods when turning the heat on or off, as this may, of course, be done by means of a switch fixed anywhere in the shop. It is also less dangerous than the open gas-burners sometimes used for this purpose. In special applications such as this and in use with certain kinds of tools, electric heating seems to find its greatest utility outside of the warming of passenger cars.

It is especially interesting, now that the United States is to be supplied with a standardizing bureau of its own, to observe the great care taken in work done at the Reichsanstalt, the justly celebrated physico-technical institution at Charlottenburg, Germany. From a recent account of tests on electric meters at that institution we observe that current and pressure are obtained from accumulators, which can be connected in various ways in series or parallel by mercury switches. The maximum current that can be taken is 10,000 amperes. The main resistance consists of 800 strips of "constantan," which can be switched into parallel, one after the other. For currents higher than 6,000 amperes a water-cooled tubular resistance of about 0.002 ohm is joined in parallel with the strips. Portable slide-wire rheostats are used for exact adjustment with moderate currents. Measurements of current and pressure are mostly made with instruments of the Weston type. Times are taken either by a stop-watch or by a recording chronograph. The latter admits of at least twice the accuracy of the former, and hence saves time in testing. No meter has hitherto been found sufficiently accurate to serve as a standard. In the case of meters for large currents, the current in the leads has often a perceptible effect on the readings, and the tests are therefore carried out with the leads in the position which they will have when the meter is in use, this position being specified on the certificate of the test. It has been found advisable to measure the resistances of the meter first of all. The rate of the meter is taken by short tests, at one-fifth, one-half and full load, and it is then run at full load for an hour. They know how to do these things thoroughly in Germany, but we have no doubt that Professor Stratton and his assistants will demonstrate that equally as exact, careful and scientific work can be performed in this country.

Mayor Harrison's annual message contains an interesting reference to the street-railway problems of Chicago. The mayor says there is nothing in the "99-year act," as it is called, to prevent the city from granting franchises to competing companies to duplicate every mile of track now laid in the city. Moreover, the 99-year act does not apply to all the old lines. Wabash avenue is said to be notably excluded from the operation of its terms, as are also Wells street, Dearborn street, North Clark street, South Clark street and Michigan avenue. For these reasons the mayor thinks that claims of the companies under the so-called 99-year act are neither so strong nor well-grounded as they are at times made to appear. And for that reason, he adds, the companies are not so well intrenched that they may attempt either to dictate terms to the city or to refuse reasonable terms offered them by the city. "There is no desire on the part of the vast majority of the citizens of Chicago," continues the mayor, "to occupy the attitude of confiscating property or repudiating obligations already assumed. The results of the last two mayoralty elections state in plain, unmistakable terms what the citizens believe in and insist upon as a satisfactory settlement of the street-car-franchise question."

The mayor sums up the public demand as follows:

1. Compensation to the city based upon a percentage of the gross receipts.
2. A reduction of fare during the rush hours of the day.
3. A betterment of accommodations.
4. A distinct waiver of all claims under the 99-year act.
5. A provision for municipal acquirement of the properties at the expiration of the grant.

It is explained by the mayor that the first and second points are practically one and the same. When a careful study of the question has shown what compensation the companies can afford to pay, it will devolve upon the City Council to decide the form in which it is to be paid, whether in straight compensation, in a reduction of fares or in both forms. "In addition to these questions," concludes the mayor, "the companies must be required to lay the grooved rail in all streets where property owners have laid permanent pavements, while the overhead trolley, as well as the antiquated cable, should be supplanted by the underground trolley at the very least in the district bounded by Twenty-second street, Western avenue and North avenue."

Thus the re-elected chief magistrate of the city lays down his programme. The outline is one providing for a settlement that may be perfectly fair to the companies or unjustly onerous, according to the manner in which it is carried out. The declaration against the "antiquated cable" and overhead trolley wires in downtown streets is no surprise, and it may be accepted as a fact that, once the franchise question is settled, great changes in the mechanical equipment and operation of the street-railway systems will be effected. For one thing the great polyphase station of the Chicago City Railway company will be built, and Chicago will have an up-to-date power-generating plant. Whether the conduit system will also be installed is not so certain, but it may be in the principal thoroughfares, although the companies will not acquiesce in the employment of this very expensive system without the most vigorous kind of a protest.

In the meantime several street-railway bills of varied nature are pending in Springfield. There is said to be a fair prospect of the passage of the bill recommended by the Chicago Street-railway Commission and summarized by the Western Electrician a couple of months ago. Several other bills bearing on the subject of uniform accounting, bond issues and municipal control have also been introduced, and the outcome of it all is doubtful. One thing is evident: The street-railway situation in Illinois, and in Chicago particularly, will be of great public interest for the next year or two, or until the general question is settled, some time before 1903, when many important franchises expire.

Ohio Telephone Association.

The regular annual meeting of the Ohio Telephone association was held in the assembly room of the Chittenden Hotel, Columbus, on April 5th. The meeting was called to order at 10 o'clock by President James M. Thomas of Cleveland. There were an even 100 delegates present, made up of the managers and officers of the Independent companies throughout the state. It was indeed a representative body of telephone men, and the enthusiasm displayed in the conduct of the business was sufficient to warrant even greater success in the future than has characterized the events of the past few years.

In a few well-chosen words, Judge Thomas introduced Mr. Henry A. Lanman, president of the Citizens' Telephone company of Columbus, who delivered the address of welcome. Among other things, Mr. Lanman said: "It was a community of interests that brought into existence the Ohio Telephone association, born as the result of a menace from a gigantic monopoly which was not content alone to cast a shadow upon its securities, but with an uplifted club in the so-called Berliner patent was ready to beat out the life of any who might enter the field of fair competition. Since our meeting in Cleveland one year ago this club has been broken. Our honored president, Judge Thomas, and our secretary, Mr. Critchfield, have not only served this organization efficiently in working to show the invalidity of the Berliner patent, but they are entitled to the lasting gratitude of all of the people of the country who have been paying unjust tribute, not to a deserving inventor, as contemplated by the patent law, but to men who have been holding the country up under outrageously false pretenses. Most cordially and heartily I welcome you among us. Not being a telephone expert, I do not make the assertion of my own knowledge, but am told by those who I believe are well qualified to judge that we have one of the best equipped plants in America, and it is with some pride and a good deal of pleasure that I invite you, on behalf of the directors and management of our company, to pay us a visit, assuring you, one and all, that you will be heartily welcome."

At the conclusion of Mr. Lanman's address, Mr. J. Y. Bassell, secretary of the Columbus Board of Trade, was introduced and made a little address of welcome on behalf of the body which he represents.

Judge Thomas responded to the two addresses of welcome and gave a short history of the Independent movement. A few of those interested in the Independent telephone companies that had been formed in the state of Ohio met at the office of Judge Kibler in Newark, Ohio, to arrange for the defense of their companies against the suits which the Bell people brought against them, and the outcome of the matter was that a meeting was arranged to be held in April of that year, 1895, at the Chittenden Hotel, Columbus; and at that time the first organization of Independent interests was formed. That was the only possible means that could be suggested to defend the rights of the new enterprises that were springing up, and it has resulted not only in a state organization, but in a national organization as well. With the memory of those early struggles and the fact that the movement crystallized in the city of Columbus, Judge Thomas said: "I see no reason why we should not always meet here to discuss matters of business and form new plans for the improvement of the business which has grown great in those few years since that time." He also complimented the few persons who were present at that first meeting and said that the success that has been attained by the Independent companies is very largely due to their determination and their foresight when the future was very dark to all others. Through the community of interests thus formed, it has been possible to surmount all the obstacles that have been placed in their path by one of the most formidable opponents that has ever existed to menace the life of any new enterprise.

The first paper on the programme was read by Kora F. Briggs, secretary and manager of the Home Telephone company of Tiffin, Ohio, whose subject was "Our Farmer Patrons."

After the reading of Mr. Briggs' paper James B. Hoge, treasurer of the United States Telephone company, and a prominent banker of Cleveland, was introduced.

Mr. Hoge gave a history of the Berliner and other telephone-patent cases and referred to the meeting of a few of the Independent telephone men at Chicago a few weeks ago and the decision they reached to make up the sum of $25,000 to defray expenses already incurred in these cases and any possible outlay that may be necessary to carry them through the higher courts. The proportion to Ohio operating companies is $4,000, which averages seven cents a telephone, and the same amount for each mile of toll line. Mr. Hoge asked the members as a matter of business to ratify the action of the state officers in making the pledge and give their checks for the amounts assessed. "If there was ever a time when the telephone business should be aggressive, it is this year," said the speaker.

Judge Thomas explained the division of the fund above referred to between the operating companies and the manufacturers in equal amounts, and said that not a cent of it would be spent outside of the purposes for which it was intended. He also said that any amount remaining after the cases were settled would be returned. There were a few objections on the ground that the manufacturers should take care of their own cases, but these were met by Mr. Hoge with the explanation that there is no company strong enough to stand the expenses if all the patents were attacked at once, and that the existence of the business depends upon the decisions.

At this point it was brought out that the Ohio Telephone company, a Bell organization, is seeking toll-line franchises in Southern Ohio. This is supposed to be a method of renewing franchises which are about to expire, and the agreement is said to call for much more than it shows on the face.

Mr. Cable suggested that there should be a committee on taxation appointed to see that there is a fair and uniform method adopted for assessing telephone companies. The state board has invited a conference with the state association or its representatives for this purpose.

Next a roll call was taken to ascertain what the members present would be able to contribute to the legal fund promised from this state, and it resulted as follows:

Name of company—	Telephones.	Miles of toll line.
Antwerp Telephone company	80	10
Archbold	90	...
Bellefontaine	385	40
Bellevue Home	360	...
Black River of Lorain	650	...
Bluffton	200	...
Bowling Green	343	7
Bryan	368	...
Caldwell	75	40
Canal Dover	1,500	40
Carey	124	...
Celina	185	22
Chillicothe	725	110
Citizens' of Columbus	4,988	...
Citizens' of Fayette	115	...
Citizens' of Fostoria	450	...
Citizens' of Washington Court House	800	50
Clinton, Wilmington	600	100
Columbiana County of Salem	1,905	40
Covington Home	135	10
Crestline	150	...
Cuyahoga	6,050	50
Delta Home	135	...
Dunkirk	54	...
Eaton	325	30
Edgerton	115	...
Franklin, Westerville	65	...
Galion	360	...
Gallipolis	350	...
Home of Cambridge	400	60
Huron County, Chicago Junction	450	50
Inland, DeGraff	85	100
Jefferson and Warren	400	100
Kent	360	40
Kenton	400	...
Lancaster	392	...
Lawrence of Ironton	450	...
Lima	700	...
Marysville	170	60
Massillon	605	53
Mechanicsburg	300	33
Miller's of West Unity	150	...
Millerburg, Wooster and Orrville	1,000	150
Montpelier	165	...
Morrow County of Mt. Gilead	300	100
Mt. Sterling	200	50
Mt. Vernon	675	110
Newark	682	200
New London and Greenwich	200	...
New Washington	50	...
Northwestern Toll Line, Defiance	...	70
Paulding Home	175	...
Peoples' of Shelby	325	...
Pioneer	75	...
Piqua Home	700	25
Plain City	200	100
Portsmouth	670	...
Ravenna Home	360	25
Rising Sun	42	3
Sandusky	900	25
South Charleston	120	20
Sunbury and Galena	160	...
Tathens of Athens	180	40
Tiffin Home	825	...
Troy	...	416
United States	250	2,000
Upper Sandusky	210	40
Urbana	825	15
Wapakoneta	130	...
Waverley	175	50
Williams County	75	168
Woodsfield	200	80
Youngstown	1,300	...

The forenoon session adjourned about 12:30 p. m., and after luncheon the members visited the plant of the Columbus Citizens' Telephone company and inspected it. They were conducted through the various departments by Manager Frank L. Beam.

Upon reassembling at 3 p. m., Mr. G. P. Thorpe of Wilmington, Ohio, made a short address on the subject "Toll Lines; Their Advantages as Auxiliaries to the Local Exchanges." Mr. Thorpe declared that he was in the telephone business only for fun and that he knew but very little about it, but before he had completed his talk it was ascertained that he had a pretty good idea of what he had taken the floor for. "There are," said he, "two great classes of toll lines, those which pay and those which do not, and with the latter class we have no concern. The points between which toll lines are proposed should be considered as to population and business interests. The cost of construction should be accurately ascertained and every point having a bearing upon the matter should be thoroughly investigated. If, after this, it is concluded that a line may be built that will pay a good dividend, then it is a duty that a good one should be constructed. It must be remembered that the cheapest is not always the best, but that the best is always the cheapest."

Mr. Thorpe said that he considered it a great mistake to take it for granted that the right-of-way may be easily secured because the members of the company are well acquainted with the people along the line, and for this reason to proceed with the building without asking for the right. He said that all people feel that permission should be asked for a special privilege, and though landowners usually willingly grant it when asked, they are very apt to make trouble if an individual or a company assumes rights without asking.

Mr. Thorpe said that toll lines would largely increase the number of renters at the various exchanges through or between which they pass, and that he believed that if constructed in the right manner they would pay well.

A Circleville gentleman asked as to charges that should be made for toll services over these lines.

Mr. Morrison replied that he had found that 10 cents for 10 miles or less, 15 cents for 10 to 20 miles and 20 cents for 20 to 30 miles had given satisfaction, and that his company had realized a good profit from it. When no charge is made for toll service for short distances the lines are never kept in condition and are undesirable.

Mr. Briggs said that local exchanges could not exist without toll lines, but it is all a mistake to have a free service. To the assertion that the Bell company is doing this in many places, Mr. Briggs replied that it is not necessary to the Independent companies, if their competitor is doing it.

Judge Kibler said that the Newark Telephone company has 32 toll stations in Licking County. It had planned to get beyond competition. For local business a charge of 10 cents to any point in the county is made. There is also a free service between Newark and Granville. They have found that the toll lines pay very well with this charge.

The representative from Washington Court House said his company allowed free service to and from the county seat within the county limits, but charged where the persons desiring service had to be connected up at the central exchange.

The election of officers was next taken up, with the following result: President, Judge James M. Thomas, Cleveland; first vice-president, D. J. Cable, Lima; second vice-president, C. Y. McVey, Youngstown; secretary and treasurer, H. D. Critchfield, Mount Vernon.

The committee on taxation is as follows: Judge James M. Thomas, H. D. Critchfield, D. J. Cable, Frank Davis, Judge Hagerty, Harry M. Daugherty and Edward Kibler.

Convention Notes.

The Erner-Hopkins company of Columbus had a display of rubber-covered wire.

George W. Christian, manager of the Troy Telephone company, is building his business up rapidly. He now has more contracts than he can fill, owing to delay in securing instruments.

Charles W. Stiger, representing the Stromberg-Carlson Telephone Manufacturing company of Chicago, was present at the meeting, chatting with his many friends. He could not get into the city in time to arrange a display.

Miss Angie Fruchay of McComb, the only lady manager in the state or the United States, was present. She built her exchange about three years ago and has been very successful. She had built about 10 miles of toll line before, and it is in operation in connection with the local plant.

President Sherman M. Granger of the Zanesville Telephone and Telegraph company was in a happy mood Friday. Ground has just been broken for the new exchange at Zanesville, and before many months they expect to have things in good shape there. It has been a pretty hard matter to get the Independent movement started in Zanesville, but now it is rapidly growing in favor with those who have heretofore opposed it.

The National Automatic Telephone company of Chicago had several of its automatic appliances for small offices displayed at the Chittenden, in charge of J. A. Russell, who has just begun the work of introducing them in Ohio. These devices are especially adapted to small exchanges where an operator is not employed both day and night or where the operator's services can be dispensed with altogether. The automatic wall telephone, desk telephones and selective party-line telephones were shown.

The Kellogg Switchboard and Supply company of Chicago had an interesting display of instruments, including the combination common-battery and magneto switchboard for local and long-distance work, which proved of much importance to those who have the old system, but wish to enlarge or replace gradually by the latest systems. The Kellogg company also had a combination toll box for instruments of any kind. H. B. Hanford, Ray H. Manson, W. N. Taylor and A. G. Rousseau were in charge.

Extension of Metropolitan Elevated.

Extension bonds to the amount of $5,000,000 were authorized at a special meeting of stockholders of the Metropolitan West Side Elevated Railway company of Chicago on April 8th. The bonds will bear four per cent. interest, will be dated February 1, 1901, and will run until August 1, 1938, expiring the same time as the first-mortgage bonds. It is proposed to issue approximately $1,500,000 to pay for the two extensions in immediate contemplation. These are extensions of the Garfield Park line from West Forty-eighth avenue to West Fifty-second avenue, distance one-half mile, and on the Douglas Park branch from the present western terminus to West Fortieth avenue, 1.85 miles. The balance will be reserved for future extensions which may be determined from time to time.

DEVELOPMENT OF THE TELEPHONE FIELD.

Indiana Telephone Items.

Two companies were organized and incorporated last week: The Elizaville Co-operative Telephone company, to operate a line in Montgomery, Clinton, Boone and Hamilton counties, and the Greenfork Co-operative Telephone company.

The new long-distance telephone exchange of the Central Union company at Thirtieth and New Jersey streets, Indianapolis, is now in use. This exchange employs 20 persons and is used to connect the telephones of this city with Chicago, St. Louis and other long-distance points. The exchange is thoroughly equipped.

Rural telephones are declared a success in Delaware County, where a year ago they were only an experiment. The entire northern and eastern parts of the county are supplied with telephones and they are being introduced in the remainder of the county as fast as a large force of linemen can do so.

Word comes from Elkhart that Barber & Bailey of Ohio, who in the last few years have established 15 different Independent telephone companies in various parts of Ohio, Indiana and New York, retaining an interest in nearly, if not quite, all, are endeavoring to form a combination of the 15 companies, and the indications point to success.

The Alexandria and Elwood Central Union exchanges have been consolidated, and Ira Stabler, the former manager, will be transferred to Terre Haute. This and other consolidations in view are said to be in the interest of economy.

At Wabash the Central Union company's franchise expires next year, and for this reason a determined but secret effort is being made to gain control of the Home Telephone company of that city. Recently liberal premiums have been offered for the Home company's stock.

There is sharp telephone competition at Clarkshill. The Farmers' Co-operative Telephone company has been organized to meet the rates charged by the Bell and other companies. Subscribers are required to pay toll to use the city service of the old companies, while the Co-operative company offers free service to all city switchboards operated by it at only 25 and 50 cents a month. As a result, many subscribers to the old companies have withdrawn their support. The Co-operative company will form a branch of the co-operative line which is extending over the state.

At its annual meeting, on the 5th inst., the Fort Wayne Home Telephone company declared a dividend of six per cent. This is an Independent company owned by Fort Wayne business men. The company recently purchased the long-distance lines controlled by the Independent companies in this vicinity, and is now preparing to extend the long-distance service.

The Rochester Telephone company has purchased the telephone line along the Cudahy oil pipe line from Roann to San Pierre, a distance of 71 miles. The company proposes rebuilding the line and opening stations at Disko, Gilead, Delong, Monterey, Bass Lake, North Judson and San Pierre. At Roann connection will be had with the Independent long-distance telephone service of Indiana, Ohio and other states. The line will also connect with the local telephone systems at Kewanna, Plymouth, Winamac, North Judson and Knox.

Richard C. Clark has been appointed receiver for the Central Energy Telephone company of Frankfort.

F.

Telephone News from the Northwest.

The Grue telephone bill in the Minnesota Legislature has been killed by the Senate committee. The bill gave individuals and companies the right to use telephone poles already set, by paying a price to be determined by a board of appraisement.

D. N. Tallman of Willmar, Minn., has bought the local exchange at New Paynesville, Minn., from A. F. Knebel.

The Interstate Telephone company met at La Crosse, Wis., recently, and elected officers, as follows: President, J. A. Tawney; vice-president, John Dietze; secretary and treasurer, Otto Troost, Jr. The directors are E. K. Tarbell, John Dietze, James A. Tawney, Edward Lees and E. Stott.

Receiver James Murphy of the North Dakota Telephone and Electrical company, connecting Harvey, Fessenden, Carrington and other North Dakota towns, will sell the line at private sale. Since being in the hands of a receiver, it has paid handsomely. The Northwestern Telephone Exchange company will bid for it. There will be other bidders also.

Mayor Arbuthnot of Winnipeg thinks the rates of the Bell Telephone company are extortionate, and has entered into communication with the Home Telephone company, which has systems at Buffalo, Niagara Falls and other cities in the state of New York.

The Maxwell Telephone company has been incorporated at Maxwell, Iowa, and a local exchange will be installed as soon as the frost is out of the ground.

The Farmers' Mutual Telephone company was refused admittance to Keota, Iowa, in the late election.

The Van Wagenen improved central-energy telephone and dial, invented by A. Van Wagenen of Sioux City, Iowa, has been completed for test purposes and is being exhibited. It is designed to work with the Clark automatic switchboard.

The telephone company at Redwood Falls, Minn., announces a fine of 50 cents for each violation of the rule forbidding subscribers from allowing non-subscribers free use of the lines.

The receiver for the Mississippi Valley Telephone company in Minneapolis and St. Paul has petitioned the courts for his discharge. The Twin City Telephone company, which has assumed the business, has taken up the work of construction and is pushing it. The company has just placed an order for $100,000 worth of telephone cable with the Roebling company. A large force will be placed on outdoor work as soon as the frost is out of the ground.

W. J. Steckel of Bloomfield, Iowa, has been granted a franchise for a local exchange at Mount Pleasant, Iowa.

A company has been formed at Bozeman, Mont., to construct a telephone line to Gallop.

A company has been formed at Story City, Iowa, to build a local exchange.

A company has been formed at Adair, Iowa, to build a telephone line to Jobes, Safeside and North Branch.

R.

COMMUNICATION.

Large Telephone Switchboards.

To the Editor of the Western Electrician:

Noting in your issue of March 23d the claim made with reference to the Cuyahoga Telephone company's exchange system in Cleveland, that it is claimed that this board is the largest switchboard in the world, we not only wish to take exception to this, but to give proof.

In Copenhagen, Denmark, is a switchboard of 10,000 capacity on one floor, and in the same building, on the lower floor, is between 5,000 and 6,000 capacity additional, making between 15,000 and 16,000 capacity all under one roof.

In Stockholm, Sweden, with 30,000 or more subscribers, there is one large switchboard of about 10,000 capacity and several other smaller boards in different parts of the city.

We do not think we need to refer to other installations, as this proves the statement referred to above.

F. HEMENWAY,
Secretary Ericsson Telephone company.

New York, April 2, 1901.

Extensions in Mississippi.

A correspondent in Pontotoc, Miss., writes: "The Alabama, Mississippi and Tennessee Telephone company and the Amory and Tupelo Telephone company have jointly built a good telephone line from Pontotoc, via Tupelo, to Amory, which not only connects the Amory and Pontotoc exchanges, but also the systems of the two companies. The new line, which was opened for service on March 30th, will enable good service to be had between Middleton, Tenn., and Columbus, Miss., via Pontotoc, Amory and Aberdeen exchanges, with many good pay stations. The Independent telephone companies are building good lines and exchanges in this section of country and equipping them with good telephones and switchboards."

Trouble in Sioux City.

The council of Sioux City, Iowa, is at outs with the Iowa Telephone company. The latter absorbed the Home Telephone company there, after a competition extending over a number of years. Since gaining a monopoly, the Iowa company has forced up rates, until the council thinks they are too high. The latter threatens to compel the company to bury its wires, and uses this threat as a means to secure its demands for lower rates. The telephone company proposes to make common cause with the electric-light company and others affected, and fight the demand.

Bell Telephone Statement.

The following is the output statement of the American Telephone and Telegraph company, for the month ended March 20th:

March.	1901.	1900.	1899.
Gross output	76,751	65,878	67,033
Returned	37,517	20,664	13,530
Net output	39,234	45,214	53,503
December 21st to March 20th:			
Gross output	216,109	183,003	162,844
Returned	89,427	63,004	41,725
Net output	126,682	119,959	121,119
Total outstanding on March 20th.	2,079,498	1,700,464	1,246,365

The Home Telephone company in Niagara Falls, N. Y., is but 10 months old, but still it has installed 428 telephones. This number is being rapidly increased, and within a few weeks the number of subscribers will be over 500. Surrounding towns are being connected, and there is a general sentiment in favor of the Independent company and its enterprise.

GENERAL TELEPHONE NEWS.

The Greenleaf Telephone company of Greenleaf, Kan., has been incorporated, with a capital stock of $10,000.

The American Telephone and Telegraph company will distribute $776,589 in paying the dividend recently declared.

A. W. Huggins is organizing a stock company for the construction of a telephone system from London to Manchester, Ky.

The People's Independent Telephone company of Winthrop, Minn., has filed articles of incorporation. The capital stock is $10,000.

E. A. Wilson and others have organized an Independent telephone company for the construction of a system at Carlisle, Ark.

R. E. Sisk, president of the Farber Telephone company of Farber, Mo., is in the market for line and exchange equipment of all kinds.

The Jackson County Home Telephone company of Jackson, Ohio, has filed articles of incorporation. The authorized capital stock is $50.000.

The Bell Telephone company of Missouri has increased its capital from $2,000,000 to $4,000,000, according to a report from Jefferson City.

The Sidney Home Telephone company of Sidney, Ill., with a capital stock of $2,500, has been chartered by C. C. McElwee, H. M. Bentley and C. H. Flymire.

The Louisville Home Telephone company, with a capital stock of $100,000, has been incorporated, to build and operate a telephone system in Louisville, Ky.

The Citizens' Mutual Telephone company of Cambridge, Ill., has been incorporated, with a capital of $2,250, by W. M. Smith, C. B. Taylor and J. W. Nelson.

The Bishopville Telephone company of Bishopville, S. C., has been incorporated, with a capital stock of $5,000, by W. S. Smith, Nat Barnett and J. E. McLure.

The Southern Telephone and Telegraph company of Kirkwood, Pa., has been incorporated, with a capital stock of $10,000, to do business in Lancaster County, Pa.

The North Georgia Telephone and Telegraph company has been organized for the construction of lines from Winder to Athens, and from Winder to Augusta, Ga. R. B. Russell is president of the company.

Vice-president and General Manager Edward J. Hall, of the American Telephone and Telegraph company, denies the report that the company has offered to lease the Western Union Telegraph plant under a guarantee of six per cent.

After a contest lasting three years, the Portland (Me.) aldermen have granted rights to the Dirigo Telephone company of Maine. Heretofore the New England Telephone company has been the sole occupant of that city. The Dirigo company will immediately begin the installation of a plant and will connect the city with its exchanges in central Maine.

MANUFACTURERS AND DEALERS.

The American Electric Telephone company, Chicago, reports that the central-energy switchboard which it is installing for the Citizens' Telephone company at Terre Haute, Ind., is rapidly nearing completion. The American company is equipping this exchange complete in every respect, and says that it will be one of the finest equipments of central-energy switchboards ever installed by an Independent company. The Raleigh Telephone company of Raleigh, N. C., has a similar switchboard, and, according to the latest reports, the equipment is giving excellent service.

The Eureka Electric company of Chicago is sending out corrected blue-print maps showing the Independent toll lines of the states of Indiana, Kansas and Iowa, and is compiling maps of the toll lines of all the leading Independent states, which will be sent free to any company desiring them. The Eureka company calls attention to its new pay-station apparatus (coin boxes with five, 10 and 25-cent slots) and also to its new No. 34 desk set. It announces that its new flashlight switchboard, as well as its new multiple board, will be ready for the market within the next 60 days.

The Horix Manufacturing company, one of the oldest manufacturing concerns in Cleveland, Ohio, successor to the Phœnix Manufacturing company, engaged in the manufacturing of hardware specialties and all articles requiring brass and iron castings finished in enamel or nickel-plate, has recently introduced a new concealed-cord telephone arm having a very ornamental base of neat design. This company has had long experience in metal casting, and is confident that the day is not far distant when the plain and enameled boxes and transmitter arms now in use will give place to very ornamental designs, artistic and pleasing to the eye, and that the cost of castings for the new designs will be no more than for the excessively plain articles now in use.

Wireless Telegraphy.

By F. Braun.

During this winter I have delivered two lectures before Strassburg scientific societies on a part of my practical and scientific experiments in wireless telegraphy, and I take the liberty of giving a short account of the substance of these lectures.[1] My experiments were commenced in the summer of 1898, and were at first devoted to methods of signaling through water in a more effective manner than hitherto. This, however, will be referred to on another occasion.

Following these, experiments on the Marconi system were undertaken with a view, in the first instance, to increase the action of the transmitter. At that time the general idea, and also Marconi's, was that he was working with Hertzian—i. e., with relatively short waves. In fact, the introduction of the Righi oscillator was manifestly with the intention of increasing the frequency of the waves as much as possible. One might be doubtful, however, to what extent this assumption was correct, for the question here was obviously to what distance the charge had already traveled in the transmitting wire connected to the Righi balls at the moment when the balls themselves are charged up to the sparking potential. If one takes the simpler connection with only one spark gap, the natural conception would be that the whole transmitter would be charged to practically constant potential, owing to the slow charging process, and that it would thus behave as a Hertz oscillator; this assumption alone would explain the fact that the effects at a distance increased with an increasing length of transmitting wire. But, if these views were correct, Marconi's transmitting arrangements were not favorable. Then, his transmitter has small capacity, and this cannot be increased so long as the transmitter remains open. But oscillations of this character die out very quickly, as one knew from numerous experiments; they are damped too quickly by the sparks, a fact which Hertz expressed in the form that if the length of the spark is to remain "active" a certain size must not be exceeded.

All these considerations led to arrangements in the following manner: Condensers, with a capacity of about the order of the usual Leyden jars, were charged singly or in combination to a high potential, and their discharges through appropriately dimensioned self-inductions were employed to feed the transmitter directly or indirectly. Here, for the first time, slower oscillations than Hertz's were undoubtedly employed, and the first question that occurred was whether a coherer with the ordinary connections—where it is embedded in a circuit which is closed in the geometrical sense—would still act sufficiently. Then, the usual idea, which seems to be supported by facts, was that the coherer only responds to very short waves, as only these would produce a potential difference between the two poles sufficient to break down the gap in the coherer. This view seems to be directly confirmed, if one first considers the coherer entirely insulated and exposed to the electric waves; and, secondly, if one is certain that it does not follow the periodic currents, but the periodically varying potential difference.

Experiments with the Leyden jar discharges well defined in every respect, gave a positive result. First, the conditions of the experiments were varied to a considerable extent, among the arrangements tested being the connections now employed by Slaby and Count Arco. Especially closely examined was an arrangement which I denote as inductive excitation of the transmitter, and to the description of which I will confine myself at present. It is characterized by the fact that one leaves the transmitter quite sparkless, and excites the oscillations in it by induction. The condensers discharge through a primary circuit, and this excites the oscillations in the lower spirally wound end of the transmitter. The lower end of the latter remains insulated from the earth, and it follows that its assistance in increasing the action to a distance, which Marconi found to be the case with his connections, cannot be interpreted in the usual manner. As a matter of fact, the earth acts, it may be mentioned, parenthetically, in causing the transmitter to take up a greater electromagnetic energy.

The advantages of my connections are as follows:

1. In the primary circuit a large amount of energy can be employed usefully; the action of the transmitter increases with the energy employed to a much greater extent than with the Marconi connections, and can be augmented by increasing the capacity of the condensers, as well as by increasing the potential.

2. The oscillations of the transmitter are, as is known, hardly active physiologically, in spite of their high potential, and a danger from unintentional contact is therefore quite excluded.

3. Less attention need be paid to the insulation of the transmitter than in the case of electrostatic excitation.

4. The oscillations of the primary-condenser circuit are slightly damped, as has already been known for a long time (for instance, from the classical experiments of Feddersen). They excite in the sparkless transmitter waves which are still less damped. If, therefore, both are brought to resonance, they increase in the latter case to a very high amplitude.

5. Thus, they fulfill the fundamental conditions necessary for electrical tuning between a transmitting and receiving apparatus. The region of useful rays of oscillations will at the same time be extraordinarily extended, as is particularly desirable for this purpose.

The first assertion is proved by the following table:

Primary Current in the Induction Coil.	Relative Electromagnetic Energy in the Transmitter.	
	Marconi Connection.	Inductive Excitation.
2 amperes	8	26
2½ to 3 amperes	10	40
4 amperes	10	55
6 amperes	10	62

The table shows that the mean energy of the waves in the Marconi transmitter (in consequence of the spark) soon reaches its limit, while it increases considerably in the case of inductive excitation; and, further, that for the same energy expended in the primary, the latter system far surpasses the Marconi transmitter. The second and third claims scarcely need a proof. If, as I demonstrated in my lecture, one connects a Marconi transmitter to earth by means of a long, damp thread, the apparatus refuses to work, while the inductively excited transmitter is hardly affected by such a connection. The two last claims follow from resonance experiments. That the waves of the transmitter serve perfectly for a tuned telegraphy, will be shown at the conclusion of this article.

Experiments in the open air have demonstrated a superiority over the Marconi transmitter under all conditions. The first observations in Strassburg, in the summer of 1898, already proved this, when the sender and receiver were in sight of one another (partly), as well as when they were hidden from one another by obstacles. The tests were resumed at Easter, 1899, at Cuxhaven, and in the winter of 1899-1900 telegrams were sent to Cuxhaven (Kugelbake) from the small steamer Silvana of the North Sea line, in her journey to Heligoland. With a transmitting wire of 15 meters in height on the Silvana, and a receiving wire 29 meters high at Kugelbake, regular and perfect messages were received to a distance of 32 kilometers, and signals could be distinguished at distances of 50 kilometers. During the experiments in the autumn of 1900, between Cuxhaven and Heligoland (63 kilometers) with masts 29 and 31 meters in height, respectively, at the two stations, comparative tests were made. While with inductive excitation all the signals were received of 450 transmitted with Marconi connections not a single one could be observed at the receiving station, although the supply of energy was pushed to the extreme limits. The remaining conditions were strictly identical. The following table gives a comparison in which the figures referring to the Marconi transmitter are taken from official reports reprinted in the Elektrotechnische Zeitschrift:

	Distance of Transmission (E).	Height of Masts.		Product of the Heights of the Two Masts (P).	$\frac{E}{P} \times 10^3$*
Inductive Charge Method:	km.	m.	m.		
"Silvana"—Kugelbake	32	15	29	435	74
Elbe I.—Kugelbake	32	30	29	870	37†
Heligoland—Kugelbake	63	31	29	900	69
Marconi Transmitter:					
Borkum—Borkum Fire-ship	32	40	38	1,520	21
North American Navy	13.5	13.5	39	526	25

*The product of the heights of the masts should be about proportional to the distance attainable.
†The smaller figure is because the actual distance is much smaller than what would have been attainable.

The last column in the table gives the distance over which signaling should be possible, calculated according to a well-known rule. On the significance of the rule and the assumptions under which it applies, see Hertz, Wied. Ann.. Vol. 36, p. 1, 1888. Even if one does not take this rule literally, the summary above proves the undoubted superiority of the transmitting arrangement described. The distance attainable should be, from the present facts and material, 2½ to three times that by the Marconi transmitter, although the receiver employed in the experiments was less sensitive than Marconi's. The fact that large amounts of energy must be available in order to signal over considerable distances with low masts may, of course, be troublesome in some instances, but in many cases it will hardly come into consideration.

The connections have here been described in their simplest form; they can be varied in different ways, and the energy of the transmitter thus increased. The extent of its applicability in radiating large amounts of energy, whether in the form of long or short waves, is not fully portrayed in the above article.

In conclusion, the experimental proof that the oscillations produced are slightly damped, remains to be given. This was done by means of resonance experiments. It is known that the Hertz waves, which die away quickly, excite in the resonator its natural period of oscillation to a considerable extent, a phenomenon which at first led to the assumption that a Hertz oscillator, similarly to the light of an incandescent body, received a continuous succession of vibrations, and to which the name of multiple resonance was later given. In distinction to this, the oscillations employed here show sharply pronounced resonance phenomena. In my lecture I showed discharges which made 10,000,000 complete oscillations per second, and thus approached closely to Hertz's. These had a visible effect on a distant wire circuit in which a Geissler tube was included, provided this circuit was in tune.

It would thus be possible to base on these discharges a tuned system of telegraphy. But resonance phenomena of this kind are not favorable for other reasons; they show, it is true, that good conditions are fulfilled in the transmitter, but the task still remains to construct a correspondingly good receiver.

The problem was, therefore, attacked in another manner. The object was, on the one hand, to tune the oscillating systems between narrow limits, and, on the other, to increase the receiver effects. This latter could be done in two ways. One way would be to make as great as possible the energy taken up by the receiver—a course which was not followed in this case. If one considers the energy taken up as a fixed quantity, it only remains to concentrate it on the receiving apparatus, so that the latter benefits by it as far as possible, exclusively. The arrangement then works as a lens, which does not increase the energy of the light, but concentrates it. I confine myself here to mentioning experiments which I showed in my lecture. These demonstrated that the electric waves which pass the receiver can be concentrated 20 times or more. Then they can be made to act in the form of heat on a microphone contact or on a coherer of the most suitable form, and the latter may be placed in such a way that its action cannot fail, whether it reacts with current or potential difference.

I further showed in the lecture the sharpness of the tuning. Very slight changes in the tuning immediately diminished the localized energy very considerably. As the energy only collects in the tuned parts, the other parts will refuse to act, and thus the problem of the so-called multiplex telegraphy is solved in a very complete manner.

1. The lectures were delivered November 16, 1900, and January 31, 1901. The account here given is taken from the London Electrician.

Scarcity of Guttapercha.

[From the New York Sun.]

Commercial concerns, as well as governments themselves, have in the past few years been giving very close attention to the guttapercha problem. Tropical forests have been ransacked for the tree or for one so nearly akin to it that a cable-covering product may be had from it, and there are various attempts at creating plantations of the original tree in regions where heretofore it has not grown. The forest ransacking has resulted in failure, and the plantations have not yet got beyond the experimental stage.

The area in which the guttapercha tree thrives is extremely limited. It is confined exclusively to a portion of the Malay Archipelago and the Malacca Peninsula. Where there is an even temperature of an average of from 80 to 82 degrees Fahrenheit and the soil is favorable, the tree grows with great vigor. But with only a slight variation of these conditions and particularly where there are sudden changes of temperature, even if those changes are not extreme, it languishes and dies.

The Philippines touch closely upon the guttapercha belt, yet the tree does not grow there indigenously, and it is at least very problematical whether it can be cultivated there. It will not grow in Cochin China, likewise near the guttapercha belt, because the average temperature is too low and the changes too sudden.

Guttapercha trees have been transplanted to a score or more places where they have failed, although the Dutch have succeeded in establishing several plantations in their East Indian possessions which give promise of success. The experiment is by no means complete as yet.

In 1898 the French explorer Raoul collected about 1,500 plants gathered at the foot of the trees, where they had sprung up from seeds that had been dropped. These he put out in the conservatories at Marseilles, and after a time one-third of them were taken to the Congo and put out in plantations, and another third were distributed among the planters of the West Indies and in French Guiana. In 1897 M. Jacquet, inspector of agriculture in Cochin China, carried away 700 plants from Singapore, 100 of which in 1899, were in a fair condition.

It remains for the future to determine what the results in the Congo, the West Indies and in French Guiana will be, although those who have studied the tree and know the very exacting nature of its demands in regard to soil and climate are by no means hopeful.

An Amalgamation of Interests.

It is reported that the Bullock Electric Manufacturing company of Cincinnati and the Wagner Electric Manufacturing company of St. Louis have been consolidated. The Wagner company telegraphs the Western Electrician under date of April 10th that the reported consolidation consists of an amalgamation of the selling interests of the two companies.

J. E. London of Alma, Ark., is interested in the organization of a company for the construction of a telephone system from Fayetteville to Fort Smith.

High-potential Phenomena.[1]

By A. P. Carmen.

In the earlier history of electricity there was nothing that excited the interest of the world more than the electric spark. It is hardly more than two centuries since the first electric spark was observed. We of this day have become so accustomed to startling discoveries that it is only with difficulty that we can understand the childlike amazement with which men in the eighteenth century heard of electric sparks an inch or so in length, and how the shock of crude little Leyden jars with their faint illumination was a matter for a year's wonderment and letter writing. The rapid development of galvanic or current electricity, the invention of the dynamo and of the electric motor, and of alternating-current apparatus, and their extended use for lighting and power seemed to engross for years men's thoughts and activity, and high-potential or static electricity, with its less understood forces and more elusive phenomena, attracted less and less attention until a dozen years ago. There were so-called practical men who advocated writing our textbooks on physics and electricity with static electricity relegated to an appendix. Only in the laboratory of the scientist was it regarded with much interest. All this is now changed. The disruptive discharge with its electrical spark has been found to be the center of a group of phenomena all important in our understanding, not only of electricity and magnetism, but of light, radiant heat, and even of some fundamental properties of matter. And not only in pure science but in its industrial applications, the phenomena which center about and accompany the disruptive electric discharge are holding the interest of the electrical world. From the spark go out waves, traveling with the velocity of light, and these waves are the bearers of messages, giving us wireless telegraphy and wireless telephony. In connection with the oscillating static electric field, we get also some of the most beautiful illuminations of vacuum tubes. There are those who think that the electric light of the future is to be that from these electric discharges of high potential and of high frequencies in vacuum tubes.

Another circumstance that has forced these phenomena upon the attention of practical electricians is the introduction into commercial work of alternating currents of high potentials. It is only a few years ago since we were wrestling with the problem of handling a thousand volts. To-day, the use of 10,000 volts is not uncommon, while 20,000 and 30,000 volts are perfectly feasible, and even 100,000 volts have been considered possible. With such pressures the problems of electric discharge become the serious ones. At such potentials it becomes so very apparent that we are dealing with forces far beyond the little wires which we have formerly fancied carried the power. We propose this afternoon to review rapidly some of the fundamental phenomena of static-electric discharges and to show you one group of these phenomena, namely, that generally known as the Tesla experiments.

In this subject there is an advantage in starting with the very elements, so as to connect our ideas with familiar phenomena. I hope you will therefore pardon me if my account is very elementary for a few minutes.

Let us start with the well-known experiment of our school days—that of the fur and the vulcanite rod. We rub them together, and, upon separation, we find they are electrified or have charges of electricity. By this we usually mean that they have the property of attracting light objects, as pieces of paper, pith balls, or thin gold leaves. If we perform this experiment in a dark room we shall see still another phenomenon, namely, a glow and even small sparks on the fur and along the rod where the two have been in contact. We get this glow and the sparks more pronounced when we electrify an insulated metal ball. This we can do by rubbing the electrified vulcanite along the metal body. The vulcanite rod thus communicates its electrification to the ball. When a body is thus electrified it has a tendency to give up its electricity to surrounding bodies. We describe this tendency by the term electric pressure or potential. We say the body tends to discharge itself because the electricity is at a pressure or potential higher than that of a neighboring body. Some substances offer very little resistance to this pressure. Thus, a piece of copper wire will allow an easy passage to the electricity from an electrified body. Such substances are called conductors. Other substances offer great resistance to the passage of the electricity. Rubber, glass and air are substances of this kind. They are called nonconductors or insulators. But the electric pressure or potential of a body may be made so great that it overcomes the resistance of the insulator and breaks through it. We then have the disruptive discharge. This may take the form of a spark, or it may be a phosphorescent glow or a brush discharge. In each case this is produced by the pressure or potential of the electrified body. We have the electricity constantly tending to flow from points of higher potential to points of lower potential.

How can we produce this high difference of electric pressure or potential, that is, a pressure capable of breaking through layers of air and giving disruptive discharges? We shall not try to mention all possible methods, but shall notice four, which are used frequently in the study of high-potential phenomena, and with which you are familiar from your papers and books. They are, first, static electrical machines, such as the Holtz and the Wimshurst machines; second, primary and secondary batteries; third, the ordinary induction coil or transformer; fourth, the Tesla high-frequency induction coil.

The static electrical machine is a piece of apparatus that cannot be said to have graduated yet from the physical laboratory, but since the discovery of the Roentgen or X-rays and the revived interest in electric-discharge phenomena, it has attracted more attention. We have several forms of the machine, as the Holtz, the Toepler and the Wimshurst machines, all of which are represented in the physical cabinet of the University of Illinois.

A description of these machines is not necessary here. It is sufficient to know that by revolving glass plates near similar fixed or moving plates we can get those plates highly electrified, and that, by certain devices, we can collect the electrification, so that a high difference of potential is produced between the discharge terminals of the machine. Static electrical machines are high-potential generators, but they give very small quantities of electricity; that is, the current is exceedingly small, but under very high pressure. To increase the quantity we use multiplate machines. Such machines do not have a higher potential, and hence do not give longer sparks, but they give us thicker and more continuous sparks; that is, they produce more quantity. We have been constructing here in the physical laboratory of the university a Wimshurst machine with 20 plates. Each plate is two feet in diameter, and it gives a heavy spark seven inches long [demonstrating].

The second method of producing an electrical pressure is by means of batteries. The terminals of an ordinary gravity cell are electrified. We have delicate instruments in the physical laboratory to show that they have the same kind of attraction as the terminals of the Holtz or the Wimshurst machine, but the pressures or potentials in this case are almost infinitesimal compared to that of the Holtz machine. Experiments made many years ago by Lord Kelvin show that it would take about 5,500 gravity cells joined in series; that is, so as to add their potentials to produce a spark one-twentieth of an inch long in air. The potential of a gravity cell is just a little more than a volt. This is our unit of electric pressure; that is, to produce a spark one-twentieth of an inch long in air requires 5,500 volts. To produce a spark of four inches requires probably over 125,000 volts, or as much as would be given by 125,000 gravity cells in series. But the current given by one gravity cell through a mile of telegraph wire is possibly greater than that given by this static machine. You can see that the galvanic cells are not well adapted to laboratories of limited means to the study of high potentials. Professor Trowbridge of Harvard has a battery of 20,000 small storage cells, each giving him two volts, so that he can get a direct pressure of 40,000 volts; but that is the only case I know of where such very high potentials have been secured directly from a battery. We can, however, get high pressures from galvanic currents by the use of the induction coil. The induction coil consists of two separate coils of wire carefully insulated and fixed over a common iron core. A current, which is made and broken rapidly or is reversed rapidly, is sent through one coil and a difference of potential or electric pressure is by this means produced at the terminals of the other coil. The first coil is called the primary coil and the other the secondary coil. The modern alternating-current transformer is, as you know, this induction coil adapted to commercial work. The induction coils which we have here are step-up transformers; that is, they enable us to take the low-pressure current of the primary coil and raise it to the high-pressure current of the secondary. This is accomplished by giving a proper ratio to the number of turns on the two coils. In this induction coil [indicating] we have about 14 volts' pressure in the primary circuit, and in the secondary we get 150,000 volts, possibly more, for it is hard to measure potentials that break across so many inches of air. I may say that the construction of a coil to give such pressure requires the greatest care. It means winding and insulating on the secondary coil of from 15 to 20 miles of wire of about the size of a hair.

There is another form of the induction coil which has attracted a great deal of attention. It is the famous Tesla coil, the form which Mr. Nikola Tesla used a few years ago in some brilliant public lectures which he gave before the electrical engineers of New York and of London. The Tesla coil is an induction coil with very high insulation and without any iron core. The Tesla coil which we have here [indicating] has the primary coil wound on a hard-rubber spool and this separated by several inches of air from a secondary coil which is wound on a glass tube. Often an oil insulation is used. Through the primary coil we send the high-potential discharge of our induction coil, or we can send the discharge of the Wimshurst machine. We thus have a high pressure in the primary and a still higher pressure in the secondary. But possibly the most important part in Tesla's coil is that we have a very fast interrupter in the primary, and so we get a very high frequency in our secondary. In the primary of the ordinary induction coil we have a vibrating interrupter which makes and breaks the current possibly 500 or 600 times a minute. Mr. Tesla introduces an interrupter which interrupts several million times a second. We introduce in the secondary of the first induction coil a Leyden jar across the ends, and then pass this discharge through the primary of our Tesla induction coil. Now the spark of a Leyden jar is oscillatory. That which looks like a single flash is, in fact, a series of oscillations back and forth of hundreds of thousands a second. The discharge of a Leyden jar is like the release of a spring. It vibrates backward and forward on each side of its final position of rest. The first man to show this fact was our own famous countryman, Joseph Henry. We take advantage of this oscillatory character of the Leyden jar discharge in the Tesla coil. The current induced in the secondary of a Tesla coil then differs from the current in an ordinary alternating-current circuit in two ways. First, it is at an enormously higher pressure, and second, it oscillates so much more rapidly; that is, it has a higher frequency. In an alternating circuit we commonly have about 125 alternations a second. A Tesla coil will often have a million alternations a second, and Professor Trowbridge of Harvard records one with 10,000,000 alternations a second. This high frequency plays a very important part in the phenomena that accompany the discharges from a Tesla coil.

We will now notice some of the phenomena of these currents. The first thing, and possibly the most striking to many of us, is that the wire terminals are all aglow. The electrification seems to leap from the wire at every point. In fact, it does escape in every direction. The excitation that we have here is not confined to the wire; in fact, in some cases it would rather go through the high resisting air than along the metal conductor. We have a loop of wire connecting the terminals of the coil and coming close together at one point, but still leaving a very considerable air gap. Now, to ordinary currents, the resistance of that air gap is thousands of times greater than that of the metal wire, but to these high-frequency currents the wire offers such a high resistance that the currents will jump across the air gap rather than go along the wire. This resistance of ordinary conductors to high-frequency currents is called impedance. Many of you are familiar with it in connection with lightning discharges. A lightning discharge is an oscillating current of high frequency; it will leap across air gaps rather than go around coils of wire. In our electric-lighting plants we make use of this fact by fixing convenient air gaps so as to protect our dynamos and other electrical apparatus. In the case of the current that we get from the Tesla coil the frequency is so high that the human body offers an enormous resistance, and these currents can be handled without injury, and that in spite of their high potential. The current glides over the skin without injury to the body. With ordinary frequency this amount of electricity would probably be fatal.

Striking as are these discharge effects in air at ordinary atmospheric pressures, they are still more striking and brilliant when they take place through tubes from which the air has been more or less perfectly exhausted. Take, for instance, a large glass tube connected to the air pump so that we can exhaust the air from it. It has two metal terminals, one entering at the upper end and one at the lower end, and we connect these to an ordinary induction coil. The discharge will not take place at ordinary atmospheric pressures, but as we exhaust the tube and the air becomes rarer the discharge begins to take place and streams of purple light are seen to come from the positive terminals. At a still higher rarefication this purple light brightens into a beautiful reddish-purple spindle, and at higher exhaustions still the whole tube becomes aglow with a beautifully striated light. This is about as far as we can go with a mechanical air pump in our exhaustion. For higher vacua we use mercury air pumps and thus get those beautiful luminous effects that about 30 years ago Sir William Crookes discovered. Now these light effects are somehow connected with the rapid movement of the remnant electrified gas molecules—at least that is the way Crookes looked at it. In the tubes which Crookes used the discharge is between metal terminals or electrodes which are inserted through the glass walls of the tube.

A striking phenomenon in connection with these high-frequency electric discharges which we get from a Tesla coil is that a vacuum tube need not have a terminal or electrode in order to be lighted up. Here [indicating] we have some highly exhausted tubes, a bulb and this long snake-shaped tube. They are simply glass tubes with no metal electrodes. We bring them into the region about this high-frequency discharge coil, and you see how they immediately light up. Somehow the remaining gas molecules have been set in motion, and we have this electric glow. You can see the same phenomena when we bring these tubes near the large Wimshurst machine. Perhaps this illumination is not very bright to you, but by taking tubes containing phosphorescent substances we can get a light which, if it is not as brilliant as our modern incandescent lamps, yet it may possibly compare with the tallow dips which our fathers had to use. Mr. Tesla sees in these tubes the possibility of the electric light of the future. We could have the ceilings of our rooms electrified, and then our lamps, these vacuum tubes, would light up anywhere in the room, electric lamps without wires. Indeed, we might go still further and make the walls of our rooms vacuum chambers, which would give a soft, diffused light similar to the light of day when an electric discharge was started in the room. But, even if this dream be never realized, and we still have to use our present fragile and low-economy electric lamps, this fact of the lighting up of these

1. Lecture delivered before the Illinois State Electric association at the recent meeting in Champaign, Ill. Mr. Carmen is professor of physics in the University of Illinois.

tubes in this whole region tells us something about electricity and electrical forces which is rightly regarded as one of the most brilliant and far-reaching discoveries in physics of the century.

It was the clear mind of Michael Faraday that first saw that electricity was something that extended away beyond conductors; but it was James Clerk Maxwell, one of the few geniuses of all time, who first grasped completely the grand conception that electricity is a movement and displacement in an ether which extends through all space and permeates all bodies. When a stone is dropped in a still pond you have seen how the waves go out in ever-widening circles, carrying the energy to the farthest shore. You know how the air vibrates from the pulsations of a tuning fork transmitting the sound energy. Thus the ether may transmit energy. The disturbance set up by the electric spark is transmitted out in waves through the ether traveling with the velocity of light, for light itself is but an electric disturbance, a wave motion in this same ether. It is only a dozen years ago that this grand conception of Faraday and Maxwell was verified completely by Hertz. To-day we use the little electric sparks to send out electric waves, and Marconi has invented an instrument so sensitive that it is said he can detect these waves 50 miles and more from the spark that started them. It may be that you and I will see the power of Niagara transmitted to distant points by waves in the electric ether, as even now the energy of the sun is transmitted to us across space in this ether. This is the suggestion of one of our most practical electrical engineers, and who can say that this is a mere dream? Thus is the little electric spark which excited the wonder of the eighteenth century, revealing to us things still more wonderful, and suggesting to us possibilities of nature far beyond our boldest dreams of a very few years ago.

Tropenas Cast-steel Shop Wrenches.

Mention was made in a recent issue of the Western Electrician of the Tropenas process for the production of small steel castings as practiced at the Chicago Heights plant of the Sargent company. The accompanying illustration shows 27 specimens of shop wrenches now being marketed by this company. These wrenches are said to give as good satisfaction in general shop use as forged tools, and the cost of production is considerably less. Besides the advantage of lessened cost, the Tropenas process admits of a ready variation of quality in the material produced to meet the particular requirements of the case, and as the percentage of carbon may be varied at will, it is possible to produce a wrench which may be worked over in the same manner as is customary with forgings. Tools may be made strong, tough, hard or soft, according to the quality most suitable to the work to be done with them. In addition to wrenches of various kinds, such tools as hammers, sledges, picks and similar hand tools are readily produced by this process, and at a cost which will effect a considerable saving to large users. The Sargent company solicits investigation of its products and the process employed in their manufacture. Its office is in the Old Colony building, Chicago.

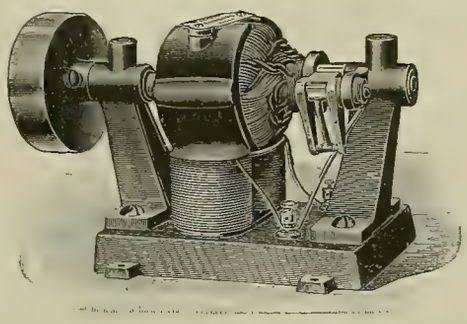
TROPENAS CAST-STEEL SHOP WRENCHES.

Cars have at last been put in public operation on the lines of the London United Tramways company. A dispatch from London announcing the fact adds: "Among the difficulties encountered, besides conservatism, was the opposition of some scientists who have a little observatory at Kew. They said the electric current would disturb their instruments, and the company had to agree to pay for the removal of the observatory to a new site."

Carlisle & Finch Ignition Dynamo.

The subject of ignition is the worry of the gas-engine man. If it were not for ignition, and the troubles which accompany it, the building and running of gas engines would be a much lighter care than it is at present. The trouble does not lie entirely with the engine device, but quite frequently with the source of energy. When a battery has been invented that will not run down or a dynamo designed that will not get out of order, many of the present troubles will have ceased. As much care and attention should be given to the design and construction of small dynamos as to their larger prototype, but it is often evident that such is not the case.

Competition and frequent returns of small ignition dynamos to the builder on account of inherent faults have brought about a better knowledge of the requirements in the case, and dynamos now being built for this purpose are no longer exaggerated toys, but good, commercial machines. Among those that may be ranked among the latter are the little shunt machines made by the Carlisle & Finch company of Cincinnati, one of which is illustrated herewith. This machine is so designed that it will give satisfactory service at any speed between 700 revolutions per minute and 2,400 revolutions per minute. The shunt winding permits it to "pick up" promptly, and the builders have had one running successfully upon a four-cylinder gasoline engine when the engine was making 700 revolutions per minute. This would give 1,400 sparks a minute.



CARLISLE & FINCH IGNITION DYNAMO.

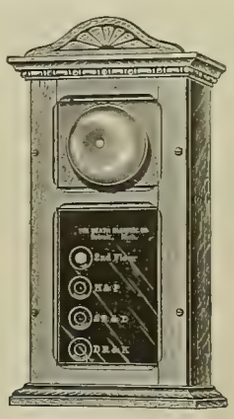
The machine has a simple type of radial brush holder, using carbon brushes. The field magnet is made of steel, having a high magnetic permeability, and it is thoroughly annealed to get the best results. The armature core is made of toothed sheet-iron punchings, and is not of the solid cast-iron type, so often seen in apparatus of this kind. The armature is drum-wound, as in the best types of larger machines. The wearing parts are of ample area, so that they possess good lasting qualities, and they are so designed as to be readily replaced and at a small cost, should it be necessary to do so. The base is of iron, to which the dynamo is securely fastened. There are no wooden parts about the machine, so there is no danger of warping.

The dimensions of the machine are as follows: Height, 6¼ inches; length of shaft, 10 inches; base, 5¾ by seven inches; the weight of the machine, including the spark coil, is 19 pounds. Dynamo and spark coil are given several coats of waterproof paint and are practically waterproof. The output is from two to three amperes at 10 to 20 volts, according to speed.

Heath Burglar Alarm.

The cut illustrates the Heath Electric company's Ideal burglar alarm, which is provided with individual cut-outs, continuous ringing attachments, silent test, etc., and which, together with the other products of the factory, is sold under a guarantee respecting both reliability and wearing qualities.

The annunciator made by this company is noteworthy, as it does away with the annoyance due to the neglect of servants or others to reset the drop after a call has been made. By a simple yet effective arrangement this annunciator is so made that only the last call made remains in sight; hence, it requires no more attention than an ordinary single bell. In addition there is said to be no danger of the disarrangement of the mechanism to which annunciators are subjected by the constant and violent hammering which they receive in resetting.



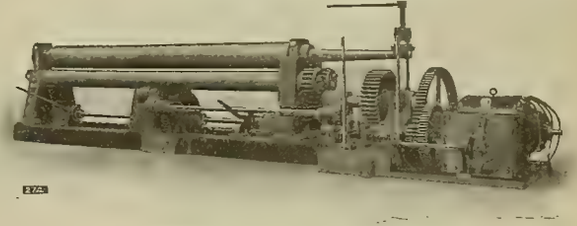
HEATH BURGLAR ALARM.

Up to 10 indications these annunciators are arranged in one row; from 10 to 20 indications in two rows, and from 21 to 30 indications in three rows. The Heath Electric company is addressed at Detroit, Mich.

Electrically Driven Bending Rolls.

In the machine illustrated the rolls are solid wrought-iron forgings, arranged in pyramid form, and have a capacity for bending plates up to 12 inches in width and five-eighths of an inch thick. The lower rolls are geared together, while the upper or bending roll is revolved by the friction of the plate in passing through. It is adjustable by power to suit the thickness of the plate and the radius to which it is to be bent. It has a hinged bearing at one end which may be turned down out of the way, while the other end has a long shank extending to a third support, which retains the roll in position for the removal of rings or flues. This will be found a great advantage in boiler and other shops where plates are to be bent to a complete circle. Midway between the housings a set of supporting rollers is placed, to give additional stiffness to the lower rolls. For very long machines additional sets of rollers are added. The machine is firmly tied together by a heavy cast-iron soleplate. It is very strongly geared and all parts are made stiff and substantial. Suitable levers and clutches are conveniently placed for the quick and easy control of all the operations.

The machine is driven by an 18-horsepower, reversible, constant-speed Bullock motor. For controlling the motor, an automatic rheostat is used to prevent the operator from throwing on the full current too quickly and burning out the motor. The field consists of a circular yoke of special steel. The pole-pieces, built up from soft sheet-steel of the highest magnetic quality, are securely bolted to the yoke. The shape of the punchings is such as to produce a saturated pole face, and this feature, coupled with carefully proportioned windings, is largely responsible for the sparkless operation of the motor.



ELECTRICALLY DRIVEN BENDING ROLLS.

The field coils are machine wound and carefully insulated. The shunt and series coils of compound-wound machines are separately wound. The coils are slipped over the pole before it is bolted to the yoke, and, should it be necessary, are readily removed.

The armature core is built up from thin, carefully annealed sheet-steel, possessing a high magnetic permeability. These disks are again annealed and then japanned. They are mounted upon the shaft and held firmly together by malleable-iron end plates.

The windings, which are let into slots provided in the periphery of the armature core, are made of either copper bars or wire, as best suits the require-

ments. The coils are machine-formed, and after being formed are thoroughly insulated with mica and other high-grade insulations. They are then baked in steam-heated forms while under pressure, which removes all moisture and produces a very compact coil. The result is a coil that is not liable to be injured and one which requires no further insulation when placed in position on the core. The coils of armatures are held in position by wedges of hard, thoroughly dried wood, driven into notches provided near the top of the slots.

General Electric Company.

The statement of the General Electric company, as of December 31, 1900, filed with the commissioner of corporations of Massachusetts, compares as follows with the statement made January 31, 1900:

ASSETS

	Dec. 31, 1900.	Jan. 31, 1900.
Real estate	$ 550,848	$ 563,643
Patents, etc	2,000,000	2,000 000
Cash and accounts receivable	13,339,127	8,515,075
Inventories and work in progress	7,330,832	8,921,709
Plants, investments, etc	10,736,926	9,532,270
Total	$33,957,733	$29,532,697

LIABILITIES

	Dec. 31, 1900.	Jan. 31, 1900.
Capital stock	$23,750,000	$20,827,200
Debts	1,599,179	1,052,466
Debentures	1,646,500	5,300,000
Profit and loss surplus	6,962,054	2,353,030
Total	$33,957,733	$29,532,697

From the above, reckoning the dividends paid to stockholders during the year and interest paid on debentures, together with an increase of $4,600,000 in profit-and-loss surplus, the profits for the 11 months were in round amount $6,500,000, with one month's business to come in. This may be estimated at $500,000, so that the profits for the year were apparently fully $7,000,000. This would pay 28 per cent. on the enlarged capital, after full retirement of the debentures.

General Electric stock continues to be in demand, the closing price on Monday, April 8th, being 215½.

CORRESPONDENCE.

New York Notes.

New York, April 6.—Ralph W. Pope, secretary of the American Institute of Electrical Engineers, has given out the following partial programme for the conversazione to be held on April 12th, the list including papers, addresses and exhibits:

W. S. Andrews, revolving high-frequency spark; aluminum cell. E. V. Baillard, faradmeter and bridge. C. L. Clark, phase indicator. A. F. Clift, telpherage system. F. B. Crocker, magnetic liquids. William E. Geyer, incandescent-lamp experiments. W. W. Donaldson, Gould storage battery. W. J. Hammer, Langley's bolometer; collection of balloon photographs; Nernst lamps in operation. Cooper Hewitt, vacuum-tube lighting in operation. M. R. Hutchison, micro-telephonic apparatus for deafness. F. A. Laws, radiographs of alternating-current wave forms. Otto T. Louis, electric furnace; Holtz machine and ohmmeter. C. H. Palmer, telautograph, working between Columbia and Chicago universities. Perret, Barrett and Meadowcroft, storage battery. M. I. Pupin, original apparatus used in developing recent invention for improvement in long-distance telephony. Captain Samuel Reber, wireless telegraph; army telephone outfit. Robinson, wave-form indicator and frequency, indicator. M. P. Rice, new X-ray apparatus. H. J. Ryan, radiographs of alternating-current waves. H. F. Sanville, copper-splicing machine. Charles F. Scott, alternation meter, phase-shifting transformer, power factor, indicator, etc. Elihu Thomson, dynamo-static machine, electric gyroscope and Bohnenberger sphere, and Fitzhugh Townsend, wave tracer.

A thorough test of searchlight engine No. 2 of the city fire department was made during the week at a fire at which the smoke was unusually dense. The new machine embodies several improvements over the first one built, although the first was highly successful. The later engine, however, has proven superior to No. 1 in its capacity for projecting light through thick smoke, and at the recent test it was pronounced a great improvement over the first.

A new scale of wages has been established on the Brooklyn Rapid Transit system since the change in the presidency. Under the new schedule the elevated employes are divided into four classes. Those who have been in the employ of the company for at least five years are placed in the first class, and their wages increased 15 per cent. The second class includes those who have served at least three years on the elevated roads. These are to receive an increase of 10 per cent. in their pay. Employes who have worked for the company for at least two years are placed in the third class, and their wages increased five per cent. All other employes are listed as fourth-class men and receive no increase in their pay.

The Metropolitan Street Railway company is about ready to begin work on a number of important changes in its lines which have been decided upon during the winter. Some time in May the Broadway and Lexington Avenue lines will be changed from the cable to the electric system, and by the beginning of June these lines will be in operation. When this is accomplished a great saving to the company will result from the abandonment of the various power stations. The entire system will then be fed from the new power house at the foot of Ninety-sixth street and the East River. The present power houses at Broadway and Houston street, East Twenty-fifth street, at Sixth avenue and Fiftieth street and others will be used only as sub-stations, where the alternating current received from the central generating station will be transformed into direct current. There will be five of these sub-stations in Manhattan.

The New York and Port Chester Railroad company has been incorporated, to operate an electric street-surface road 25 miles long, from the Harlem River at Port Morris through the Borough of the Bronx to Mount Vernon, Pelham Manor, New Rochelle, Larchmont, Orienta, Mamaroneck, Milton, Rye and Port Chester, to the Connecticut line, with a branch to Clason's Point, on the East River. The company has a capital of $250,000, and the directors are Charles Heinecke of Whitestone, M. F. Germond of Dumont, N. J., W. H. Heath of Brooklyn, M. W. Baldwin, E. D. Mailloux, Mesmore Kendall, Christopher Kaiser, C. O. Mailloux of New York city and Ernest Muller of Westfield, N. J.

The Joy Printing-telegraph company of New York city, with a capital stock of $30,000, has been incorporated by O. J. Smith, G. W. Cummings and J. H. Grant.

At the annual meeting of the Albany and Hudson Railway and Power company, which operates the new third-rail electric road between Albany and Hudson, held at Hudson, on April 2d, the following-named directors were elected: Clinton L. Rossiter, formerly president of the Brooklyn Rapid Transit company; Governor Foster M. Voorhees of New Jersey, Henry Seibert, W. F. Sheehan, R. A. Smith, Seth L. Keeney of Brooklyn, A. M. Young of Branford, Conn., James Purcell of Hudson and H. G. Runkle of Plainfield, N. J.

President Orr of the rapid-transit commission has written a letter to the chairman of the railroad committee of the City Council, in which he gives as a reason for rejecting the Johnson offer to build the Brooklyn extension the fact that at the present time the city cannot afford to borrow for rapid-transit purposes more than $8,000,000. This amount, as the rapid-transit board is advised, would probably suffice to build the railway as now planned. Such a road as Mr. Johnson describes, it is stated, would probably cost in the neighborhood of $24,000,000. Mr. Orr further adds: "If it were possible to provide now for more rapid-transit facilities with due regard to the other needs of the city, this board would have been only too glad to propose them, not only for Brooklyn, but in other directions. It is impossible, however, for the city to supply all demands at once, and the only sensible way to deal with the present situation is to supply as fast as possible such needs as we can and as are the most pressing. This is the course that the rapid-transit board has followed." M. L. G.

New England News.

Boston, April 5.—The stockholders of the New England Electric Vehicle Transportation company will hold a special meeting at Jersey City, N. J., on April 29th, to vote upon the directors' recommendation that the company be dissolved. Up to February 28, 1901, the company had expended $769,036 for the purchase of vehicles and batteries. On March 1st the company had on hand $607,084 in cash and 245 vehicles. It controls the capital stock of the Boston Transit company, with a cash capital of $100,000. For the six months ended March 1st, the gross income was $95,310, and the expenses, $211,969. The directors say that there has been a continuous reduction in the operating expenses incurred by the public-carriage and delivery-wagon business in Boston, but they believe that, in view of the large outlay necessary to establish the present business and the limited scope of the same, the returns expected at the beginning will not be realized and that they feel that it is not for the interests of the stockholders that the company's cash and real estate should be longer applied to a business from which, under existing conditions, they believe there cannot be obtained a return commensurate with the amount of capital. Aside from current liabilities, the company has no debts. An officer of the company expresses the opinion that the Beacon street line of omnibuses may be kept in operation and that more commodious vehicles may be put on in time. These 'buses will not be operated during the summer, however, as nine-tenths of the people living on their route will be out of town. The delivery wagons leased to most of the business firms will be withdrawn when the contracts expire. The company's anxiety to establish the latter branch of the service led to its making contracts at a price considerably below the cost of maintenance.

At its town meeting, April 1st, Concord, Mass., appropriated $10,000 for an electric-light plant.

The mayor of Springfield, Mass., has recommended an appropriation of $30,000 for additional machinery and the enlarging of the electric-light plant, and on April 1st the aldermen postponed action thereon until their next meeting.

The Massachusetts gas and electric-light commissioners are unanimous in their approval of the proposed consolidation of the Edison Electric Illuminating company and the Boston Electric Light company. They have submitted a bill covering the matter to the legislative committees on manufactures and mercantile affairs, the companies having cooperated in its preparation. The bill provides that Edison stock may be exchanged for that of the Boston company at such proportional value as the board may decide to authorize, or the Edison company may issue additional stock and purchase that of the Boston company.

Wire Commissioner Lott has reorganized the Boston Wire Department. The following appointments have been made: Inspector, exterior department, J. Nash Ives, with a salary of $1,000 per annum; deputy inspectors, interior department, Thomas A. Dunham, G. W. Fuller, J. A. Desmond, Thomas W. Fitzgerald and John S. Keenan, each with a salary of $1,000 per annum; lineman, exterior department, Albert J. Bleiler, with a salary of $858 per annum.

The state Senate has concurred with the House of Representatives in accepting the committee report killing a bill by which the gas and electric-light commissioners were to be given control of "every species of business concern which tends to a trust or monopoly in procuring, carrying, manufacturing, distributing or selling gas or electricity for electric lighting."

The New Bedford city government has asked the Legislature for authority to establish an electric-lighting plant in an abandoned water-pumping station, the plant to be used for municipal purposes only.

A Boston brokerage firm has issued a letter containing information regarding the Massachusetts Electric Companies. It says that the corporation controls about 40 per cent. of the street-railway mileage in Massachusetts and has franchises in every city and large town in Eastern Massachusetts and Southern New Hampshire; also in Providence, R. I. It serves a rapidly increasing population, which now amounts to 2,000,000 people.

The Massachusetts Institute of Technology has received a 60-cycle, constant-current transformer, a complete outfit of series incandescent lamps and five arc lights from the General Electric company, for use in its electrical engineering laboratories. The incandescent lamps are in sockets of the street-lighting type. The arc lights are of the latest style, 60-cycle, 6.6-ampere, enclosed pattern. The transformer equipment has been further increased by a matched pair of 10-kilowatt, 60-cycle transformers which have primary windings for either 1,000 or 2,000 volts, suitable for connection to the Mordey dynamo. The secondary is arranged for the regular three-wire system.

Some weeks ago the Newton (Mass.) Board of Aldermen granted a franchise to the Boston and Worcester Street Railway company, but the conditions imposed meant the outlay of $160,000 for street construction before a car could be run. The company remonstrated, and on April 1st the aldermen granted certain concessions which make it probable that the scheme for a through line of electric cars between Boston and Worcester will soon become a fact, as Newton was the only city in which the company had not obtained a franchise that it could accept. B.

Canadian Intelligence.

Ottawa, Ont., April 6.—A by-law to borrow $10,000 to purchase an electric-light plant for the town of Dresden, Ont., has been approved by the ratepayers of the town.

Mr. Frederick Thompson of Montreal has been appointed electrical expert for the city of Kingston, Ont., to value the plant in the power house there, which the city purposes purchasing by arbitration. The expert will draw $25 per day salary.

Advices from Victoria, B. C., state that the steamer Quadra, which made a survey of the coast for a landing place for the all-British cable, has returned to that port. It is understood that a more favorable place for landing than that at San Juan was found in Barclay Sound, and that the cable station will be in Alberni. Mr. Peake, the engineer in charge of construction work, has gone to Australia, to select a landing place in the southern colonies. A contract for a cable steamer, the largest ever built, has been let to an English firm. The steamer will take 10,000 tons of cable for the stretch from Victoria, B. C., to the Fiji Islands.

Another important deal is about consummated at Sydney, N. S. A syndicate, promoted by Mr. B. F. Pearson of Halifax, N. S., is buying out the Sydney Gas and Electric Light company, paying therefor $40,000. The Sydney Ferry company, the Eastern Telephone company and the Electric Tramway company, to which latter company the local Legislature of Nova Scotia, last year, gave an extensive franchise, are included in the deal. An electric tramway will immediately be constructed from Glace Bay to Sydney. The tramway lines have already been surveyed.

According to the report of Lieutenant-colonel Domville of Kings, N. B., there will soon be an independent cable and telegraph line to the American and Canadian Yukon. The Northern Commercial Telegraph company will, Colonel Domville declares, lay a cable up the coast from Seattle to Juneau, and thence to Skagway and Dawson, by a new route. The Americans are now building a line from the mouth of the Yukon up to Dawson, and there is already a line built from Nome to St. Michaels.

Ottawa will soon have a third big electric corporation furnishing electricity for heat, light and power. A charter is about to be granted by the City Council of Ottawa to the Consumers' Electric company for such purposes. This franchise will ex-

pire in 23 years. The new company's rates will be 10 per cent. lower than those of the Metropolitan company. Sixteen-candlepower incandescent lights will be supplied at 10 cents a week, and arc lights at about $55 a year. The city, under its present agreement with the Ottawa Electric company, pays $65 a lamp a year. There will also be a similar reduction in the price of power. The Metropolitan company's figures for power, as set forth in its agreement with the city, are for from one to four horsepower, $50 per annum; five to nine, $45; 10 to 19, $43; 20 to 49, $38, etc. A. V. W.

Western New York.

Niagara Falls, April 6.—The Castner Electrolytic Alkali company has awarded the contract for the new buildings to be erected as an extension of its plant on the lands of the Niagara Falls Power company at Niagara Falls to Wentworth & Taylor. There will be two buildings, each 200 feet long and 300 feet wide. They will be three stories high and built of brick. The cost of the buildings will be about $250,000.

The Niagara Falls Hydraulic Power and Manufacturing company has commenced the work of enlarging its canal in order that a larger supply of water may be furnished to the power house and mills on the canal basin. The waterway will be extended the full width of the right-of-way, which is 100 feet. The average depth is to be made 14 feet. The Niagara Falls Hydraulic Power and Manufacturing company has in contemplation the extension of its forebay to the north, which means that the company contemplates the erection of a new station in the gorge at the water's edge.

Governor Odell has signed the 21 bills compelling the Rochester Railway company to pay for pavement laid between the tracks of its lines in Rochester. The sum aggregates $270,000.

There is good reason to believe that Niagara Falls will yet give to the world discoveries of greatest importance to the scientific and industrial worlds, the result of experiments that are now being made in that city by men who have the facilities of the wonderful supply of electricity and the features and facilities of the electric furnace. It may be predicted that more than one man will rise to world-wide fame through the discoveries in electrical science to be made at Niagara Falls. D.

Southern Developments.

Charlotte, N. C., April 5.—Five miles of new track will be built by the Gas, Electric Light and Railway company of Spartanburg, S. C. It now has 11 miles in operation. F. D. McEowen is president of the company.

The Petersburg (Va.) Gas company, authorized to furnish gas and electricity for motive power, heating and lighting, has been chartered, with an authorized capital of $200,000. R. D. Apperson of Staunton, Va., and F. H. Shelton, secretary and treasurer, of Philadelphia, are among the incorporators.

Surveyors have begun work on the proposed electric line between Gainesville and Dahlonega, Ga. J. F. Moore of Dahlonega is interested.

The Charleston (S. C.) Consolidated Railway company has been granted a franchise to build and operate a line between that city and the grounds of the West Indian Exposition.

It is stated that C. C. Howell and associates of Knoxville, Tenn., are preparing to develop Matt's shoals, 30 miles from Charlotte, N. C., and that they propose to furnish power to neighboring towns.

The Fayetteville-Wilmington (N. C.) Steamboat company has been chartered with $25,000 capital. The charter grants the right to operate a street-railway and electric-light system in Fayetteville. W. L. Holt of Fayetteville is interested in the project. L.

From the Buckeye State.

Columbus, Ohio, April 8.—The Columbus, Delaware and Marion Electric Railway company was incorporated recently, with a capital stock of $1,000,000. The incorporators are S. T. Everett, Jay E. Latimer and J. W. Holcomb of Cleveland, Lyman Gardner, Worthington and Howard C. Park, David C. Beggs, T. A. Simons and F. D. Simons of Columbus. The officers of the new company are as follows: President, T. A. Simons; vice-president, J. E. Latimer; treasurer, J. W. Holcomb; secretary, O. W. Aldridge. The Messrs. Simons own a road from Columbus to Worthington, and this, with three miles of track built by D. E. Sullivan, has been purchased. Work will begin on the extension to Delaware at once. The officers have little to say in regard to the route from Delaware to Marion, as they first wish to secure the right-of-way before making any announcements. At Marion connections will be made with lines to Cleveland and Sandusky, if possible, and it is also the intention to make connections with Toledo or build such a line as will be necessary to connect with some of the roads running out of that city.

The Newark, Zanesville and Coshocton Railroad company of Newark has been incorporated, with a capital stock of $10,000. J. M. Ickes and others of Newark are interested.

The Central Ohio Traction company of Bucyrus has been granted a franchise to build a line from Galion to Crestline.

John Kilgour and George B. Kerper of Cincinnati have purchased the Toledo and Bowling Green electric-railway property. Mr. Kerper already owns the Findlay street railway and is building a line to North Baltimore. A link will be built to connect the two and the line will be complete from Toledo to Findlay. It is said there are plans under way to connect Findlay with Urbana and the Dayton, Springfield and Urbana line, thus giving a through line from Toledo to Dayton. Mr. Kilgour and his associates will incorporate a new company to operate the roads mentioned above, under the name of the Toledo and Southern Railway company.

The jury in the case of the village of Franklin vs. the Southern Ohio Traction company for $5,000 damages, because of injury to the water pipes by electrolysis, disagreed, and it is said that the case will not be pushed further. Other towns had similar suits prepared, in case the village was successful, but these will probably be dropped also.

It is reported that the Everett interests have purchased the Detroit and Toledo Shore line and that it will be completed to Wyandotte, where it will connect with another line from the south. This is another link in the Lake Shore plan.

A Cleveland syndicate, headed by Lamprecht Bros., James Christy, Jr., and F. N. Wilcox, has organized the Washington-Baltimore Electric Railway company, to build a line from Washington to Baltimore and Annapolis, Md. It is said the capital of $1,500,000 has already been oversubscribed. Engineers are already at work on the line, which will be an important one.

The Dayton and Xenia Traction company of Dayton has been incorporated, with a capital stock of $800,000. The new company has planned some new lines on the streets of Dayton, and, it is said, will purchase the Dayton and Xenia interurban line. The incorporators are H. L. Ferneding, C. J. Ferneding, Edward Canby and others.

The Citizens' Electric Light company of North Amherst has been incorporated, with a capital stock of $50,000.

The Wheeling and Western Railway company of Bridgeport has been incorporated, with a capital stock of $10,000, to build a line of electric road from Bridgeport to St. Clairsville. O. M. C.

Information from Indiana.

Indianapolis, April 6.—The city of Carthage has granted a franchise for an electric-light plant and contracted with the company for lighting for 10 years, with the privilege of buying the plant at the expiration of the franchise.

Judge Fox of Richmond has ruled against the taxpayers and charged them with the cost in a suit brought to restrain the City Council from locating an electric-light power house in the city park.

The city of Brazil is taking steps to erect and operate its own electric-light plant. An Indianapolis company proposes to establish the plant, with compensation payable in such installments as the city is now paying quarterly for the service now rendered by the Stone-Webster company.

Two judgments holding the town of Gosport liable on a contract to pay $600 a year for lighting the streets with electricity were affirmed by the Indiana Supreme Court on the 5th inst. A new board of trustees repudiated the contract made by their predecessors, urging that the payment of such a price by a town which contained about 600 inhabitants was unreasonable and oppressive. It did not appear that the tax levy of the town had reached the limit allowed by law for municipal purposes, and the Supreme Court held that the town must carry out the contract. The court said that making a contract for lighting the streets of a town is the exercise of a business power, and such contract may be valid, although there is no town ordinance on the subject.

Action has been taken by a joint meeting of the committees from the Commercial clubs of New Albany and Louisville, with a view of furthering the project to utilize the waterpower of the Falls of the Ohio, at New Albany. The plan is to construct a canal on the Indiana side to empty into the river just below the falls, after utilizing the water to drive machinery to supply electrical power sufficient for the two cities and the surrounding towns and country.

At a meeting of the directors of the Commercial Club at Bloomington it was voted to build an electric railway between Bloomington and Martinsville. The committee raised $40,000. The estimated cost is $250,000. Charles L. Henry has agreed to be one of 11 men to share in the construction of the line.

The farmers in the southern part of Madison County are proposing to build an electric road from Newcastle to Pendleton, a distance of 30 miles. A meeting has been held and considerable stock taken. Another meeting will be held during the week.

The county commissioners of Knox County, on April 3d, granted B. G. Hudnut and others of Terre Haute permission to establish and operate electric lines to every town in Knox County, providing the work is completed in three years. Mr. Hudnut said: "Surveyors will begin the work at once. The lines to Monroe City and Bicknell will be built first and the other lines taken up as fast as possible. We will extend the Vincennes lines and form belt lines around the city."

The affairs of the Kokomo, Wabash and Northern electric railway, organized two years ago, with a capital of $300,000, by local business men of Wabash and Kokomo, to build an electric line between the two cities, have been settled. All the debts are paid and the stock subscriptions returned to stockholders. The corporation will not go out of existence, and later the line may be constructed.

The Indianapolis and Greenfield line is reported by the manager to be doing a freight business slightly in excess of $22 a day per car. The wages of the men are $110 a month. The net gain to the company, therefore, is about $500 a month—the best paying car in the service. The freight cars on all the other interurban lines are said to earn proportionate amounts monthly. F.

Northwestern Notations.

Minneapolis, April 6.—H. C. Mercord, the proprietor of the electric-light plant in Prescott, Wis., is preparing to enlarge and remodel the system to meet the growing demand for light. New machinery has been ordered, and a new power house will be erected as soon as the weather will permit.

An electric railway is projected from Waterloo to Des Moines, Iowa, by way of Eldora and Nevada. It is understood that the line from Charles City to Greene, which has been lately promoted, is to be part of the system.

A trolley line from Hamilton to Missoula, Mont., is proposed, utilizing power from waterfalls along the route.

It is understood that work will be started soon on the electric line at Mankato, Minn.

It is proposed to develop the power from Nisqually Falls, near Eatonville, Wash., and transmit the power electrically to Tacoma and other cities.

A mass-meeting at Clear Lake, S. D., voted to offer Konold Bros. a franchise for an electric-light plant for 10 years, instead of 20, as asked. The firm had previously refused a five-year franchise, but took the 10-year offer under consideration.

G. E. Haney has bought the electric-light plant at Manson, Iowa, and has taken possession. The plant has resumed operations. Mr. Haney plans to enlarge and improve the system as rapidly as the business justifies.

A proposition has been made to Bloomer, Wis., to put in an electric-light system.

G. M. Johnson of Willow Lakes, S. D., contemplates putting in an electric-light system at De Smet, S. D.

It is understood that the Postoffice Department will permit the Twin City Rapid Transit company to allow the signs "U. S. Mail" to remain on its cars until the latter are withdrawn to be repainted or repaired. The government will require that the signs be removed, however, except when the car is actually carrying mail.

The electric-light plant at Valley Junction, Iowa, has been closed down—the company says, for repairs. But the citizens fear it is permanent. The plant was originally built to be turned over to the city, but through an error in the election, the franchise merely entitled the company to build. A second election was held, but the voters did not ratify the purchase of the plant. It is understood that the operation of the system has not been a profitable one.

A measure has been introduced in the Minnesota Legislature which provides for a system of gross-earnings' taxation of street-railway systems, similar to that already levied on steam-railroad companies. It will require a constitutional amendment, and it is proposed to submit the question at the next general election.

Smith & McDowell, operators of the electric-light and power plant at Staples, Minn., have dissolved partnership, I. N. Smith succeeding.

The citizens of Casselton, N. D., will vote on selling the electric-light plant or appropriating $5,000 for enlarging it.

Citizens of Corning, Iowa, will vote on aiding the proposed Creston-Winterset electric line by a five per cent. tax. The company has been granted a franchise at Winterset.

The Wagner Milling company of Millbank, S. D., contemplates establishing an electric-lighting system in connection with its mill.

Kearney, Neb., will vote on a proposition for municipal ownership of the electric and gas systems.

The street-railway company of Butte, Mont., will experiment with all-night service.

The Brice Gas and Electric company of Mason City, Iowa, has been incorporated, with $300,000 capital stock. W. E. Brice and C. H. McNider are the incorporators.

N. E. Franklin has succeeded in interesting Chicago capitalists in the construction of an electric railway, connecting Deadwood, S. D., with Lead, Terraville, Central City and Spearfish. It is announced that as soon as franchises are granted, work will be started on the proposed road, which will be about 15 miles long.

A mass meting at Park River, N. D., voted in favor of a municipal electric-light plant.

The New Traction company is the style of the corporation which has been granted franchises at Creston and Winterset, Iowa, and will build an electric line between those cities. Its officers say that work will be started within 30 days and trains will be running by fall.

Anamosa, Iowa, voted to grant a franchise to the Metcalf Electric Light company.

The council of Clear Lake, S. D., refused a franchise for a lighting plant to Kunold Bros. A mass meeting voted in favor of it, but another meeting remonstrated. A stock company is proposed for a local plant, to be sold to the city at any time, and there is also talk of a municipal plant.

The councils of Deadwood, Lead and Spearfish, S. D., will be asked for franchises for the projected

electric railway through the Black Hills. There will be about 25 miles of road, and it will cost in the neighborhood of $400,000.

A right-of-way is being secured for the Furth electric road between Seattle and Tacoma, Wash. Work is to be started about May 1st, if no trouble is met in securing the right-of-way.

New London, Iowa, voted for an electric-lighting plant.

Fairfield, Iowa, has voted for a municipal electric-light plant.

Charles City, Iowa, has voted a franchise for the projected electric railway to Powersville and Greene.

From April 1st the users of electric light in Iowa City, Iowa, will be on the meter system.

The Big Bend Power company has applied to the council of Davenport, Wash., for a light and power franchise through the city. The company will canvass the city for patronage, and if it is sufficient to justify making the connection, the company will expend $250,000 on its proposed power plant at Big Bend.

The Fox River Valley Gas and Electric company has been formed at Appleton, Wis., with $350,000 capital stock and rather extensive objects. The company proposes to furnish light, heat, steam power and hot water in the cities of Neenah, Menasha, Kaukauna, Appleton, and also in all towns and villages in the counties of Brown, Calumet, Winnebago and Outagamie. All plants for generating power and gas will be located in Appleton, as will also the general offices.

The city of Clinton, Iowa, voted to sell the old municipal light plant of the city of Lyons (which has been incorporated into Clinton) to the Clinton Gas Light and Coke company. The latter company has been granted a new franchise, and will proceed to make extensive improvements in the electric-light plant purchased.

The council of Duluth, Minn., has concluded to accept the terms of the Commercial Light and Power company for street lighting for a term of years. The company made a very low rate, in order to head off the proposed municipal plant for street lighting. The company feared that it would not be long until the city would be an active competitor for commercial lighting. R.

PERSONAL.

Joseph H. Cooke, Chicago manager for the Buckeye and Jandus Electric companies, is making a speedy recovery after his recent severe illness.

Mr. J. B. Ware, well known as the manager of the Citizens' Telephone company of Grand Rapids, Mich., has accepted the position of general manager of the new People's Telephone company of Detroit.

Mr. V. C. Grace, who was formerly associated with Robert L. McOuat of Indianapolis, is now making his headquarters in Chicago, and is representing J. Jones & Son of New York and Queen & Co. of Philadelphia.

Charles T. Yerkes sailed from Southampton for New York on April 9th. He is reported to have nothing to say in regard to the rumors of his connection with the District Underground, being contented with his work on the Charing Cross and Hampstead railroad, and leaving all other ideas for the future.

Francis Raymond, a well-known Chicago electrical man, has established new offices at 48 West Jackson boulevard, where he deals in pure cast copper and electrical appliances, representing the General Incandescent Arc Light company, the Process Copper and Brass company and other companies.

Mr. Stephen L. Coles, managing editor of the Electrical Review of New York, has severed his connection with that journal to engage in other business. Mr. Coles has been engaged in electrical journalism for 12 years, and during that period has made many warm friends, who will wish him success in his new venture.

Carl J. Schlesinger, vice-president of the Alden Electric company of Chicago, died at his parents' home in La Salle, Ill., on March 30th, after an illness of two weeks' duration. Mr. Schlesinger was a young man, but had had eight years' experience in practical electrical work. He traveled for his company in the state of Illinois.

Mr. Frank H. Clark has resigned as manager of the Chicago office of the Electric Storage Battery company. Mr. Clark is an electrical man of ability and wide experience, and since he has been engaged in business in Chicago he has made many friends for himself and his company, securing a number of large and important contracts for the latter.

Charles A. Meade has resigned his position as manager of the Chicago office of the Shelby Electric company and is now associated with Mr. J. H. Cooke in the Chicago office of the Buckeye and Jandus Electric companies. Mr. Meade is an experienced lamp salesman, and in returning to the Buckeye and Jandus companies is simply renewing a former connection. He will have charge of the city business.

Professor Frederick G. Hesse, who for 25 years has been at the head of the College of Mechanics in the University of California, celebrated his seventy-sixth birthday on March 29th. His senior class presented him a solid silver model of a Pelton water-wheel five inches high and mounted on an onyx base. The gift was of special significance to the aged scientist because he is said to have invented the style of bucket used on the Pelton wheel. In the evening members of the faculty gave Professor Hesse a banquet in honor of the occasion.

ELECTRIC LIGHTING.

J. J. Nicholas of Port Republic, Va., wants prices on power-plant equipment.

Citizens of Fairfield, Iowa, have voted to establish a municipal electric-light plant.

C. McKee of Fordyce, Ark., is back of a project to establish a lighting plant in that town.

The Burnside Electric Light and Power company has been chartered at Burnside, Ky., with a capital of $4,500.

W. S. Pettis of Ellisville, Miss., will soon let contracts for machinery for the new municipal lighting station there.

The directors of the Home Heating and Lighting company of Indianapolis, Ind., have decided to begin the construction of the company's plant at once.

The Village Board of River Forest, Ill., has granted a 25-year franchise to the Maywood Electric Light company, in addition to a contract for street lighting.

The Rappahannock Electric Light and Power company of Fredericksburg, Va., is desirous of corresponding with builders of alternating-current machinery.

The proposition to permit the City Council of Lincoln, Neb., to issue $55,000 in bonds to establish and maintain an electric-light plant was carried at a recent election.

The plant of the Corning Electric Light company at Corning, Iowa, was burned recently, the loss being largely covered by insurance. The plant will be rebuilt immediately.

At the coming spring election the citizens of Milford, Ohio, will vote on a proposition to issue $25,000 worth of bonds to establish a system of electric lights and waterworks.

The Redding Light, Power and Water company of Redding, Cal., has been incorporated, with a capital stock of $75,000, by W. Ellery, E. B. Pixley, J. H. Sisson and G. E. Whitaker.

J. B. Oliger, R. B. Stitcher and S. C. Padelford of Cleburne, Texas, have filed articles of incorporation, under the name of the Cleburne Light and Power company, with a capital stock of $25,000.

W. W. Moore, president of the Brown Electric company of Little Rock, Ark., is in the market for a 60-kilowatt alternator, a 25-kilowatt, direct-current, 220-volt generator and a quantity of telephone cross-arms.

J. Pierpont Morgan has bought the power plant of the Liberty Electric Light and Power company at Liberty, N. Y., and presented it to the Loomis Sanitarium for Consumptives at that place. The price is said to have been about $40,000.

The directors of the Metropolitan Electric Supply company of London, England, are considering the expediency of adopting larger units, and are prepared to receive designs, accompanied by full specifications and approximate price (erected at their works in London), for complete two-phase steam units having an output of from 3,000 kilowatts to 4,000 kilowatts at a pressure of 500 volts per phase, and at a frequency of 60 complete cycles per second, such units to work in parallel with the existing 1,500-kilowatt units of the company. As an alternative, similar units generating at 10,000 volts may be considered.

ELECTRIC RAILWAYS.

The route for an electric railway between Kenosha, Wis., and Waukegan, Ill., is being surveyed.

An electric railway is to be built from Hartford to Beaver Dam, Ky. S. A. Anderson is secretary of the railway company.

The Northern Texas Traction company has been organized to build an electric railroad between Dallas and Fort Worth. K. M. Vanzant is president of the company.

The Tampa Electric company of Tampa, Fla., is greatly improving its street-railway service and extending its branch lines. The entire line will be supplied with new ties and new 65-pound rails.

The Edwardsville, Collinsville and St. Louis Electric Railway company has been incorporated, with an authorized capital of $50,000. The principal office is in East St. Louis, Ill., and the company will construct an electric street-railway line from Edwardsville, Ill., to Collinsville, Madison County.

A trolley line is projected to connect the cities of Concord, Dover, Somersworth and Rochester in New Hampshire. Two companies have been chartered for this purpose; one, the Concord, Dover and Rochester, with a capital of $400.000, and the other, the Dover, Somersworth and Rochester, with a capital of $300,000.

A St. Louis syndicate has purchased the street-railway system at Paris, Texas, and will install electric-car service, either by purchasing the local electric plant or by building a new one. The directors are R. H. Cornell, W. F. Little and Charles Hewett of St. Louis, Mo., and W. F. Dulaney and R. W. Wortham of Paris. R. F. Grimes is local superintendent.

Officers of the Charleston and Mattoon (Ill.) electric road, which is to reach Springfield, eventually, have plans to issue $200,000 in bonds for the construction of the line between Charleston and Mattoon, a distance of 12 miles. The promoters of the project are F. Holton of Huntington, W. Va., and H. Rawie of Anderson, Ind. The scheme includes the extension of the line from Charleston to Springfield, via Fuller's Point, Sullivan, Todd's Point and Taylorville. The Charleston City Council has granted the corporation a franchise.

AUTOMOBILES.

The cash on hand and real estate of the New England Electric Vehicle Transportation company is said to be about $3.50 a share in liquidation. It is expected that the company will pay out $5 a share.

At the meeting of the stockholders of the Illinois Electric Vehicle Transportation company, held recently, in Jersey City, the recommendation of the directors for a liquidation of the concern was accepted by a vote of considerably more than the necessary two-thirds of the outstanding stock.

The Postoffice Department has issued an order for the establishment of an automobile mail service in Buffalo, according to a report from Washington. A contract has been made with the proprietor of an electric-vehicle company in Buffalo, and the route is to be between the city postoffice and the postal station on the grounds of the Pan-American Exposition. Not more than seven and not less than five round trips a day are to be made.

PUBLICATIONS.

A general catalogue has been issued by the Stilwell-Bierce and Smith-Vaile company of Dayton, Ohio, describing the single and duplex pumps, pumping engines, air compressors, jet and surface condensers, etc., manufactured by this company. The catalogue is well illustrated, and contains about 125 pages, giving, in addition to the illustrations, considerable descriptive matter and data relating to hydraulic systems, together with general instruction for the installation and operation of Smith-Vaile pumps. This company's products include simple and compound condensing and non-condensing steam-driven pumps, single, duplex and triplex pumps for direct connection to steam engines or to be geared to electric motors, pumps for handling air, water, syrups, tar, wet cement and other semi-fluid matter, horizontal and vertical pumping engines, and feed-water heaters, filters and purifiers.

SOCIETIES AND SCHOOLS.

The sixth annual convention of the National Association of Manufacturers will be held at Detroit, on June 4th, 5th and 6th. The citizens of Detroit are said to be manifesting much interest in the event, and are determined to make it a success. Mr. George H. Barbour of Detroit, the Michigan vice-president of the association, is in general charge of the arrangements there.

The Engineers' Society of Western Pennsylvania is taking much interest in Andrew Carnegie's offer to endow a great technical school in Pittsburg with $1,000,000, or more, if necessary. A committee has been appointed to consider the proper scope of such a school and to make suggestions. Many of the members are of opinion that the school best suited to Pittsburg would be a combination of a trade school and an engineering school, the former being a preparatory course for the latter, but so organized that it would be complete in itself for turning out good mechanics, foremen, sub-superintendents, etc.

MISCELLANEOUS.

The John Scott Legacy premium and medal has been awarded by the Franklin Institute of Philadelphia to Thomas Wilkinson Blakey of Keene, N. H., and William Courtenay of New York, N. Y., for their "reconstructed granite as a material for insulating purposes."

A lineman in the employment of the electrical department of the city of Chicago recently took the civil-service examination for promotion, and, fearing that on account of a defect in his hearing he had not qualified, he committed suicide. It was stated that he was a good workman and an excellent telegrapher, and that it was probable that he had passed the examination.

A remarkable constitutional amendment, approved by the California Legislature, and to be submitted to the electors at the next election, would substitute a state commission for the railroad commission, the bank commission and the insurance commission. The new body would fix telegraph and telephone rates, as also rates on gas, water and electricity; would supervise railroad and sleeping-car companies, banks and insurance companies, and, in general, would control all quasi-public institutions and all public utilities. To this end it would exercise many of the powers now held by the boards of supervisors in the counties.

TRADE NEWS.

The Pan-Electric Manufacturing company of Mercer, W. Va., has been chartered, with an authorized capital of $100,000.

The Electric Appliance company, Chicago, is advertising as its "big four" Packard lamps, Packard transformers, A.-B. arc lamps and Gutmann wattmeters.

The name of Spies & Co. (Philip Spies and John M. Klein) of Chicago, manufacturers of electrical and mechanical work, at 87 and 89 West Van Buren street, has been changed to Spies Electric company.

Langstadt & Meyer, electricians, Appleton, Wis., announce that they have succeeded to all the rights and privileges of the late firm of Langstadt & Croswell. A. H. Meyer, a graduate of the Rose Polytechnic Institute, brings to the new firm both theoretical and practical experience in matters electrical.

The American Bridge company has been or is about to be absorbed into the new United States Steel corporation. The latter offers for each $100, par value, of preferred stock of the American Bridge company, $110, par value, in the preferred stock of the United States Steel Corporation, and for each $100, par value, of common stock of the American Bridge company, $105 in the common stock of the United States Steel Corporation.

"It is announced that after May 1st of the year 1901 at 128 West Jackson boulevard, Chicago, in the building known as the Electrical building, will be found the western office of the American Circular Loom company." Thus runs the wording on a simple but effective announcement card sent out by the company named, of which Thomas G. Grier is the Chicago agent. Under a quaint little picture attached to the card one may find the imprint of H. Jenkins of Chicago, the clever adsmith who designed the card.

BUSINESS.

The Berlin Iron Bridge company has contracted to furnish the Province of New Brunswick, Canada, four bridges. There will be required four 63-foot riveted spans, one 150-foot through pin-connected span, one 200-foot deck pin-connected span and one 80-foot deck pin-connected span.

The Ball Engine company of Erie, Pa., has recently installed for the Pennsylvania railroad shops at Altoona, Pa., a 450-horsepower engine, direct-connected to an alternator for parallel operation, two 90-horsepower engines for the George Wiedemann Brewing company, Newport, Ky., and one 150-horsepower direct-connected engine at the County Hospital, Denver, Colo.

The Consolidated Railway, Electric Lighting and Equipment company of 100 Broadway, New York, has just opened a western office at 519, the Rookery, Chicago, with its general agent, Colonel John T. Dickinson, in charge. This company exploits the Consolidated "axle-light" system of lighting for railway trains and coaches by electricity generated from the car axle. This system is in use on a number of railroads. It was recently adopted by the Santa Fe system, and Professor George D. Shepardson of the University of Minnesota, in a recent lecture in St. Louis, said: "Personal observation of the working of this [the Consolidated] device on the Santa Fe road last December showed that, after the dynamo was connected with the lights, a sensitive Weston voltmeter indicated no perceptible variation of voltage between 15 miles and the highest speed attained, probably 40 miles per hour. In a few cars there was a slight but gradual change at the critical speed when the lights were shifted from the dynamo to the battery, or vice versa. In no case was the fluctuation objectionable, and it was probably not noticed by the passengers."

The equipment of the great shipbuilding plant of the Fore River Engine company, at Quincy Point, Mass., exemplifies in marked degree the varied applications of the fan blower. Draft for its boilers is produced by an induced-draft fan drawing the gases directly from the uptake flue and discharging them through a small stack extending only a few feet above the roof. Under the forced system fan draft is likewise employed for creating the necessary intensity of combustion in the heating furnaces and forges, while the smoke is removed from the forges through hoods communicating with an exhaust fan. All buildings are heated by the hot-blast system, by means of which a fan forces the heated air through distributing pipes and delivers it along the walls and above head level. Notwithstanding the exposed position of the buildings, it is said that the first winter has been passed with uniform internal temperature throughout all of the buildings. The entire equipment of blowers and heating apparatus was installed by the B. F. Sturtevant company of Boston, Mass.

The American District Steam company of Lockport, N. Y., is engaged in building large additions to its works at Tonawanda, N. Y., in order to take care of its increasing business. It is in receipt of a large number of orders already, and anticipates being very busy later in the season. Many electric companies are taking up the matter of exhaust-steam heating to find a market for their exhaust steam. The American company says: "Electric companies who are operating our system report that they are paying all their station expenses and interest on the investment for steam mains from the sale of their exhaust steam, thus practically securing their current at the station free of expense. We consider an exhaust-steam-heating plant a very much better investment for an electric company than an expensive water plant, which is usually situated miles away from the point of distribution, and at certain times of the year cannot be operated on account of shortage of water, thus requiring the company to keep a steam plant in reserve to use on such occasions."

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 2, 1901.

670,927. Incandescent Electric Lamp. Charles R. Campbell, Huguenot, N. Y., assignor to himself and Howard H. Bush, New York, N. Y. Application filed July 12, 1900.

A conical lamp base of insulating material carries circumferential metal bands spaced apart on its periphery. Several filaments are mounted in electrical connection with the metal bands. Metal arm socket contacts bear upon the different metal bands on the lamp base to complete the electrical connections.

670,943. Electric Fire-engine and Hose-carriage. Wilbur M. Whitlock and Edgar P. Harrison, Newark, N. J. Application filed April 21, 1899.

A long vehicle body mounted on wheels has at the front a raised seat, the body having a horizontal flooring which serves to hold the folded hose and as a supporting bed for the motor and pump to hold the same in alinement. The motor and pump are suspended from beneath the level flooring and bed-plate and held in operative relation thereby.

670,946. Electric Igniter for Gas Engines. Jacob L. Ash, Lansing, Mich. Application filed November 4, 1899.

A flanged plug extends through the end of the cylinder, and a pin extends through the plug and is suitably insulated from it and provided at the inner end with a sparking point. A spindle extending through the plug is provided at its inner end with an arm and a sparking point. An arm is placed at the outer end of the spindle, and a supplemental spindle is provided with a coacting arm, both arms being spring-held against each other. A stud extends outwardly from the end of the cylinder. The crank wheel is connected to a pitman and derives movement from the main shaft, and a spring-held dog is suitably pivoted at the end of the pitman and located with the end normally in proximity to the lower end of the arm depending from the supplemental spindle.

670,948. Brake for Vehicles. Adolph G. Carlson, Chicago, Ill. Application filed May 19, 1899.

A brake shoe partly or wholly surrounds the axle and is opposed to a fixed part on the axle of each car. A receptacle is placed between a support to which the brake shoe is movably attached and its associated brake shoe. The fixed part, brake shoe and fluid receptacle are arranged in planes substantially parallel to each other and at right angles to the axle. An electrically controlled valve admits fluid into the receptacles, and a controlling device is located on one of the cars, with suitable electrical connections whereby admission into all of the receptacles may be simultaneously controlled from one of the cars.

670,949. Adjuster for Incandescent Electric Lamps. Lewis A. Carpenter, Revere, Mass., assignor to Frank W. Morse, Boston, Mass. Application filed September 12, 1900.

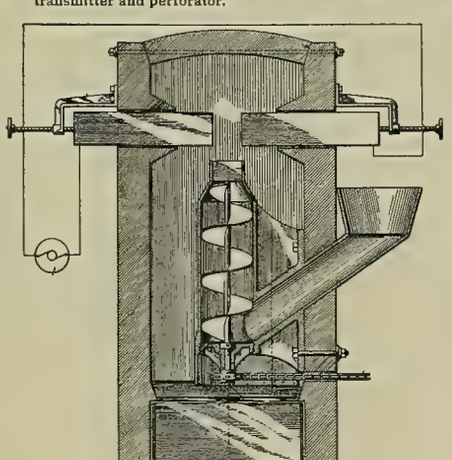
A casing composed of two co-operating members has interlocking flanges forming a cord-receiving groove. The lamp cord is retained in the groove. A spring-actuated drum or reel located within the casing is provided with a suspending cord extended through the casing and attached to the lamp cord.

670,952. Potential Regulator. Augustine R. Everest, Lynn, Mass., assignor to the General Electric company of New York. Application filed September 24, 1897.

A transformer whose primary is connected across the circuit mains has a secondary winding divided into sections. Contacts including more or less of the secondary winding are in circuit with one of the mains, and brushes engage with them. A choking coil connected between the brushes prevents disruptive sparking and maintains the circuit of one of the mains continuous at all times, and a tap leads from the winding of the choking coil at a point between the ends so that when only one brush is in circuit, the current will traverse only a portion of the coil.

670,964. Telegraphy. Donald Murray, New York, N. Y., assignor to Postal Telegraph-cable company, New York, N. Y. Application filed January 17, 1901.

An automatic transmitter directs upon the main line current impulses of unit duration or integral multiples thereof, and is driven by a phonic wheel propelled by electromagnets. A vibrating reed and a local circuit supply current impulses to the magnets. An electromagnetic tape-perforating device is located at the receiving station, together with means for maintaining unison between the transmitter and perforator.



NO. 671,008.

670,980. Telegraphic Instrument. Ambrose S. Bissell, New York, N. Y. Application filed September 4, 1900.

The base has an opening formed therein, and a slotted plate provided with a longitudinally and transversely adjustable support is mounted in the opening. A magnet is mounted on the base, with an armature arm pivotally supported adjacent thereto. A circuit actuates the magnets and the arm, and devices connected with the arm burn dots and dashes in the tape, these devices being in an independent heating circuit.

670,986. Automatic Protecting and Detecting Device for Electric-light Circuits. Harry Etheridge, McKeesport, Pa. Application filed June 19, 1899.

An electromagnet is arranged within the main circuit upon a low-resistance winding, and a spring-supported armature is normally attracted thereto, this armature having contacts. An auxiliary resistance is arranged in a shunt circuit and connected with the armature. A separate electromagnet having contacts to be engaged with those of the armature is provided, and a separate circuit of high-resistance winding, upon both of the magnets, is arranged in parallel with the main circuit. Part of the separate circuit is arranged to aid in releasing the armature and the remaining portion to aid in returning and retaining the contacts of the armature rigidly against the magnet contacts and re-establishing the continuity of the main circuit, through the resistance.

670,994. Electric-lighting System. Joseph A. Mesiroff, Milwaukee, Wis. Application filed April 30, 1900.

In an alternating-current electric-lighting system, a contact device closes and breaks the primary circuit of the transformer. An electromagnet is energized in parallel with the station transformer for operating the contact device. Means are provided operating through the medium of the conductors of the secondary circuit of the transformer to control the operation of the electromagnet.

671,008. Apparatus for Producing Calcium Carbide. John Zimmerman and Isedore S. Prenner, Chicago, Ill. Application filed March 13, 1899.

Two electrodes extend transversely through the side walls of a furnace into the furnace chamber. A feeding and compressing chamber is located within the furnace chamber and provided with a mouth or discharge opening of smaller diameter than the diameter of the chamber and located in line with and below the arcing space. A mixture of carbon and lime is forced through the feeding and compressing chamber and out of its mouth or discharge opening directly into the arcing space within the furnace chamber. (See cut.)

671,046. Telegraph Recorder. George L. Foote, Brooklyn, N. Y., assignor to himself, H. G. Pierson and Charles Freemann, copartners, under the firm name of Foote, Pierson & Co., of New York. Application filed January 29, 1898.

This instrument comprises a writing lever, an actuating electromagnet therefor and a press whose operative surface is limited in the direction of the length of mark, and is automatically fed away from marking position in the direction of the length of marking while the writing lever remains in position to record the signal.

671,080. Trolley. Henry S. Goughnour, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed June 8, 1900.

The pole is pivoted to the base. A spring seated in a slide mounted in the base bears against it at one end. A connection is made between the trolley pole and the opposite end of the spring, with means for normally holding the slide against movement and for automatically releasing the holding device when the pole escapes the trolley wire, the holding device being arranged when released to be engaged by the pole in a depressed position thereof and thereby returned to normal position.

671,084. Electric Welding Apparatus. Henry F. A. Kleinschmidt, Johnstown, Pa., and Frederick A. Phelps, Jr., Newark, N. J., assignors to the Lorain Steel company of Pennsylvania. Application filed April 24, 1900.

Pivoted terminal legs are provided with means for applying pressure thereto. Contact-carrying arms are placed in recesses of the legs and contacts carried by the arms at one end portion thereof. Means are provided for moving the opposite end portions of the arms toward and away from each other.

671,093. Switch and Outlet Box. Miner Robinson, Newton, Mass. Application filed January 31, 1901.

A universal switch box with holes for receiving the switch-attaching screws has the threaded portion of the holes at considerable distance back from the switch ears when the switch is in place, whereby a considerable discrepancy may exist between the position of the holes in the switch ears and the threaded holes in the box, and be compensated for, and at the same time allow of a universal adjustment of the switch in the box.

671,106. Automatic Stop for Electric Elevators. Allan Cowperthwait, Brooklyn, N. Y., assignor to Alonzo B. See and Walter L. Taylor, Brooklyn, N. Y. Application filed February 4, 1901.

An element travels correspondingly and proportionately with the car. The elements are connected with cams to drive the latter whenever the element passes beyond its normal limits of travel in either direction, and electric switches are moved by the cams to stop the elevator.

671,139. Electric Heater. Alexander R. Leask, London, England, assignor of one-half to Percy Morgan Bellis, London, England. Application filed December 13, 1900.

A ring is formed of a non-conductor of heat and electricity, and a thin wire coil is wound around it. Metal rods connect the ring with a headpiece, and electric conductors communicate current to the wire coil. A spring contact underneath the headpiece is actuated to close the circuit through the heater by a portion of the vessel into which the apparatus is placed.

671,179. Trolley Car. Louis A. Brod, Brooklyn, N. Y. Application filed August 15, 1900.

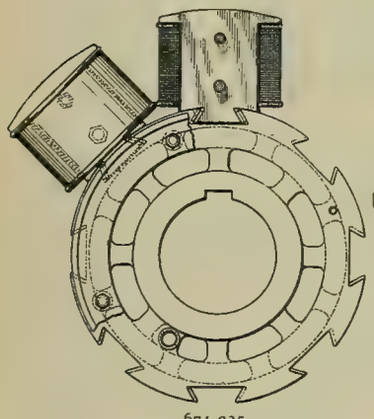
A spring-operated trolley arm is pivotally connected with its support and provided at its free end with a spring-operated crank lever, one end of which carries the trolley wheel, the other projecting below the trolley arm. The support is provided with an extension which projects in the same direction as the trolley arm and contains a longitudinal chamber, the top of which serves as a rack-bar. A slidable spring-operated block is mounted in the extension, and a dog pivotally connected with the block operates in connection with the rack-bar, and also in operative connection with the crank lever, the block being also connected with the trolley arm.

671,195. Shade Holder for Electric Lights. Edwin O. Pease, Bangor, Me. Application filed November 21, 1900.

The shade clamp is carried by the body ring, with means for clamping the body ring to a lamp socket or other support. This latter is accomplished by a split ring and locking devices carried by the body ring, the locking devices comprising a body portion provided with oppositely projecting pliable fingers engaged with the free ends of the split ring to maintain it in clamping contact with the lamp socket.

671,235. Means for Attaching Pole Pieces. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 29, 1900.

A pole-piece support having diagonal dovetail slots of uniform width carries a pole-piece having a straight dovetail projection to be inserted in one of the slots. A right-triangular key between one side of the projection and a wall of the slot is inserted from one direction, and a similar key between the other side of the projection and the other wall of the slot is driven in from the opposite direction. (See cut.)



671 235.

671,249. Rectifier. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed January 9, 1900.

A rectifying commutator is connected to the secondary of a transformer, with a polyphase motor for driving the commutator. Connections are made between the primary supply circuit for the transformer and the conductors corresponding to one phase of the supply circuit for the motor. Connections are also made between conductors corresponding to another phase of the motor supply circuit and the secondary circuit of the transformer. (See cut.)

671,259. System of Motor Control. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 29, 1900.

Several electromagnetic devices are connected to a controlling system comprising a number of conductors less than the number of devices. The conductors are connected in various combinations to a source of power to successively operate the electromagnetic devices.

671,265. Electric Recording Instrument. Frank P. Cox, Lynn, Mass., assignor to the General Electric company of New York. Application filed July 9, 1900.

A shaft or other rotatable body is resiliently connected to an electrodynamometer. A motor and a magnetic drag device are in operative relation between the motor and the shaft.

671,271. Electric Fuse. William L. R. Emmet, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 27, 1900.

An insulating support is provided on its under side with a recess, and a barrier extends from one wall to the other of the recess. Guides are provided in the walls for the barrier, and an insulating tube is mounted on the barrier, containing a fuse wire. Contacts connect with the fuse terminals on the tube, and spring clips are connected with the fixed circuit terminals, to engage the tube and connect the fuse in circuit.

671,272. Electric Metering System. Walter C. Fish, Lynn, Mass., assignor to the General Electric company of New York. Application filed January 18, 1899.

A two-rate meter and a maximum instrument are connected to the same circuit, together with means whereby the normal operation of the two-rate device cuts out the maximum instrument during the period of low rate.

671,273. Metering Electric Energy. Walter C. Fish, Lynn, Mass., assignor to the General Electric company of New York. Original application filed January 18, 1899. Divided and this application filed January 26, 1901.

This patent covers a method of measuring current or energy taken by a consumer from a system of electrical distribution which consists in integrating the load at two different rates during different hours of the day, and recording the maximum load during the period of high rate only.

671,278. Electrically Controlled Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed December 30, 1898.

This device is a motor-operated switch, comprising a driving electric motor operative always in the same direction, a gear, a clutch connecting the two, means for disconnecting them after a definite range of movement, a two-way circuit controller in the motor circuit, a lost-motion connection between it and the gear, and a control circuit having connections with the two contacts of the two-way switch.

671,279. Measuring Instrument. Charles S. Jameson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed December 23, 1898.

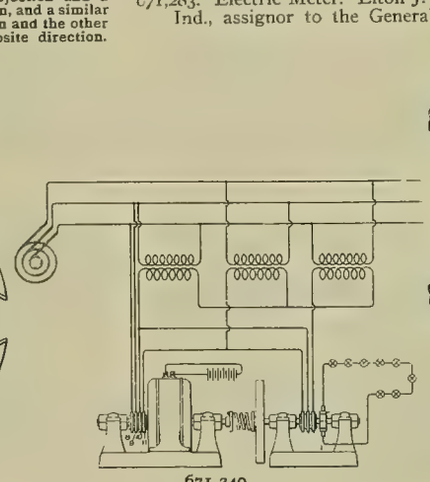
In an electric measuring instrument containing a field magnet is mounted an armature comprising disks which are separated from each other by a space, the disks being mounted on the shaft at an angle to its plane of movement, and occupying planes which are other than parallel to each other. (See cut.)

671,282. Electric Meter. Elton J. King, Fort Wayne, Ind., assignor to the General Electric company of New York. Application filed January 20, 1900.

In a meter for alternating currents a cup-shaped armature is used. A series coil is arranged adjacent to the cylindrical surface of the armature on the outside. Several relatively adjustable shunt coils are placed within the armature. A retarding magnet is located in co-operative relation with the armature.

671,283. Electric Meter. Elton J. King, Fort Wayne, Ind., assignor to the General Electric company of New York. Application filed January 31, 1901.

In an electric meter for alternating currents, means are provided for producing a series field and a shunt field displaced by substantially 90 degrees from it, on non-inductive load, at a specified frequency. An armature is acted upon by the fields. Auxiliary means are provided for modifying the phase of the shunt field when the meter is supplied with currents of a different frequency. (See cut.)



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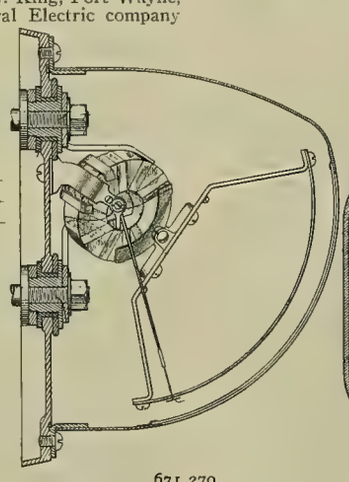

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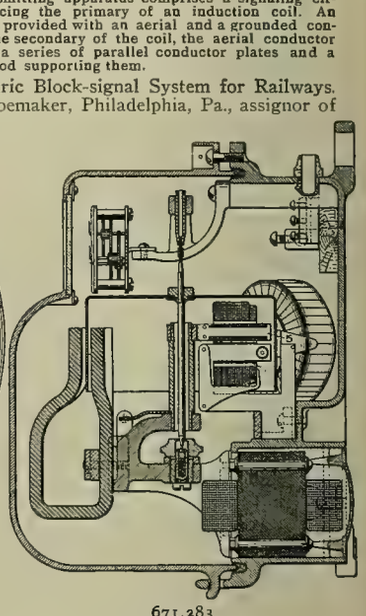

671,283

671,289. Controlling Rotary Converters. Samuel W. Mauger, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 16, 1901.

The system of distribution comprises rotary converters driven by alternating current, independent circuits supplied thereby, a three-wire interconnecting circuit, switches for connecting the several machines between a pair of wires on either side of the circuit, and a variable starting resistance between the pair of outside wires.

671,311. Telephone Call Box. Ward Decker, Owego, N. Y. Application filed April 20, 1898.

A metallic spring attached to one of the leaves of the lid hinge of the box is arranged to strike against the revoluble contact of the magneto-generator armature. The box containing the generator and other electrical apparatus is in part attached to the lid and in part to the body of the box. Electric connection between the two parts of the apparatus is made by the hinges, and the generator is directly connected to the hinge without intermediate connections.

671,334. Construction of Morse's Registering Telegraphic Instruments. Eugene Ducretet, Paris, France. Application filed July 29, 1898.

An adjustable resilient blade is engaged by a depending arm on the indicating lever to act on an auxiliary electromagnet. Means are provided on the armature of the auxiliary electromagnet for engaging and stopping the clockwork of the apparatus as the armature is attracted.

671,338. Conductor and Contact for Electrical Glow Lamps. Julian A. Halford, Bayswater, England, assignor to the Electric Lighting Boards, Limited, Pall Mall, London County, England. Application filed September 10, 1900.

A pair of insulated bundles of conducting wires are mounted in a flexible support with a non-conducting penetrable covering for the bundles. A pair of spikes carried by a lamp penetrate the covering and bundles of conducting wires.

671,349. Electric Signaling Apparatus. William H. McClure and Dennis E. Healy, Worcester, Mass., assignors to the Gamewell Fire Alarm Telegraph company, New York, N. Y. Application filed December 8, 1899.

A number of circuit-operating devices are provided, each adapted to change the normal condition of the circuit for a different period of time. A visual indicator operated by the circuit consists of a drum having code indications thereon corresponding to the different circuit-operating devices. A shaft to which the drum is secured carries a ratchet wheel with a pawl normally engaging it for holding the drum in its normal position. A pivoted armature lever bears the pawl, and an electromagnet operated by the circuit controls the operation of the armature lever for disengaging and thereafter engaging the ratchet wheel, permitting the drum to rotate. An escapement mechanism connected to the shaft by a ratchet-and-pawl connection times the movement of the drum, and means are provided for simultaneously resetting the drum and for rewinding the actuator independent of the escapement mechanism.

671,350. Alarm System. James H. McCracken, Washington, Ind. Application filed November 23, 1900.

This device comprises a circuit-breaking mat with a perforated and movable insulating slab having spaced contact strips. Headed pins mounted loosely in the perforations of the slab permit of movement of the slab with the contact strips into and out of contact with the heads of the pins. Means are provided for holding the slab yieldably with the contact strips in contact with the heads of the pins, and connections are made between the pins and a circuit to be broken, the pins being connected in series through the connections and the contact strips.

671,403. Wireless-telegraph System. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Marie V. Gehring, Philadelphia, Pa. Application filed November 26, 1900.

The transmitting apparatus comprises a signaling circuit embracing the primary of an induction coil. An oscillator is provided with an aerial and a grounded conductor in the secondary of the coil, the aerial conductor comprising a series of parallel conductor plates and a conductor rod supporting them.

671,404. Electric Block-signal System for Railways. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Gustave P. Gehring, Philadelphia, Pa. Application filed November 26, 1900.

The track is divided into sections. Relays of different strengths bridge the rails of adjacent track sections, and are provided with an armature common to both relays. Electromagnets control the track signals, the circuits for the electromagnets being controlled by the respective relays.

671,405. Telegraph. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Gustave P. Gehring, Philadelphia, Pa. Application filed January 12, 1901.

This invention comprises a type-writing telegraph, comprising a shaft carrying a cylinder and a commutator provided with teeth as conductors, and with insulators between the teeth upon the periphery. Key bars are adapted to engage the cylinder one at a time to stop the shaft. An electric circuit connected with the commutator contains an electromagnet which operates a type wheel simultaneously with the commutator. The printing mechanism is operated by an electrical circuit, and the spacing mechanism by a different circuit but with the same batteries.

671,406. Wireless Telegraphy. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Marie V. Gehring, Philadelphia, Pa. Application filed January 17, 1901.

In a transmitter of ether waves the current source has an earthed and an aerial conductor with an emitter between the conductors comprising sparking terminals, a casing therefor containing a gas under pressure, and means to control the current source.

671,407. Wireless Telegraphy. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Marie V. Gehring, Philadelphia, Pa. Application filed January 22, 1901.

In a system of ether wave telegraphy, the receiving apparatus comprises a receiving circuit including a coherer, a main circuit in parallel with the coherer, a relay circuit controlled by the main circuit, a signaling relay therein, and means controlled by the relay circuit to render the signaling relay active between the impulses impressed on the relay circuit.

671,426. Electromagnetic Brake. Paul F. L. R. H. K. Voigt and Wilhelm C. Kusterer, Ilmenau, Germany. Application filed October 12, 1899.

A plate carrying a catch is adapted to be attracted by an electromagnet. A ratchet wheel engages with the catch and is thereby revolved, step by step. A connection is provided between a ratchet bar and the ratchet wheel whereby the ratchet bar will be raised at each upward movement of the plate. A connection is also made between brake blocks and the ratchet bar whereby the blocks will be operated to brake the wheels when the ratchet bar is raised.

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The Institute Conversazione.

In the dictionary a conversazione is defined as an assembly for conversation, "particularly on literary or scientific subjects." But the gathering at Columbia University, New York, on the evening of April 12th was that and more, being also an exhibition of one evening's duration of the latest advances in the science and art of electricity. It was held by the American Institute of Electrical Engineers, with the co-operation of the university authorities, and was a brilliant success. The effort to present electrical features of real novelty was satisfactorily carried out, and the attendance was worthy of the exhibits and demonstrations, including such men as Edison, Tesla, Elihu Thomson, Sprague, Bell and Pupin. The affair was held in the Engineering building and Havemeyer Hall, the latter being devoted exclusively to Tesla's demonstrations. In all there were 32 special exhibits. A collation was served on the third floor of the Engineering building. The committee of arrangements consisted of W. S. Barstow, chairman, and Edward Caldwell, W. J. Hammer, R. T. E. Lozier, F. B. Crocker, T. C. Martin, C. W. Rice and George F. Sever. The reception committee embraced a long list of well-known names, with Carl Hering as chairman and R. W. Pope as secretary. Following are brief accounts of exhibits.

Pupin's Improvement in Long-distance Telephony.

Professor M. I. Pupin of Columbia University was in attendance and explained to visitors the original apparatus used in developing his recent invention for the improvement of long-distance land and ocean telephony, consisting in the location of inductance coils in the line at distances which are definite small fractions of a current-wave length. This apparatus was shown in the basement of the Engineering building.

Tesla's Experiments.

In Havemeyer Hall, Nikola Tesla performed startling and suggestive experiments with his oscillator —experiments remarkable to see, yet impossible adequately to describe. An interesting feature of the Tesla demonstration was the high tribute paid Tesla by Edison's presence at his demonstration, for Mr. Edison's reluctance to attend functions of all sorts is well known. The entrance of Edison was the signal for tremendous cheering on the part of those present, and Tesla's smiling and evident appreciation of the high compliment paid him by the older inventor was by no means the least interesting feature of the evening.

As is often the case where highly scientific demonstrations of an impromptu nature are essayed, and with a short time for preparation or test of apparatus after transportation, Mr. Tesla had to suffer his disappointments. In the midst of his most remarkable experiments, and at a point where he had hoped forcibly to illustrate certain remarkable phenomena relative to the transmission of energy without wires, well known to himself, but it is safe to say, new to the majority of those present, the transformer on the city electric-lighting system, that had been tapped or temporarily installed by the college authorities to furnish Mr. Tesla his main supply of current gave out. The manly and patient manner in which Mr. Tesla endured what must have been a most trying ordeal won him the sympathy of every practical scientific man present. The fact, too, that he had worked throughout the entire preceding night and had brought to Havemeyer Hall an astonishing amount of heavy yet delicate and intricate apparatus, earned him the thanks of everyone present for his effort, as he smilingly put it, "not to instruct, but to amuse." Fortunately for Mr. Tesla, however, he was enabled to make an exhibition of high-frequency induction effects and of high-tension discharges of a highly interesting character. Edison's entrance and later that of Tesla were greeted with cheers by the Columbia students. Tesla explained that he was going to use an electric oscillator to produce wave vibrations which were to be discharged in various parts of the room by means of a large transmitting cable. The brilliancy of the electric light from a large coil was made to decrease and diminish by Tesla rubbing his hands along the sides of the coil.

Geissler tubes were made fluorescent, and a beautiful effect was produced by waving vacuum tubes charged with the electric current.

The later experiments partook of the nature of the results obtained by induction currents. A glass moon was lighted from a huge wire coil, the current passing through the air as in wireless telegraphy. Tinfoil was heated from the center of the coil. When the coil was short-circuited, the foil heated so quickly that the demonstrator dropped it with smothered exclamations. By far the most spectacular performance was the last. A huge, flat coil, 10 feet high, was constructed in the front of the room and the current turned on in full force. Sparks leaped six feet in all directions from the end of the wire, and the heat was so intense that the insulation began to burn. The audience felt uncomfortable and Tesla smothered the flames, remarking that "It's just nothing."

FIG. 1. THE INSTITUTE CONVERSAZIONE.— PICTURE-TELEGRAPH MACHINE AT CHICAGO END OF CIRCUIT.

Palmer and Mills' Picture Telegraph.

H. R. Palmer's and Thomas Mills' "facsimile picture telegraph" was one of the exhibits. This instrument is worked on a system whereby half-tone pictures, sketches, handwriting and the like can be transmitted over long distances by employing ordinary electrical circuits.

An attempt was made to send and receive pictures to and from Chicago, the instrument on exhibition having been connected with long-distance telephone wires, but the experiment failed this time, although the efficacy of the appliance has previously been demonstrated over long distances. The explanation for the failure was that the induction in the underground cables in New York caused the trouble.

It is not claimed that this apparatus is entirely perfected for commercial use nor that it involves any new principle in picture transmission, the idea being to utilize synchronously revolving cylinders, the one at the transmitting end having the picture on a prepared zinc plate treated with an insulating compound to break the circuit of a metallic stylus in contact with it. At the receiving end is a duplicate machine, in which, however, a pen takes the place of the stylus and produces, on a sheet of paper on the receiving cylinder, the outlines or dots transmitted by the electrical impulses of the transmitting cylinder. Automatic synchronizing apparatus is provided. In the experiment arranged for the Institute Mr. Palmer was at the New York end and Mr. Mills in Chicago. The accompanying picture (Fig. 1) shows the instrument set up in a room at the Quadrangle Club of the University of Chicago and was taken on the evening of April 12th, at the time of the test. Mr. Mills, one of the inventors, is in the chair in the foreground, with an assistant at his left. The machines will be exhibited at the Pan-American Exposition by the International Electrograph company of Cleveland, of which Mr. Palmer is president.

Poulsen's Telephoncgraph.

Poulsen's telephonograph was exhibited by Lemvig Fog and Emil S. Hagemann of Copenhagen, Denmark, and Mr. William A. Rosenbaum of New York. This exhibition attracted the enthusiastic attention of all who saw it, and none was louder in praise than Mr. Edison, who gave great credit to the inventor for his work. The apparatus, as exhibited, consists of a brass drum, 11 by five inches, upon which is wound piano wire. Resting upon the wire is a tiny electromagnet, which is connected to a carbon telephone transmitter, two cells of battery and preferably an induction coil. When the transmitter is spoken into, it acts as a tap on the battery, causing currents of varying strength, in proportion to the strength of the sound waves, to pass through the electromagnet. The current causes the magnet transversely to magnetize the steel wire as the drum revolves, and the magnetic lines of force are permanently recorded therein. After the steel spiral is filled—which operation takes about 39 seconds, and permits the recording of 100 to 120 words—the tiny magnet is placed in its original position and connected with a Bell receiving telephone. The cylinder is again revolved, and as the magnetized steel wire passes before the poles of the electromagnet it forms a species of magneto-electric generator, giving out currents of electricity of a strength and direction corresponding to the magnetization of the steel wire, which correspondingly affect a Bell telephone held to the ear and reproduce the sounds and words originally spoken with absolute fidelity. In addition, there was shown the band form of telephonograph and a dictation machine for office use. The band form gives the machine a practical value, as it makes it possible to extend the dictation almost indefinitely. The record is wiped out at the will of the operator, or retained permanently. There is no waste of material. The telephonograph is not yet considered perfect by its inventor, who is constantly at work upon it. The reproduction is similar to the sound of the telephone, the buzzing of the phonograph being obviated.

Hewitt's Mercury-vapor Lamp.

One of the most remarkable exhibits, due largely to its importance as bearing upon the future of the incandescent electric light was that of Mr. Peter Cooper Hewitt. With a knowledge of the present efficiency of ordinary types of arc and incandescent lamps and also that of such lamps as the Nernst, Mr. Hewitt's record with his mercury-vapor lamp, operating at 74 volts with three amperes, consuming a total of 222 watts and giving 700 candlepower, or, in other words, giving light at the rate of 0.32 watt per candle, measured horizontally at right angles to the tube—such a result as this means something to the electric-lamp industry. Mr. Hewitt was naturally very solicitous that those present should use the ammeters and voltmeters for themselves, and many verified the tests. This mercury-vapor lamp operates on ordinary 115-volt, constant-potential circuits and gives a most peculiar light, which will doubtless subject it to some criticism. In this lamp, it was explained, a gas is used as the illuminating medium, instead of a filament or a carbon pencil,

as in other electric lamps. Mr. Hewitt's gas is mercury vapor. The lights are long and cylindrical in shape. At the bottom of each lamp is some mercury, from which, when the current of electricity has been run through it, there issues the vapor referred to. The current is transmitted to the mercury direct. The most peculiar colored light is emitted from the tubes. It is half purple, half green. This, according to the explanation of the exhibitor, is a disadvantage, but it can be obviated by the use of counteracting colored shades. The reason the crowd seemed to be especially interested in the long tubes was the fact that everybody who came into the room had his or her features so distorted that the skin of the face appeared to be covered all over with ghastly, violet-colored eruptions. The lips that came under the light seemed purplish gray, the pupils of the eye lost their natural hue, whatever it had been, and assumed a greenish tinge.

Ryan and Phelon's Radiographing of Alternating-current Waves.

Professor Harris J. Ryan of Cornell University and Professor J. O. Phelon exhibited a most valuable application of a Braun tube in radiographing of alternating-current waves. This is a method for securing stationary and continuous diagrams or cards of alternating-current values, which are conveniently recorded by means of a simple form of pantagraph, that is run over the luminous diagram and operates a lead-pencil.

Hutchison's Akouphone.

M. R. Hutchison exhibited two instruments known as the akouphone and akoulalion, and which are intended to make the deaf hear. W. H. Van Tassel of the New York Institute for the Deaf and Dumb brought eight of the deafest boys in the institution for experimental purposes. One lad was born deaf, dumb and blind. He was led to the apparatus and the earpieces fixed over his head.

The operator spoke into the akouphone, which is described as a microtelephonic instrument, so constructed as to reproduce and largely intensify sounds and still preserve their quality. The boy jumped when words were spoken, showing the novelty of all sound to him. When the word "hello" was repeated many times he made an effort to repeat the sound, with only partial success. A phonograph was attached to the receiver and band music was played. A faint smile appeared on the boy's face and he spelled out the word music with his fingers to his preceptor. He began to keep time with his hands and his face was soon wreathed with smiles. He resisted when the cap was removed from his head. Mr. Van Tassel said experiments with the akouphone on another inmate of the asylum had resulted in great success.

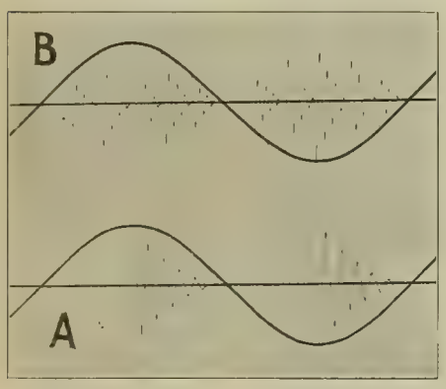


FIG. 3. THE INSTITUTE CONVERSAZIONE.—ANDREWS' SPARK EXPERIMENTS.

Elihu Thomson's Apparatus.

Professor Thomson showed a dynamo static machine, containing a small direct-current motor, the windings of which are tapped and connected to two rings, giving a primary alternating current for the operation of a step-up transformer, which gives a secondary current of about 20,000 volts, being capable, however, of regulation through a wide range. The tops of the alternating-current waves of high potential obtained from this secondary transformer are used to charge a number of glass-plate condensers in parallel. The rotating frame synchronously driven with the motor makes the connection to the condensers periodically and in synchronism with the alternating current. The connection by the rotating frame is alternately in parallel and in series, condenser plates being charged to 15,000 volts and with 10 in parallel, giving 150,000 volts when connected in series. The machine therefore furnishes from low-pressure direct current, high-potential discharges of definite polarity at the discharged terminals.

A new rotary electrical apparatus, consisting of an iron sphere heavily electroplated with copper and mounted so that it may revolve on any axis or in any plane, was also exhibited by Professor Thomson. Surrounding this sphere are three coils in planes, at right angles to each other. By suitably energizing these coils with polyphase current, the sphere may be made to revolve on any axis or in any direction, or it may be said to illustrate a three-dimension polyphase system. This apparatus illustrates the principles of the gyroscope and Bohnenberger sphere.

A third device was an illuminated disk mounted on a shaft free to rotate and having applied to it in special ways alternating-current magnetic fields, the rotations of the disk involving interesting paradoxes.

Andrews' Spark Experiments.

The following experiments were made by Mr. W. S. Andrews to determine some features of a high-frequency spark, the apparatus being energized from an alternating-current lighting circuit of 118 volts and 58 cycles. For convenience of observation,

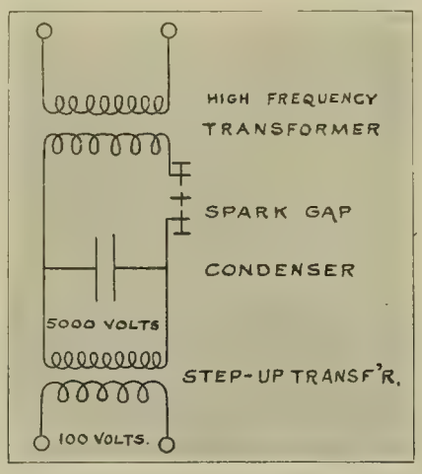


FIG. 2. THE INSTITUTE CONVERSAZIONE.—ANDREWS' SPARK EXPERIMENTS.

the spark was passed through a glass tube having a bore of about 0.25 millimeter. The current was conducted into the tube by wires inserted in the ends, leaving an air gap about five inches long inside the tube, the ends of which were not sealed. The tube was revolved while illumined by the discharge, the optical effect being a circle of bright radial lines. Under these conditions, the number of primary radii is obviously determined by the ratio between the alternations and the speed of rotation, but the characteristics of the primary radii may be changed by manipulation of the apparatus.

Referring to the theoretical diagram of high-frequency apparatus shown in Fig. 2, when the spark gap is set at a certain length and the potential of the transformers adjusted, so that the condenser discharge will only just arc across it, the radii will appear as single lines, indicating that the condenser discharges only once during a half wave. See (A), Fig. 3. If the primary potential is now increased, or if the spark gap is shortened, the single radii will be seen to open out like a fan into two or more lines, thus indicating a corresponding number of condenser discharges during each half wave. See (B), Fig. 3.

To obtain permanent records of the different effects, photographs were taken. Fig. 4 shows a snap exposure of the high-frequency sparks during two half waves. Fig. 5 shows a star produced when the tube was revolved at 430 revolutions per minute. During each half revolution eight compound radii were formed in each half of the circle, corresponding to eight half waves in a 58-cycle current.

"It would be difficult, if not impossible," says Mr. Andrews, "to record any purely high-frequency oscillations by the present method, as a sufficiently high speed of rotation could not be attained. The results described, however, appear to present a clear proof that each half wave may be the source

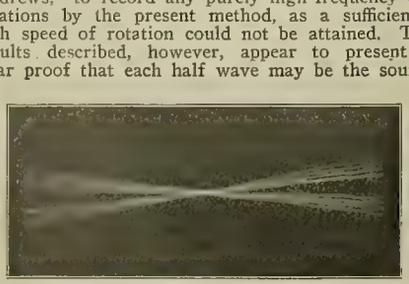


FIG. 4. THE INSTITUTE CONVERSAZIONE.—ANDREWS' SPARK EXPERIMENTS.

of a number of groups of high-frequency oscillations. It therefore follows that an arc across a high-potential circuit containing inductance and capacity ruptures itself instantly, so that, if the voltage is high enough, it can occur repeatedly during each half wave."

Nernst Lamps.

Mr. William J. Hammer exhibited European "Nernst" and other electric lamps. These lamps were shown in operation during the evening. Mr. Hammer also showed his personal collection of photographs from Hiram Maxim of his flying machine and also of his own trip in a balloon from Paris, while he was, some years ago, Mr. Edison's representative at the Paris Exposition.

Storage Batteries.

Mr. Herbert Lloyd exhibited Chloride accumulators. Cells of a special form, designed for traction purposes, as used on the Thirty-fourth street cross-town line, New York city, were shown; also oxide cells for vehicle purposes and specimen plates.

Frank Perret, J. A. Barrett and W. H. Meadowcroft exhibited a storage battery made on a unit system, whereby cells of different sizes are built up of universal units of definite capacity. Purely Planté formation is used. No oxidizing agents are employed and nothing but pure lead, sulphuric acid and water are made use of for the process of construction.

Mr. A. S. Hubbard showed the Gould storage battery as follows: (1) Positive and negative plates, having a small amount of active material, which have gone through a series of charges and discharges at half-hour and twenty-minute rates; (2) an automobile battery cell with a "spinning," giving 450 square inches of surface per pound of lead; (3) a positive and negative plate of automobile type of cell; (4) an unformed plate with delicate "spinning," giving 144 square inches per cubic inch of lead. The feature of the battery is the increase of superficial area of the plate obtained by spinning or grooving with rotary knives, which force the lead up between them, forming ribs and grooves of any desired dimensions. Each rib is made independent by tying the ends with the main cross-bars, and not depending on any center conductor or support, thus giving a low internal resistance.

Mr. Elmer A. Sperry displayed types of storage battery for automobile work, with diagrams of discharge curves.

Clarke Synchronism and Phase Indicator.

A synchronism and phase indicator for indicating when two alternating-current machines are in synchronism and the phase relations of their electromotive forces was the exhibit of Mr. Charles L. Clarke. It is also applicable for showing the lag of a current behind the electromotive force, either in the same or another circuit, provided they have equal frequencies, and also for showing the phase relations of currents of the same frequency. The instrument, as exhibited, which is intended for use in lighting and power stations, consists of two synchronous alternating-current motors, which respectively drive two stroboscopic disks, the stroboscopic image formed opposite a scale indicating when the generators respectively supplying current to the motors are in synchronism, or nearly so, and, in the latter case, which of the generators is running at the greater polar speed. When the generators are in synchronism, the stroboscopic image is stationary, and its position relative to the scale indicates the degree to which the electromotive force of one generator leads or lags behind the electromotive force of the other.

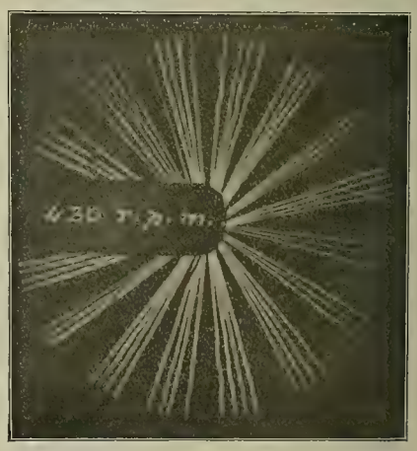


FIG. 5. THE INSTITUTE CONVERSAZIONE.—ANDREWS' SPARK EXPERIMENTS.

Miscellaneous Exhibits.

Mr. Otto T. Louis showed an electric furnace consisting of several terracotta cylinders, about two inches in diameter and one-half inch thick, around which is wound platinum wire of 22 B. & S. gauge. The wire is put on in four circuits, so that, as the resistance increases with the heat, the circuits may be thrown from series to parallel. The cylinders have longitudinal and vertical motions, and are held in position by clamps. Mr. Louis also had an ohmmeter for making direct measurements from 10,000 to 10,000,000 ohms and a 55-centimeter Wimshurst influence machine.

Other exhibits may be mentioned as follows:

Mr. E. V. Baillard.—Faradmeter and bridge for measuring low resistances.

Professor George F. Barker and Professor Arthur W. Goodspeed.—Radiographs.

Mr. A. F. Clift.—Telpherage system for the transportation of freight in small bulk, express matter, mail, etc., by means of an electric motor traveling

upon an overhead cable obtaining current by rolling contact with a lighter wire above.

Dr. Francis B. Crocker.—Magnetic liquids, with apparatus in operation for showing the magnetic properties of liquids and for measuring their permeability.

Mr. H. P. Davis.—Two switchboard panels, showing principally a phase-shifting transformer, a power-factor indicator, a synchronizer, an alternation meter and various new indicating and integrating instruments.

Professor W. S. Franklin.—Magnesia arc lamp (an electrolytic lamp on the Nernst principle, operating on 1,000 volts).

Dr. William E. Geyer.—Incandescent-lamp experiments. (Experiments employing incandescent lamps on circuits containing self-induction and capacity).

Mr. Caryl D. Haskins.—Power-factor indicator, showing relation between real and apparent energy in an alternating-current circuit, and single-coil astatic instruments, which, instead of using four coils, employ only one.

Professor Frank A. Laws.—Radiographs of alternating-current wave forms and oscillatory discharges, made by the use of cathode-ray tubes of the Braun pattern.

Colonel Samuel Reber, U. S. A.—Wireless telegraphy in operation, employing methods and improvements as worked out for the use of the United States government; also field telephone and telegraph kit used in the Cuban and Philippine campaigns.

Mr. Martin P. Rice.—New X-ray apparatus, employing a modified form of Wehnelt interrupter.

Mr. L. T. Robinson.—Wave-form indicator, consisting of a small synchronous motor in connection with suitable commutating devices, and used for determining the wave shapes of alternating current.

Mr. H. F. Sanville.—Copper-splicing machine, consisting of a portable and self-contained splicing press, with independent pump and flexible hose, used for making a solderless splice in wires and cables, forming a cold weld. This machine has an ability to give a pressure of 20 tons per square inch in the weld.

Mr. E. T. Schoonmaker.—Floating magnetic field.

Mr. Fitzhugh Townsend. — Alternating-current wave tracer. (In this device the contact is made during one-half of the period in contradistinction to the instantaneous-contact method ordinarily employed.)

Steam-boiler Efficiency.[1]

By William Kent.

In designing a new steam-boiler plant, the first consideration is the quality of the coal that is available. When there are several different kinds that may be used, it will usually be found that the coal of the poorest quality is relatively undervalued in the market, and is therefore the cheapest to use, provided the furnaces are suitable for burning it. The size and kind of furnace required for a given horsepower depend upon the quality of coal. The furnace should therefore be designed to suit the coal.

If the coal is bituminous, the furnace should be designed so that it will consume the smoke. This is not difficult. There are several kinds of furnace that will accomplish it. Whether automatic stokers should be used or not will depend upon the size of the plant. If the plant is over 1,000 horsepower it will generally pay to use them. In large plants, also, it will pay to install overhead coal-storage bins and mechanical appliances for elevating and storing the coal, which is then fed by gravity through tubes into the hoppers of the stokers.

The furnaces should be designed of such a capacity that they will burn the maximum quantity of coal that will be needed to make the steam when the steam demand is the greatest, when the coal is of the poorest quality that is likely to be used, and when the atmospheric conditions are the most unfavorable. The capacity of a boiler for producing steam is limited by the capacity of the furnace for burning coal, and this capacity depends upon the quality of the coal and upon the draft.

Having settled upon the style of furnace and upon the area of grate surface required to burn the coal, the boiler itself is next to be considered. The area of heating surface to be furnished for a given power will depend upon the degree of economy which it will pay to secure. In order to have a boiler efficiency of from 70 to 75 per cent., the furnace being designed so as to effect complete combustion, it will be necessary to provide one square foot of heating surface for every three pounds of water to be evaporated per hour. If less than this amount of heating surface is provided, the economy will be diminished. How much the economy will be decreased with rates of driving more rapid than three pounds of water per hour per square foot of heating surface, is quite a complex problem. It may be solved, mathematically, by an equation containing not less than five variables. The most important of these is the air supply, per pound of fuel. Next in importance are quality of coal and thoroughness of combustion, and design of gas passages so as to avoid as much as possible the short-circuiting of the gases. Of lesser importance are the loss by radiation and the pressure of the steam.

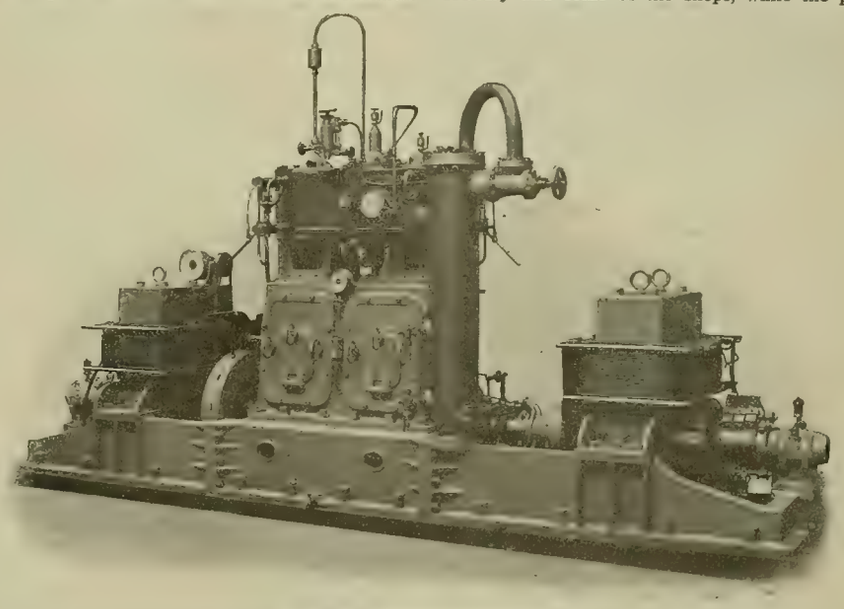
The amount of air supply being the factor of greatest importance in the efficiency of a boiler, and it being impossible for the fireman to determine by the ordinary means of observation whether the air supply is what it should be, it is highly desirable that some means be provided to assist in determining it. One of these is an apparatus for continuous indication of the amount of carbonic acid or of free oxygen in the chimney gases. Another is a recording furnace pyrometer. The maximum possible furnace temperature is the condition upon which depends maximum economy, and this corresponds with an air supply of about 20 pounds of air per pound of carbon, when the fuel is anthracite or a high grade of bituminous, and a somewhat smaller supply when the fuel is low-grade bituminous or lignite.

1. Abstract of a lecture delivered April 10, 1901, before the Engineering College, University of Illinois. The lecture was illustrated by lantern slides made chiefly from the illustrations in the lecturer's new book on "Steam Boiler Economy."

An English Direct-connected Set.

The power plants of the Port Talbot Railway and Docks company and the Darlington corporation in England have been equipped recently with two direct-connected generating sets, which are of some interest, as they are of a type having two dynamos connected on each side of a compound engine, and arranged to run in series or in parallel at 460 volts or 230 volts, as desired. The accompanying illustration shows one of the outfits, which was supplied by the English engineering firm of Ernest Scott & Mountain and was built at the Close Works at Newcastle-on-Tyne.

This type of engine was intended to meet the need for a compact and at the same time an economical engine which could be coupled direct to one or two dynamos and run satisfactorily at higher speeds than is possible with the open or inverted types. In this engine the steam admission, as well as the exhaust, is controlled by one eccentric from the crankshaft. This valve works in a special "liner," of close-grained cast-iron, the parts being accurately machined to give any desired cut-off, and this arrangement also allows a new liner to be fitted at any time, if found necessary.



AN ENGLISH DIRECT-CONNECTED SET.

The crossheads work in cylinder guides, cast in one piece with the distance piece, so as to secure great rigidity. Four bearings are provided, and oil is supplied to all of them, and through them to the crank pins and crossheads, under a pressure of about 20 pounds to the square inch. This forced lubrication is one of the important features of this English engine, and it is claimed that upon its satisfactory working depend the economy and long life of the engine. The oil is supplied to the different parts through brass pipes, and a continuous flow is maintained as long as the engine is running by means of an oscillating oil pump in the bottom of the crank chamber. The governor is mounted on the end of the crank shaft, and acts directly on a throttle valve, regulation being accomplished while the engine is running by means of a small hand wheel at the side. This governor controls the engine without trouble within five per cent. between no load and full load.

In the illustration it will be noted a tachometer and indicator gear are fitted, and the engine and two generators are mounted on one combination bed plate. The direct-current set shown in the picture is for special purposes, such as town supply, where it is required to run the dynamos either in parallel or series, when working at 230 volts or 460 volts, respectively.

The field magnets are made of cast-steel of high magnetic permeability, and are designed so that easy access can be had to the armature at any time. The magnet windings are arranged on removable bobbins, which can easily be replaced, if they should be accidentally damaged in any way. The armature consists of a solid core, built up of thin plates of charcoal-iron, which are slotted on their outer surfaces, to receive the conductors. These plates are clamped between strong end drums, which serve to carry the spiral ends. The conductors are form-wound, and, being embedded in the slots of the core, are safe from mechanical injury or the strain that often results from winding upon a smooth core.

The outer bearings are of the self-aligning, self-oiling type, so largely used in this country, oil being supplied continuously to the wearing surfaces by loose rings revolving on the shafts and dipping into oil wells in the base. P.

Armour Institute of Technology to Be Enlarged.

A recent gift of $1,000,000 made by Mrs. Philip D. Armour and her son, J. Ogden Armour, to Armour Institute of Technology, will enable some long-cherished ambitions of those in charge of the institution to be realized. Prominent among these is the construction of the new engineering building, which will in all probability contain the laboratories, electrical, mechanical and chemical, together with the foundry and some of the shops, while the present building will be reserved for uses to which it is more suited. The courses in cooking and sewing are to be discontinued and the entire resources of the Institute devoted to the development of engineering education, the work in electrical engineering being given special attention.

The course in civil engineering recently established has been put on a firm basis, and a course in chemical engineering will be added soon. Through the instrumentality of Colonel John T. Dickinson, general agent of the Consolidated Railway, Electric Lighting and Equipment company, a complete axle-lighting equipment of this company's make has been presented to the electrical department.

A course in telephone engineering is to be established as an elective, and will be under the direction of a telephone expert. The outlook for the Institute is especially bright at present, and the recent addition to its resources seems to put an end to the rumors of affiliation with the University of Chicago, although cordial relations exist between the two institutions.

Marconi at Newport.

The secretary of the navy recently appointed a special board, consisting of Captain French E. Chadwick, president of the war college, Lieutenant-commander Albion C. Hodgson of the torpedo station at Newport and Lieutenant W. N. Powelson, to investigate the merits of space telegraphy as applied to naval service. The board met at Newport, R. I., and Mr. Marconi made a visit to that city at the same time to advocate the use of his system. Successful trials of the Marconi system have been held at the Newport stations, and the inventor hopes to effect its adoption for use in the United States naval service.

Electrical Growth and Improvement in Boston.

From the annual report for 1900 of Mr. William H. Lott, commissioner of wires for the city of Boston, the following facts of general interest are taken:

The old style of roof construction is rapidly disappearing in the business section of the city, and it is seldom that a fixture is placed upon a roof except by companies operating high-potential wires. The system adopted by the Low Tension Wire association is to trunk its wires along the walls of buildings, and not cross over the roofs. This style of construction is less expensive and less objectionable to property owners. The companies also avoid the responsibility and care of the roofs. The expense of keeping roofs on which fixtures are located in repair has always been very heavy, and a burden which

FIG. 1. ELECTRICAL GROWTH IN BOSTON.—CONDUIT OF EDISON COMPANY.

the companies are striving to relieve themselves of as fast as possible.

The result of fuse inspection has been more than satisfactory, it seldom being found that an installation has been made without the line being suitably protected. This is a safeguard, and a great improvement over the conditions at the time the Wire Department was created, as inspection at that time showed that the absence of suitable protection devices was the rule rather than the exception.

During the past year a marked improvement has been made in the pole-line construction, fewer accidents having occurred to workmen required to handle the wires than in any previous year since the Wire Department was created.

The city has been divided into districts, and an inspector assigned to and held responsibile for the conditions of the wires in each district. This proves to have been a great help in keeping the construction in good condition, as the inspectors early familiarize themselves with the condition of the streets. The inspectors are required to go over their entire district once in four or five weeks, and consequently they are quick to notice any changes that may have been made in the wiring since their previous inspection. Any defects noted are reported and the interested parties at once notified from this office of the defect, which notice in most cases receives prompt attention, the Wire Department being notified of the action taken on same, and it is found usually that repairs have been made in a satisfactory and approved manner.

Every effort is being made to separate the low from the high-potential wires so as to reduce the danger to linemen who are obliged, owing to the nature of their work, to come in contact with the same. In order to successfully carry this out it has been necessary to erect two lines of poles, one on each side of some of the streets; when this cannot be done, a separation is required, when it is possible, of 40 inches. I will add that the officials of the leading companies, realizing the importance of this step, have rendered this department every assistance possible to carry this out to a successful conclusion.

A survey is being made to determine the exact location of every pole in the limits of the city used for the support of telegraph, telephone, fire-alarm, police, electric-light and other wires. This is a difficult task, and is one which has never before been attempted, to my knowledge. It is estimated that there are about 20,000 poles standing in the streets at the present time, not including the poles of the Boston Elevated Railway company, used for the support of trolley wires. Of the location of these poles there is no correct record. This work is being carefully done and a watchful care kept of removals, renewals, changes, etc., and a record of the same kept on atlases and books provided for this purpose, so that it will be possible at a moment's notice to give the ownership, location and condition of any pole of which information is desired; a thing very necessary on account of the growing number of inquiries, which are made almost daily.

Iron lamp-posts, which have for many years been in use, to support arc lights for street lighting, are being replaced by approved wooden posts. This style of post is being used by the Brookline Gas Light company and the Charlestown Gas and Electric company, in their respective districts, so that it is reasonable to expect that in a short time none of the old pattern will be in use in any part of the city. The Boston Electric Light company was the first to use the new-pattern posts, and the absence of accidents to linemen and trimmers in its employ shows it to have been a wise move.

In the streets in which the elevated structure has been built by the Boston Elevated Railway company the structure has been utilized for the carrying of heavy lines of feeder wires required for the operation of the surface-car lines. The feeder wires have been placed on the structure with a view of securing the safest construction possible in relation to the structure and such other wires and fixtures as are used for the operation of both elevated and surface cars, i. e., trolley wires, third rails and third-rail feeders.

The feeder wires are mostly 1,000,000 circular mils in size, and their insulation consists of a covering of three layers of braiding, filled with insulating compound.

Owing to the changing type of construction used for the elevated structure, two distinct methods of supporting the wires had to be used.

Where plate cross-girders were used three-inch holes were drilled on six centers in the middle of the cross-girder, and so situated that the wires would come in the space between the two pair of longitudinal girders. Thus, while at a considerable inconvenience for stringing, the wires would be placed upon the structure where they would be the least obtrusive, and so contribute to the general neatness of the whole construction.

Where the arched cross-girder construction obtained, the only available space for carrying such a heavy line of feeders was immediately over the middle of the arch and between two pairs of longitudinal girders for the tracks, but at a level slightly higher than the tops of these girders.

In the plate-girder construction the feeders are threaded through the three-inch holes, the girders averaging nearly 50 feet apart. At each girder where the wires pass through, and outside of the space occupied by the holes for the feeders, on both sides of the plate-girder, vertical pieces of hard pine are bolted securely to the plate. Then, to these vertical wood pieces, are fastened three-inch by three-inch cross-arms, placed in proper relation to the horizontal row of holes. These cross-arms alternate on each side of the cross-girders with each successive horizontal row of holes, this being necessary to give working room between the cross-arms for the proper placing of the insulating supports, it being remembered that the centers of holes are only six inches apart.

The wood cross-arms are used to give an electrically safer support for the insulator which carries the wires, and at the same time to give a support which will carry the wire through the three-inch holes in the plate girder, clear and independent of the sides of the hole.

A supporting porcelain insulator is screwed fast to the top of the cross-arm and so placed that it holds the wire in the center of the hole in the girder, thus precluding the danger of the wire coming in contact with the ironwork, or sides of the hole. As an additional safeguard, a hardwood sleeve, split and about five inches in length and treated with an insulating compound, is fastened about the feeder wire at the point where the wire passes through the three-inch hole, thus avoiding any chance for abrasion to the insulation of the wire, even should any mishap occur to the main support.

To avoid putting any other but a vertical strain upon the insulating supports just described, in order to hold the wire tight and keep slack out of the sections as much as possible, dependence must be had upon the method of anchoring the wire at the ends and at long intervals in the line.

To meet the severe strain which a 1,000,000-circular-mil wire would necessarily put upon any kind of insulating anchor appliance, an entirely safe insulator, and strong anchor appliance is made of two properly shaped blocks of lignum-vitæ wood, held in tandem with iron straps, which are bolted together through the centers of the wood. The feeder wire is wound around in the groove of one of the lignum-vitæ blocks and there fastened, and in a similar manner a heavy galvanized-iron guy wire, or specially placed wrought-iron clamp is placed in the groove of the other block, and this connected with a clamp or other fixture, held securely to the cross-girder.

A double insulation of the very highest strength is thus secured.

The constructions used for the support of the wires on the arched cross-girder of the structure is, in effect, and it might be said, in fact, the same as is in common practice on heavy pole-line feeder construction, i. e., wood cross-arms, locust pins and petticoated-glass insulators of the "Jumbo" type, the only difference being in the method of holding the cross-arms in place.

Although the district prescribed for the removal of overhead wires during the year 1900 was much smaller than for any previous year, yet there was more underground work done than ever before in one year.

The falling off in cables is due to the fact that the Boston Electric Light company during the year 1899 connected up their L street station, drawing cable amounting to over 1,200,000 feet.

While the accumulation of illuminating and other explosive gases cannot be wholly prevented, yet with the present system of inspection, and the prompt action of the gas company in seeking for and stopping the leaks when notified of their existence, through the presence of gas in the manholes, there was but one explosion during the past year. There have been 18 such explosions since the organization of the Wire Department, the greatest number in any one year being six, and one year there was none.

From the ducts surrounded by concrete, and the conductors contained therein, little trouble need be apprehended, but where the iron ducts for service connections and the solid-tube system are laid in the earth, without the protection of concrete, they are exposed to and receive injuries that often lead to results that may at times prove serious.

Great care is exercised by this department in the supervision of underground electrical construction to provide ample separation between the ducts and gas, water and other pipes that are met with underground, and no difficulty is experienced in doing so; but as this department can exercise no control over the operations of the employes of other departments and private contractors engaged in excavating the streets, injury to this class of conduits and the conductors they contain, and contact between them and other conducting material, are too frequent for the public good.

The solid-tube system depends very largely on the earth for its stability and reliability, and the earth should not be removed from under any portion of it if it can be avoided; but as it cannot be, the greatest care should be taken to give it proper support and to maintain its alignment; but this is not always done. The tubes of this system are 20 feet in length, and are connected together by cast-iron junction boxes that are halved longitudinally and held together by screws; they contain flexible conductors that join those in each consecutive tube together and are filled with an insulating compound. As the tubes are not screwed into these boxes, should the earth be removed from under them for any considerable distance each side of them, unless rigidly supported in some way the tubes pull out, the conductors are severed or are brought in contact with the tube or

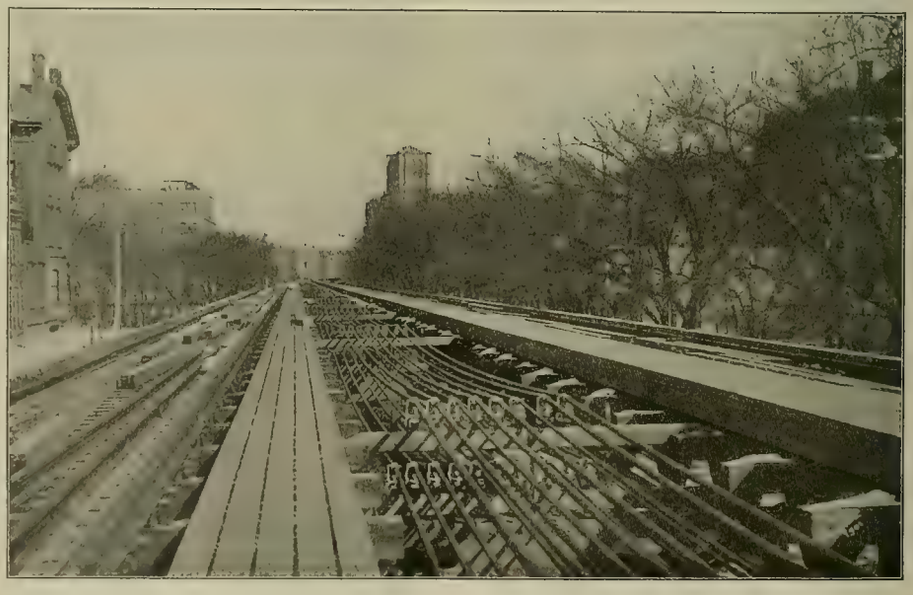


FIG. 2. ELECTRICAL GROWTH IN BOSTON.—VIEW SHOWING CABLES ON ELEVATED STRUCTURE.

box, turning them into a conductor, and should the tube at any point be in contact with gas or water pipes, current would be, and in a great many cases has been carried into buildings, causing more or less damage. Should the service ducts containing high-potential wires be brought in contact with the water or gas pipes in like manner, and should the insulation of the wires fail, in addition to the danger from fire, there would be that of injury to persons as well.

Since the organization of this department there have been 12 cases where a dangerous amount of current has been carried into buildings over the pipes supplying them with illuminating gas, four of which occurred during the year 1900. There have been two cases where holes have been burned through the gas mains in the street where they were in contact with the tubes of the Edison system. There have been no cases reported where the electrical ducts and tubes have been found in contact with water pipes, which is due, no doubt, to the fact that the latter are laid below the frost line, while gas pipes and electrical conduits and ducts are not, except in rare cases when it is necessary to avoid obstructions, so the danger resulting from contact between water pipes and electrical conduits is very small.

FIG. 3. ELECTRICAL GROWTH IN BOSTON.—CONDUIT OF MASSACHUSETTS TELEPHONE COMPANY.

The summary of the work of all the companies, both high and low-tension, for the year, is as follows: 167,766 feet of conduit completed, 851,104 feet of duct laid; 784,488 feet of cable drawn in ducts; 1,035 service connections made; 582 manholes built; 24 distribution boxes set.

Submarine Boats.

Although both France and the United States, and more recently Great Britain, are experimenting extensively with submarine boats for naval warfare, Rear-admiral George W. Melville of the United States Navy is disposed to doubt their utility, as may be seen by the following abstract of an interesting article by him in the North American Review:

With many exceedingly aggressive forces arrayed in favor of the submarine boat, it can be expected that determined efforts will be made to construct more boats of this character. The majority of naval students and experts, however, are still agnostics upon the question, because they believe that there is nothing in the capabilities of the boat which have so far been demonstrated to justify its extended use. It is possible that the type may eventually be developed to a state of reliability and efficiency; but when the serious difficulties which must first be overcome are taken into consideration, it will be evident that that hope can be realized only after important improvements have been effected.

The inherent defects which confronted the inventors of 100 years ago still exist in the submarine type. Broadly speaking, the craft is still without an eye to direct her movements. The compass on a submarine boat must, of necessity, be an unreliable instrument. As it must be placed near masses of iron or steel which are liable to be moved, there must be a constant change of directive force. When a torpedo is fired, when a spare one is placed in the tube, or when the conning-tower hatch is put on, the compass must be affected. Extraneous influences, such as chain cables, vessels at anchor, or passing ships, may cause a deflection of the compass.

Practically, but little advance has been made in securing increased stability. There can be little or no longitudinal stability in any boat which is designed to dive like a porpoise. Transverse stability can be secured, but longitudinal cannot be gotten without making sacrifices which would seriously interfere with the boat's efficiency.

Much has been written about the speed of the vessel, and yet there is no evidence that any submarine boat has ever been able, on a submerged run, to secure a six-knot speed for three successive hours. Some remarkable statements have been made as to the time required to submerge and raise this type of boat. In any boat where there is but little reserve buoyancy, care must, of necessity, be exercised in adding, removing or shifting weights. Therefore, in filling and blowing out the submerging tanks, which hold at least 12 tons of water, a considerable period of time must be required. It is simply a mechanical impossibility for the Holland to be safely submerged to even a depth of 10 feet in less than one minute. Of course, she can be sunk by an enemy or ill-disposed person in less time, but it is not the purpose of her designers to have her own crew perform this evolution.

TABLE SHOWING THE AMOUNT AND DISTRIBUTION OF BOSTON'S ELECTRICAL POWER, JANUARY 31, 1901.

Companies.	Total Rated Horsepower of Boilers.	Total Rated Horsepower of Engines.	Capacity in Incandescent Lamps.	Capacity in Arc Lamps.	Number of Motors.	Horsepower of Motors.	Number of Stations.
Boston Elevated Railway company	20,770	38,500	39,810	237	3,965	79,300	7
Boston Electric Light company	13,900	13,900	143,000	5,200	1,622	4,980	3
Edison Electric Illuminating company	7,257	10,700	239,631	2,313	2,411	10,041	6
Suburban Light and Power company	895	1,150	9,800	555	165	720	2
Charlestown Gas and Electric Light company	625	790	7,400	510	48	270	1
Brookline Gas Light company	1,450	2,400	16,000	680	36	287	1
Church Green Electric Light and Power company	770	685	7,250	38	67	682	5
*Isolated Plants	57,960	35,015	193,091	3,297	714	6,257	271
Block Plant company	273	417	4,900	.....	9	25	1
Totals	103,900	103,557	660,882	12,830	9,037	102,562	297

*The capacity of generators for isolated plants in kilowatts, 18,205.50.
In some of the isolated plants the boilers and engines are used for other purposes.

Referring to the accompanying illustrations, Fig. 1 shows a conduit in process of construction for the Edison Electric Illuminating company, composed of 120 three-inch vitrified-clay ducts. This conduit is laid in the private-way approaching the new station of this company on Atlantic avenue, opposite Pearl street. Fig. 3 shows a conduit in process of construction for the Massachusetts Telephone and Telegraph company on Franklin street, and composed of 72 ducts of three-inch vitrified clay. The manhole, which is partially built, is in front of the building occupied by the company at No. 185 Franklin street. Fig. 2 gives a fair idea of the manner of stringing the feed and return cables of the Boston Elevated Railway company on its overhead structure, showing the cross-pieces between the tracks and glass insulators supporting the wires.

Gas and Electric Interests in Chicago.

[From the Chicago Record-Herald of April 14th.]

Samuel Insull, president of the Chicago Edison company, returned yesterday from New York. He declares that there is no ground for the statement that People's Gas interests are now seeking control of the Edison company. A combination of the two concerns will undoubtedly be brought about at some time in the future, but for the present nothing is being done in that direction.

The electric-light plant at Pittsburg, Texas, was destroyed by fire recently, with a loss of $7,000.

In using three distinct systems of mechanical energy, many of the submarine torpedo boats have an inherent weakness. In the Holland, a small boat of 75 tons, gasoline, electricity and compressed air are used for different purposes. Gasoline is extremely liable to explode. At least one of its products of combustion is extremely dangerous to life. It is very attenuated, and therefore a great searcher. If there is a defective joint or pipe, or leaky valve, the gasoline will find it. In a boat of the character of the Holland, it must be difficult to keep the electric motors in a high state of efficiency, and the same remark applies to the dynamos and storage batteries. The air flasks may be an element of danger, since they are charged to a pressure of 2,000 pounds. The explosion of any one of these tanks would destroy the vessel.

There are three sets of gearing. The use of gearing on board any ship is at least inadvisable, for, no matter how strong the hull is made, there must be in a seaway some working of the vessel, and the gear is likely to break, if it does not become impaired. The noise in the engine room is a serious disadvantage. The gas engine is subjected to shock rather than to steady pressure, and therefore the engine pounds heavily. As all three sets of gearing are running continuously, there is considerable noise from that source. Since the explosion of the gasoline is effected by a spark from an ignition storage battery, any accident to this battery would throw the gas engine out of operation. This may prove a serious weakness, since the cells of the storage battery are in such an exposed position that they could be very easily impaired. Despite these weaknesses of the Holland, she possesses some value in her ability to possibly reach unseen the enemy's fleet, discharge her torpedo, and immediately disappear and get away. A semi-submerged boat would have greater advantages.

A German Frequency Meter.

The development of alternating-current measuring instruments presents many difficult problems. One of the prime requisites in most measurements of alternating-current phenomena is a reliable determination of frequency, and the frequency meter of Hartmann & Braun of Frankfort-on-the-Main, Germany, illustrated in the accompanying cuts, taken from a recent issue of l'Industrie Electrique, is said to give good satisfaction for measurements of this kind.

The principle of the instrument may be readily

FIG. 1. A GERMAN FREQUENCY METER.

understood from an inspection of Fig. 1. If an electromagnet excited by an alternating current be presented to a metallic strip or reed such as is used in ordinary harmonicas, and the period of the exciting current adjusted to that of the reed, the latter will be set in vibration by the magnetic attraction and repulsion exerted upon it by the magnet. If the adjustment can be made exact the tone produced will probably be of considerable intensity, but if only approximate, the vibration of the reed will be more or less deadened by its tendency to get out of synchronism with the magnetic reversals in the iron of the magnet.

In Fig. 1 the pole piece of the magnet is of sufficient size to extend over three reeds, whose vibration rates are designated by the figures over them. Of the three, the rate of vibration of the middle reed is the nearest approximation to the frequency of the current of the circuit, and the resultant amplitude is therefore greatest in this reed.

In the meter, which is shown in Fig. 2, the reeds are mounted around the periphery of the case, and each is adjusted to a rate of vibration represented by the number over it on the dial. The electromagnet is carried on an arm pivoted at the center

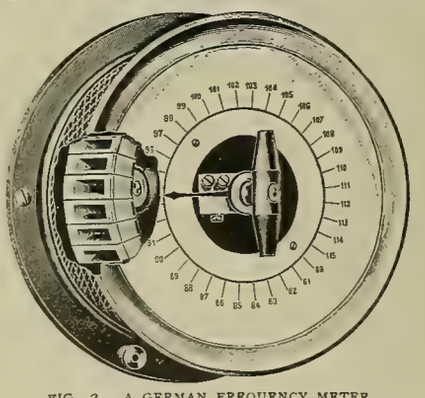


FIG. 2. A GERMAN FREQUENCY METER.

of the instrument, and is of such a size as to be presented to only one reed at a time. To take a measurement with the instrument the arm is slowly turned through the range of the scale, and the reed giving the loudest sound is that whose periodicity is nearest to that of the circuit. If the reeds differ in periodicity by one beat a second, quite accurate measurements may be taken. If, for example, it was found, in making a determination, that the loudest sound was obtained from the reed marked 101, and that those marked 100 and 102 gave tones of equal intensity, the frequency could be safely taken as 101 cycles. If the reeds marked 100 and 101 gave equal intensities of sound, a frequency of 100.5 would be indicated, while a periodicity of 100.7 would produce the greatest amplitude in the reed marked 101, slightly less in that marked 100 and still less in that marked 102. In other words, with such a scale, the error should not be greater than 0.3 of a beat a second.

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CONVENTIONS AND EXPOSITIONS.

Southwestern Gas, Electric and Street Railway association, Rice Hotel, Houston, Texas, April 19th to 22d.

Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Independent Telephone association of the United States, Pan-American Exposition grounds, Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Boston, Mass., June 19th.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Following an English custom, the American Institute of Electrical Engineers gave a very successful conversazione at Columbia University in New York last week. The exhibition—for it was really such—was devoted to the new things in electricity, and it grew under the hands of its promoters to such proportions that there was almost too much to see for one evening's view. The attendance was gratifyingly large, and although some of the experiments and demonstrations did not come up to the hopes of the exhibitors, lack of success in this particular was due to the limitations of hurried installation and did not detract from the general éclat of the brilliant affair. A descriptive article on other pages of this issue of the Western Electrician gives an idea of the size and importance of the gathering.

Commenting on the elevated electric railways of Chicago, an English street-railway journal mentions, as an offset to "a system of local transport that in convenience and cheapness of fares is unequaled," "the Cimmerian darkness of the streets of the commercial center, over which the unsightly iron structure of the elevated railways is reared." We can assure our contemporary that while the elevated structure is not beautiful and does shut off some light, the street lamps beneath are not operated at midday, as it seems to suppose. Cimmerian darkness we take to be darkness of a superlative degree, but in the wide streets of Chicago a few rays of sunlight do manage to find their way to the pavement, even in those thoroughfares where the elevated structure is placed. Moreover, by the loop system, only four of the business-center streets are partially used for the elevated-railway service, while on the diverging lines private rights-of-way are utilized to a large extent. Doubtless the elevated railway is not adapted to the narrow, crooked streets of London, but in American cities it has served a useful purpose.

One of the strong arguments against municipal ownership, or public ownership, to give it a more recent and comprehensive appellation, is that it stifles individual enterprise and discourages invention, from lack of incentive. This is the charge that is brought against the British government by no less an authority than Prof. J. A. Fleming. We have room for only a few fragments from Professor Fleming's recent article in an English review on "Official Obstruction of Electric Progress," but the following extracts will show the trend of his contention:

In the region of pure scientific research, in the development of electrical theory, Great Britain has unquestionably held her own with the world. In detailed improvements or adaptations we have not been backward, but if we except the inventions of Lord Kelvin in connection with submarine telegraphy, Mr. Swan in electric lighting, and the contribution which the late Prof. D. E. Hughes made to telephony by the invention of the microphone, it is difficult to name any first-rate new adaptation of electrical discovery for practically useful purposes in the last 30 years which has not come to us first from non-British sources. It cannot be said that the country which has produced a Watt, a Stephenson and an Arkwright is deficient in mechanical inventiveness, but it is impossible to deny that the period of time since 1870 has not been marked by the evolution of distinctly novel electrical inventive ideas proceeding from British minds.

Now, it is a curious coincidence that just at the drawn of this period of electrical activity—viz., in 1870—the government of this country set themselves up in business as electricians, and proceeded to create a gigantic government monopoly in one large department of electrical invention which has exercised a most undoubted control over the supply and demand for invention in a wide area of electrical work. Prior to 1870 the chief practical use which had been found for the electric current was in the electric telegraph. Public telegraphy was conducted by competing electric telegraph companies covering various areas of the country, just as the various railway companies do at present. Their development created a demand for electrical inventions in telegraphy, and the records of the Patent Office show how prolific were some inventors in supplying the need. The government of that day thought it right in the public interest to buy up all these companies for a capital sum of £10,000,000, with the object of bringing the benefits of telegraphy within the reach of all.

When the telephone first made its appearance the technical experts of the Postoffice laughed at it as a toy. It was only when they were convinced of its utility by hard facts that they set in motion the legal machinery which enabled them to bring it within the grasp of the Telegraph Acts.

The officials in the Government Telegraph Department were at once exalted into a position of paramount power over all electrical invention in land telegraphy. It is pure waste of time for an inventor to spend days and nights over a telegraphic invention, or invest capital in patenting it, unless he can get it tried, and if it succeeds, market his invention to a purchaser. He is not generally a philanthropist, but is spurred to work by the hope of reward. But in electric telegraphy he can try nothing and market nothing unless he first persuades or pleases the permanent officials of the State Telegraph Department. * * * * The most effective method of afflicting any department of applied science with creeping paralysis is to constitute it a government monopoly.

These are weighty considerations, and while it may be urged that American and British governmental methods are different, exactly as the temperaments of the two nations give differing results in other branches of activity, it is still the part of wisdom to give careful consideration to the results of British experience. If it is doubtful if electrical enterprises of widespread extent should be left to the general government, which is, on the whole, honestly and carefully administered, what shall we say of the prudence of placing local electrical works in the hands of American municipal corporations, which are usually carelessly and extravagantly and often dishonestly conducted? Is it not evident that if the public-ownership plan is generally adopted, the demand for economy in construction and operation of electrical machinery and electrical plants, now of pressing importance, will be greatly lessened? And without this incentive, is it not certain that American invention will languish? Is it wise to strike a blow at American inventive genius at a time when our international competitors, envying our recent commercial successes abroad, ascribe, and rightly, too, the greater part of our accomplishment to "Yankee ingenuity"? Unprejudiced answers to these questions lead to the logical conclusion that the public-ownership agitation has an economic side of paramount importance.

It is stated that recent results in municipal elections in Cleveland, Toledo and St. Louis have encouraged the hope of the formation of a national public-ownership party. Corporations and corporate selfishness have given many provocations to the electorate, but we trust that the alert American citizen will find other means of regulating quasi-public services than the drastic one of paralyzing competition and deadening individual incentive by the general adoption of public ownership, which would also, very likely, lead to the next logical step—state socialism.

Two plans are proposed for the electrical utilization of the waterpower of the Drainage Canal—one to transmit the power from Lockport to Chicago and use it for street lighting, the other to utilize it for factory purposes at sites along the canal, comparatively near the proposed generating plant at Lockport. Both are hampered for lack of funds. The city cannot very well develop the power without exceeding the statutory limit of its bonded indebtedness. The Drainage Canal Board has not the money to do the work, but in its case a bill is pending in the Illinois Legislature giving the board the right to levy an additional tax of $5,000,000 for the purpose. If this bill should become a law, a commission of experts will probably be appointed to decide on plans for the work. In the case of the city, the transmission would be about 35 miles, and the current would supply, through some scheme of transformation, about 16,000 arc lamps, or as many of them as possible. If the factory plan prevails, the conditions will be very different; the transmission line would probably be much shorter, and the current would be sold for power to various private consumers and possibly to some suburban towns for lighting. It has been calculated that 20,000 horsepower could be obtained with a flow of 300,000 cubic feet a minute through the canal. Estimates of the cost of the necessary plant vary from $2,700,000 to $3,700,000, but, of course, much depends on the system adopted and the point of delivery. It is also stated that a flow of 300,000 cubic feet a minute through the river under present conditions cannot be allowed during the season of navigation, except to the detriment of shipping. There is considerable opposition to both plans, as proposed, and as there is no need of haste in deciding the question, it is probable that no definite action in the premises will be taken for some little time, even if the Legislature empowers the Sanitary District trustees to develop the power, which is, of course, problematical.

Death of Professor Henry A. Rowland.

The scientific world was shocked to learn of the death of Professor Henry A. Rowland of Johns Hopkins University on April 16th. Professor Rowland died unexpectedly at his home in Baltimore, Md. Although he had been in ill health for several months, it was not until a few days before his death that his symptoms became at all alarming.

Henry A. Rowland was born in Honesdale, Pa., on November 27, 1848, his father being the Rev. H. A. Rowland, a prominent Presbyterian clergyman. In 1870 young Rowland graduated from the Rensselaer Polytechnic Institute at Troy, N. Y., as a civil engineer. The next year found him railroad surveying in Western New York, but his ability as a teacher was already recognized, and his services were called into requisition at Wooster University. In 1872 he returned to Rensselaer as instructor in physics, and in 1874 he became assistant professor. In the meantime he had completed his now widely known experiments on magnetic permeability, but at first he was unable to get them published. The scientific journals in America rejected his work, but, confident of its value, he sent his results to Clerk Maxwell, who at once had them published in the London Philosophical Magazine, and wrote kindly and encouraging letters to the young investigator.

He was now becoming known, and when the authorities of the newly founded Johns Hopkins University at Baltimore cast about them for someone to fill the chair of physics and become director of the physical laboratory, Rowland, with his already recognized ability and with the countenance which Maxwell's recognition of his talents gave, was chosen for the place. Professor Rowland accepted the chair, which he held until his death, with great credit to himself and with great honor to the university. For a year before the university actually opened Mr. Rowland was in Europe, working in Berlin with Helmholtz. Here he investigated the effect of static electricity in motion, and proved that a moving charge has the effect of a current.

While the energies of Professor Rowland have been largely devoted to exhaustive researches into the nature and phenomena of electricity and magnetism, his work takes a broad sweep through nearly the whole range of physics. His original work has been extensive, and many of the investigations made under his direction at Johns Hopkins are of world-wide celebrity, such, for example, as his determination for the United States government of the exact value of the ohm as the standard unit of resistance, the discovery of the "Hall" effect and many others. To the public his name is probably even more familiar in connection with his large diffraction gratings, which are ruled by a method of his own directly on concave mirrors, the image of the solar spectrum being thus produced without the aid of lenses. In fact, the photographs of the spectrum obtained with the aid of these gratings far exceed anything else of the kind, and their exhibition before the National Academy of Sciences in 1883 was one of the leading scientific events of the year.

The well-earned degree of Ph. D. was conferred upon Professor Rowland by the Johns Hopkins University in 1880, and in 1895 and 1896 he was given the honorary degree of LL. D. by Yale and Princeton universities, respectively. As a member of the Electrical Congress at Paris in 1881, and of the jury at the Electrical Exhibition at the same time and place, he received the order of a Chevalier of the Legion of Honor. In 1881 he was elected a member of the National Academy of Sciences. In 1883 he presided over the physics section of the American Association for the Advancement of Science at Minneapolis, and read a memorable address, entitled "A Plea for Pure Science." In 1884, being appointed by the government on the commission specially formed for the purpose, he presided over the deliberations of the National Conference of Electricians at Philadelphia. In 1884 he received from the American Academy of Arts and Sciences, of which he was an associate, the Rumford medal for his researches in light and heat; the Draper medal was also presented to him by the National Academy of Sciences.

Professor Rowland wrote and read many papers on electrical and physical subjects, among them being the article on "Screws" in the Encyclopedia Britannica. In addition, he developed the resources of the physical and electrical laboratories at Johns Hopkins, where an electrical testing bureau of great value has been maintained recently. His principal work in late years has been in spectrum analysis, and in 1888-89 he published his "Photographic Map of the Normal Solar Spectrum—Second Series." Among his more recent work was the development of a printing-telegraph system, which has excited much favorable comment.

During the World's Fair in Chicago in 1893 he represented the United States, as one of the five official delegates from this country to the World's Electrical Congress. He was also chairman of section A, the Department of Pure Theory, at this congress, and was president of the Chamber of Delegates. At the time of his death Professor Rowland was corresponding member for the British Association for the Advancement of Science and of the Cambridge Philosophical society, a foreign member of the Royal Society, one of the 12 foreign members of the Physical Society of London, one of the 10 foreign members of the Physical Society of Paris, a corresponding member of the Institute of France and the Royal Society of Göttingen, and of many other societies.

Annual Report of General Electric Company.

Accompanying the notice to the stockholders of the annual meeting of the General Electric company, to be held on April 29th, is presented the annual report of the company for the fiscal year ended January 31, 1901. The report shows that the profits of the company, including $419,066 from the sale of securities, and after deducting all expenses and allowances for depreciation and losses, amounted to $6,243,792. After paying interest on the $1,534,000 of five per cent. debentures and dividends on the preferred and common stocks, these three items amounting to $1,968,289, a balance of $4,275,502 was left, which swelled the surplus from $2,353,031 (on January 31, 1900) to $6,628,533. The orders received during the year aggregated $27,969,541, against $26,323,626 the previous year and $11,170,319 in the year ended January 31, 1897. The number of employes in all the works of the company is over 12,000.

In relation to the patent account, the report shows that there was expended for new patents, patent expenses and patent litigation $360,259. In addition, the patents and good will of the Siemens & Halske Electric company of America, the Marks Enclosed Arc Lamp company and various other manufacturing concerns were acquired at a cost of $604,672, making the total expended on this account $964,931. In the last previous annual report, patents, franchises and good will were carried at $2,000,000. The bookkeeping profit of the difference between the par of $3,763,000 debentures and $3,124,300 par of common stock issued therefor was credited to patents and good will. The amount is $618,057. There was written off on the same account $346,874, a total of $964,931, leaving the patents, franchises and good will standing on the books at the end of the year $2,000,000, the same as at the beginning of the year.

The three plants of the company now occupy 180 acres, and the total factory floor space of the buildings is approximately 2,362,000 square feet. The book value of these plants is $1,858,044, which is less than 80 cents per square foot of all the manufacturing floor space. The constantly increasing business of the company necessitates continuous large expenditures on its plants to increase manufacturing capacity. On January 31, 1893, the book value of the three factory plants was $3,958,528, and in the eight years ended January 31, 1900, additions of lands, buildings and machinery were made, at a total cost of $6,127,770, making the total book cost of the plants $10,086,299. Within the same period there has been written off for depreciation $6,686,297, leaving their book value on January 31, 1901, at $3,400,002. No change has been made in the book valuation of securities held since January 31, 1897. Securities for which there was no special reason for holding permanently have been sold for $1,070,272. They had been carried on the books at $651,205, showing a profit of $419,066. The proceeds of the sales mentioned were used to protect and improve existing investments to the extent of $1,126,416.

An allowance of $404,131 has been made for possible losses on bills receivable. The amount of sales billed to customers during the year exceeded $28,000,000, and during the last three months they aggregated nearly $9,000,000. Of the 12,600 regular customers on the books of the company, there were debit balances against 4,900 at the close of the year. The cash collections exceeded $26,500,000. Notes and accounts receivable at the beginning of the year footed up $7,314,930, of which all but $516,429 have been settled. The allowance for possible losses on old debts was $228,888, and for the current year $175,243, a total of $404,131. In the balance sheet raw materials have been valued at the lowest price paid by the company during the last three months of the fiscal year. The market price on January 31st last was used where it was lower than the price paid by the company during the previous three months.

The consolidated balance sheet as of January 31, 1901, shows:

ASSETS.

Cash		$2,373,683
Stocks and bonds	$ 6,012,300	
Real estate (other than factory plants)	522,453	
Notes and accounts receivable	9,596,940	
Work in progress	1,054,659	
	$17,186,352	
Merchandise inventories:		
At factories	$7,061,751	
At general and local offices	865,326	
Consignments	63,903	
	7,990,980	
		25,177,332
Factory plants	$ 3,400,002	
Patents, franchises and good will	2,000,000	
		5,400,002
Total		$32,951,017

LIABILITIES.

Five per cent. gold coupon debentures	$ 1,534,000	
Accrued interest on debentures	12,783	
Accounts payable	820,450	
Unclaimed dividends	3,750	
		$ 2,370,983
Capital stock:		
Seven per cent. cumulative preferred	$ 2,551,200	
Common	21,400,300	
		23,951,500
Surplus		6,628,534
Total		$32,951,017

The consolidated profit and loss account as of January 31, 1901, shows:

PAYMENTS.

Cost of sales		$23,585,860
Interest on debentures		240,040
Dividends paid:		
On preferred stock	$ 178,584	
On common stock	1,549,665	
		1,728,249
Surplus at commencement of year	$ 2,353,031	
Undivided earnings during the year now added to surplus	4,275,503	
Balance January 31, 1901 (surplus)		6,628,534
Total		$32,182,683

EARNINGS.

Balance January 31, 1901 (surplus)		$ 2,353,031
Sales	$28,783,276	
Royalties and sundry profits	298,366	
		29,081,642
Dividends and interest received on stocks and bonds owned	$ 232,041	
Interest and discount	96,902	
		328,943
Profit on sales of stocks and bonds		419,067
Total		$32,182,683

The balance sheet shows that the company's cash on hand in excess of all liabilities, that its securities, real estate other than plants, notes and accounts receivable, work in progress and merchandise, are $1,225,000 in excess of the capital stock outstanding. The company has no note payable nor is there under discount any paper bearing the company's indorsement or guarantee. Since January, 1895, the company has not borrowed any money, nor at any time since that date has its credit been used, either by issuing notes, indorsing customers' paper for discount or lending its name in any way; but by adhering to its established policy of maintaining sales on a basis of cash or short credit to desirable customers, all purchases have been paid for in cash. On January 31, 1900, there were outstanding $5,300,000 debentures. There were purchased for cash (average price, $1,270.83) during the year, $3,000, leaving $5,297,000. Surrendered and exchanged for common stock at $120, debentures at $100, $3,763,000, leaving debentures outstanding, $1,534,000.

General Electric stock made another sharp advance last week, closing on Saturday, April 13th, at 226½.

Electrical and Mechanical Equipment of the Chicago Government Building.

At the present time the work on the United States government building now building in Chicago has not progressed to a point where the designers can give out any detailed or definite information concerning the steam and electric plant to be installed. It is estimated, however, that there will be an equivalent of about 10,000 16-candlepower incandescent lamps, requiring a 1,000-horsepower generating plant. There is to be approximately 8,000,000 cubic feet of space in the building, and it will require about 800 boiler horsepower to supply the heating. Both indirect and direct heating systems will probably be installed. There will be six passenger and one freight elevator from the first to the ninth floors and two passenger elevators from the ninth floor to the top of the dome. In the subtreasury department will be an additional elevator, making 10 elevators in all. These will be either electrically or hydraulically driven. All the other power used in the building will be electric.

Pierce, Richardson & Neiler of Chicago have been appointed consulting mechanical engineers for the building. The appointment was made by Henry Ives Cobb, the architect of the building, and is authorized by the Treasury Department. Pierce, Richardson & Neiler will have under their supervision the drawing of the specifications and designs for the steam and electric plant, the heating and ventilating systems, and the sewerage and plumbing.

An electric line will be in operation this summer between Geneva and Chamouni, in Switzerland. The line has been built by the Paris, Lyons and Mediterranean company from Fayet-St. Gervais, a station two hours by rail from Geneva, and a trifle longer from Aix les Bains. During the summer season it is intended to operate six trains daily between Geneva and Chamouni, the time of the run being 3½ to four hours. From Paris to Chamouni will take about 14 hours. The electric line from Fayet-St. Gervais to Chamouni is 12½ miles long, and has double tracks, separated by a distance of one meter (39⅓ inches). For 2¼ miles the cars will ascend on cogs, the steepest grades being nine per cent.

DEVELOPMENT OF THE TELEPHONE FIELD.

Our Farmer Patrons.[1]

By Kora F. Briggs.

In these days of sharp competition, which the Independent telephone companies of Ohio as well as of other states are called upon to meet at the hands of the old telephone monopoly, it behooves the intelligent manager to seize upon and utilize every advantage which he can grasp, and which will more fully entrench his company in the hearts of the people, and which will render the service he is giving more and more a necessity to his patrons. We find that for a time the people remember how the Bell company and its lessees, when they had an opportunity to do so, exacted the last possible farthing from the people for an inferior service; but the lapse of time serves to eradicate the memory of these wrongs, and there is danger of the monopoly regaining much of its lost prestige if it, by superior general ship, or better, or more extensive service, is enabled to outstrip its rivals. For this reason the Independent companies are constantly on the qui vive for ideas that will strengthen their organization and better their service, and it is the opinion of the writer that in no manner can the local Independent exchange be strengthened as it will be by the extension of its service to the farming community living, say, within six miles of the town in which the exchange is located.

Our towns, and cities, too, for that matter, are very largely populated by former residents of the adjacent country districts, and many of the dwellers of these towns and cities have left parents, brothers, sisters, children or tenants back upon the old farm, with whom they desire to hold almost daily communication. If the farmer has retired and moved to the city, in order to enjoy the advantages from which he was debarred in the country, he has left upon the farm someone whom he desires to reach by telephone, and, while he may be, in many respects, a "back number," and so parsimonious that he would think a long time before separating himself from the shekels necessary to pay the rental of a telephone in his urban home, just let him know that you can connect him with the farm, and thereby enable him to direct the work thereon from his home, and order a load of produce brought in whenever so disposed, and you are pretty certain to receive an order from him for service at both ends of the line in which he is interested. Then he has a son or daughter on a farm in another direction, or in an adjacent village, who desires to talk to those under the parental roof, and that begets an influence which will bring additional subscribers, either to your company or to another Independent company, which is the next best thing.

The first question which arises in the minds of those who are contemplating thus extending their lines to the country is, Will it pay? After an experience of nearly three years with farmers' lines, I am prepared to assure you that they do pay. The rentals received therefrom will pay upon the investment necessary to their construction 20 per cent. gross earnings, and will add, on an average, three subscribers in town to every one installed on a farm, and this latter feature would make the investment a good one, even if the country lines did not more than pay the cost of operation and six per cent. on the money necessary for their construction. You will find, also, that the farmers will be the most prompt paying subscribers, many of them paying from six months to a year in advance.

The question of the rentals to be charged these country patrons is one upon which the Independent telephone companies of the state widely differ, and it would be for the common good if an agreement could be entered into whereby the same prices would prevail throughout the state. But it is probably too early in the Independent telephone development to expect concerted action along this line at this time. In most localities the telephone companies will experience little difficulty in securing contracts among farmers, for six-party lines, at $18 a year, for the full privileges of the exchange, the same as granted to town subscribers.

We require the farmers to do all the soliciting themselves, and to bring to us the requisite number of five-year contracts already signed, and also to secure for the company all the necessary right-of-way. When figuring on the rate to be charged, we estimate the cost of construction of the proposed line, and make the rate sufficiently high that the gross income from the initial number of subscribers on the line will be 20 per cent., figuring six per cent. for the investment, six per cent. for operation and eight per cent. for depreciation. For example: If the proposed line is four miles long, it will cost, approximately, $500 to build it and equip it with instruments. Twenty per cent. on the cost would be $100, hence, if we can put eight subscribers on the one circuit, we make them a rate of $12 per annum each, which gives us, practically, 20 per cent. gross income. The sequel will show that inside of two years we will have two more circuits of eight telephones each, or 24 subscribers on that lead, and for the last 16 we have had no expense for pole-line construction, as we require the farmer to erect, or pay the cost of erecting, the lateral pole line leading from his house to the main line.

Our experience has been that it pays to build a good, substantial line of 25-foot poles with six-inch tops, and use ten-pin cross-arms for at least four miles from the exchange. Beyond that distance it is sometimes advisable to use six-pin arms, but it always pays to look a long way into the future when you are building for telephone service.

We use No. 14 B. B. double galvanized-iron wire, the same as we use in the local exchange, and find that it gives good service to farmers living eight miles from the exchange, with occasional transpositions. All instruments should be bridged with 1,600-ohm ringers, and equipped with "straight-way" generators. Our first farmer lines were equipped with ordinary 1,600-ohm bridged ringers, and give fairly satisfactory service, but the frequent ringing was a source of much annoyance. A short time since we installed an eight-party line with "straight-way" generators, which allows the subscriber to signal central without ringing any of his associates on the line, and it is proving so popular that we will be under the necessity of equipping all our party lines in the same manner. By using "straight-way" generators fully two-thirds of the ringing is eliminated, only the signal from central being audible at all the stations on the line, and anyone who has installed or used a party line is cognizant of the fact that the paramount difficulty, and chief cause of complaint, is on account of the multiplicity of rings.

"How do you prevent eavesdropping on these lines?" someone asks. We do not prevent it. When the service is installed, the subscribers are warned to remain away from the instruments when they hear another subscriber's call sounded, and shown that if they desire immunity from annoyance at the hands of other patrons on the line, they must remember and put into practice the Golden Rule. After the novelty of the thing is worn off, little trouble is experienced from this source. The farmers themselves find means to reduce that kind of trouble to a minimum, and generally make it pretty warm for subscribers who are afflicted with an almost unconquerable desire to know what their neighbors are talking about.

In a paper of such brevity as this one, it is impossible to enumerate all the arguments in favor of the construction of farmers' lines. Let me recapitulate and say that the income from these lines will pay well for their construction and operation, and that they create a demand for the company's service from the residents of the town or city in which the exchange is located, make that service absolutely indispensable to the local business men, and so effectually fortify the Independent company in the affections of the people and so identify it with the daily life of the town, that the monopoly can offer no inducement which will re-establish it in public favor, or enable it to take the business away from its Independent competitor.

1. Paper read before the Ohio Telephone association at Columbus, Ohio, on April 5, 1901. Mr. Briggs is manager of the Home Telephone company of Tiffin, Ohio.

British Telephone Contract Secured by Western Electric Company.

It is announced in cable dispatches from London that the Western Electric company of Chicago and New York has received the contract to install the new telephone apparatus for the British government. Parliament has appropriated £2,000,000 for the establishment of telephone systems, and it was reported that the American firm had received a contract amounting to half that sum. In answer to the report the London manager of the Western Electric company spoke as follows to a New York Times correspondent: "Our contract does not reach anything like £1,000,000. The cables we are installing were made by British labor at our works in Woolwich. Only materials, which are absolutely unsecurable here, are being imported from America. The British Postoffice authorities and all persons connected with telephonic construction in Great Britain and on the continent admit that these are far ahead of any made on this side. The greater part of the appropriation of £2,000,000 will be spent in breaking up roads and similar work. The British firms had a fair show, and it was only when it was found that they were unable to provide the materials that the Postoffice here dealt with an American firm."

The Telephone Newspaper in Budapest.

The novel system of supplying news at stated intervals by telephone, called a "telephone newspaper," continues in successful operation in Budapest, Hungary. A recent non-technical writer in the World's Work says that the paper has 6,200 subscribers, and the staff consists of a business manager, an editor-in-chief, four assistant editors, and nine reporters. The company owns its own plant and has the same right to place wires that is enjoyed by the telephone and telegraph companies. A reader, who is called a "stentor," talks into a double transmitter, and the subscriber has two receivers like those used by the telephone operators. The sound of the reader's voice is said to be greatly strengthened by the machine. Each subscriber has a complete programme to tell him just what news to expect at any hour. The news is secured by reporters in the ordinary manner, and after being written out is copied, by means of lithographic ink, on long galley slips, from which the stentors read into their transmitters. Music is also supplied by the company to its subscribers, and experiments are now being made to install "penny-in-the-slot" machines, the coin to be used being a 20-filler piece, worth about two cents.

Independent Telephone Consolidations.

The negotiations that have been under way for some time, looking toward the consolidation of the large Independent telephone systems of Maryland and Pennsylvania, were finally consummated in Baltimore on April 11th. The action was taken at a meeting of the directors of the United Telegraph and Telephone company. As a result of the consolidation, which has been engineered by a syndicate headed by George R. Webb, the following-named properties were acquired by the United company: Maryland Telephone and Telegraph company, capital stock, $1,000,000; Pittsburg and Allegheny Telephone company, capital stock, $1,500,000; West Pennsylvania Long-distance Telephone company, capital stock, $1,000,000; Home Telephone and Electric company, capital stock, $200,000; Allegheny County Telephone company, capital stock, $200,000; Harsford County Telephone company, capital stock, $10,000; total capital stock, $3,960,000.

In all, about 50,000 telephones, either in actual operation or under contract awaiting installation, will be added to the combination. The United company obtains a strong position in the Pittsburg territory by the interests absorbed there.

The West Pennsylvania Long-distance Telephone company owns the line from Pittsburg to Beaver, Pa., where connection is made with the United States Long-distance Telephone company that will give service into Cleveland and other Ohio and Indiana places. More than 167,000 telephones will be connected by this line with the Pittsburg and Allegheny plant.

The United Telephone and Telegraph company, which absorbs these extensive interests, was chartered under the laws of New Jersey. It has a capitalization of $5,000,000 of common stock and $2,500,000 of six per cent. cumulative preferred stock. The financial plans provide for the issuance at once of $3,500,000 of the common stock, and $2,000,000 of the preferred.

The directors of the United Telephone and Telegraph company are Alexander Brown, Henry A. Parr, Thomas J. Hayward, S. Davies Warfield and James Bond of Baltimore, and John Hedden, third, of New Jersey. In pursuance of his plan to withdraw from active connection with all corporations, before going abroad, it is said that Mr. Brown will retire from the board and will be succeeded by George R. Webb. It is also understood that Mr. Webb will become president of the big company. Additional directors will be placed on the board to represent the Pittsburg interests.

Following the report of this eastern telephone consolidation, comes another that the Ohio telephone men have a plan whereby they will combine the Independent interests all over the United States and form a company that will be a dangerous competitor to the Bell Telephone company throughout the country. The Cleveland Leader, in a recent article, said:

"There is a small coterie of financial men with offices in the Electric building who are working out a task of more magnitude than is generally appreciated by the citizens of Cleveland. With Henry A. Everett as the leading spirit, they are doing nothing less than attempting to become a formidable competitor to the Bell Telephone company throughout the United States. Already they have filled Ohio, Michigan and Western Pennsylvania with a network of wires, and they are still reaching out for new territory. Within a few years they hope to cover the entire United States with their Independent systems of telephones. Then there will be a consolidation of interests, similar to the manner in which the Postal Telegraph company was formed."

There is also said to be a movement on foot to take up some of the best territory in West Virginia. The plan of the Federal Telephone company is to finance the small companies that are organized in the different towns, and the large ones, if necessary, and the work is thus made comparatively easy for the local promoters. That the movement is rapidly growing over a large field is further attested by the fact that a franchise has just been secured in Kansas City, through the efforts of Judge J. M. Thomas, and an Independent plant will soon be built there. This will make an excellent starting point for western and southern development.

New Locations for Chicago Exchanges.

The West exchange of the Chicago Telephone company, formerly at Madison street and Ashland boulevard, was moved to new quarters at Seeley avenue and Monroe street a few days ago.

The Englewood and Wentworth exchanges of the same company have been removed to a new two-story stone building, erected especially for them at 6304 Stewart avenue, Englewood. The new building is fireproof, has all the best appointments for quick service and for the comfort of the operators, and cost about $50,000. The Lake View exchange will be installed in its new building after May 1st.

Telephone News from the Northwest.

The Minnesota Telephone and Electric Light company has been formed to succeed the Northern Minnesota Telephone company of Wadena, Minn. The new company will establish a local exchange in Grand Rapids, Minn.

The Edgerton Telephone company of Edgerton, Minn., has been incorporated, with $50,000 capital stock.

The Union Electric Telephone company proposes a new line from Hector, Minn., to the Twin Cities, for the benefit of the towns west of Glencoe, Minn.

The Monroe (Wis.) Telephone company will expend $3,000 in improvements to the system.

M. H. Jewell is an applicant for a franchise for a local exchange at Bismarck, N. D.

The Northwestern Telephone Exchange company reports a net gain in subscribers for March of 170, making a total of 22,279 subscribers on March 31st.

E. E. Webster has been discharged as receiver for the Mississippi Valley Telephone company at Minneapolis. The court complimented him on the able and faithful manner in which he discharged his duties.

The Western Telephone company will build a line from Garretson, S. D., to Dell Rapids, and have it in operation by the middle of June.

Thomas E. Dydal, H. Sampson, E. J. Scofield, W. E. Landeene and L. V. Barnes have formed a local company at Elbow Lake, Minn., and will install an exchange.

The Fosston (Minn.) Telephone company will build a line to Queen, Olga, Gully, Winsor and other points.

The Northern Electric Telephone company has completed arrangements for a metallic circuit to include Wheaton, Ortonville, Appleton, Granite Falls and Glencoe, Minn. They will connect with Minneapolis.

The Northwestern Telephone Exchange company has brought suit against the city of St. Paul for $5,000, alleged to be due for toll and telephone services. The bill dates back four years. The city claims the bill is excessive, and claims exemption under its agreement with the company that the city is to receive a certain number of telephones free and other service without charge. This company has amended the order for installing no more nickel-in-the-slot machines in St. Paul and Minneapolis. The manager now uses his discretion in the matter.

The Dakota Central Telephone company of Aberdeen, S. D., has purchased materials for a complete metallic-circuit telephone system to Minneapolis. A line will be run from Britton to Lidgerwood, and new exchanges will be put in at Britton, Wilmot and Bryant. The Huron exchange will be entirely rebuilt.

The Western Minnesota Telephone company, with headquarters at Glencoe, Minn., at its annual meeting, voted that henceforth stockholders shall not have free access to the lines. The management feels that the stockholders have used the lines freely and have kept away paying business.

The Interior Telephone company of Cedar Rapids, Iowa, has secured a franchise at Grinnell, Iowa, for a local exchange.

The St. Ansgar Telephone company has been incorporated at St. Ansgar, Iowa, with $3,000 capital stock.

The Jefferson Telephone company has been given a franchise for a local exchange at Paton, Iowa.

The Western Electric Telephone company asks for a 20-year franchise at Cherokee, Iowa. If granted, the company will rebuild the system, at an expense of $12,000 to $15,000.

The Parkersburg Telephone company has been incorporated, with $10,000 capital stock, to operate in Parkersburg, Iowa.

The Victor and Summit Independent Telephone association, the German Independent Telephone association, the Victor-Hartwick Independent Telephone association and the Guernsey and Victor Mutual Telephone association have all been granted franchises at Victor, Iowa.

Grand Junction, Iowa, has refused a local-exchange franchise to Mr. Cockrell of Jefferson. He has already installed an exchange of 30 connections, which will probably have to be removed.

The Iowa, Dakota and Minnesota Telephone company has been formed, with a capital stock of $100,000. Thomas Way, T. A. Potter, E. P. Healy and B. C. Way of Britt, Iowa, and Jos. Kirby and J. F. McMahon of Sioux Falls, S. D., are the incorporators.

The Fraley and Arney Telephone company of Albion, Iowa, has become a mutual company, and will henceforth be known as the Iowa Valley Mutual Telephone company.

A new exchange is projected for Mount Ayr, Iowa, to connect with all the farm lines. The Consolidated Telephone company is to be formed by the rural lines and a local exchange installed. R.

Ohio Telephone Notes.

The Central Union Telephone company is making an effort to cover the field about Springfield and is taking in the small towns all around in order to deter the United States company from carrying out its plans. It is also proposed to build farmers' lines, and solicitors are at work in towns in Clark County. However, the Independent company is quietly going on with its plans and will build its lines.

The Star Telephone company of Ashland has filed notice of an increase of capital stock from $50,000 to $100,000, to provide for the new plant which will be installed this summer. George A. Ullman is president of the company, and Howard Swartz, secretary.

The patrons of the telephone company at Bluffton have demanded a reduction of price from $2 to $1 per month, which has been refused. It is said that they will order the telephones out, but it is probable that a compromise will be reached.

Maruce L. Sternberger, a prominent coal operator, has been elected president of the Jackson County Telephone company. The first line will be built from Jackson to Wellston, and the lines will then be extended to Portsmouth and Chillicothe.

The Bell Telephone company and the Akron People's Telephone company are having a rate war at Cuyahoga Falls. The Bell company is offering service at 50 cents a month.

The Home Telephone company of Findlay and the Postal Telegraph company have made an arrangement whereby both will use the same poles on certain streets of the town. This will allow the telephone company to use some streets over which it now has no franchise.

Contempt proceedings have been brought against the stockholders of the Farmers' Co-operative Telephone company of Mansfield. It is claimed they filed a deed of assignment when there was an injunction issued against such an action.

F. H. Lyder of Akron has secured the Garl patents on his hotel fire-alarm systems, and will form a company to manufacture the apparatus. In case of fire in any room in the house, bells are rung in all the other rooms by this device.

The Putnam Telephone company of Ottawa has increased its capital stock from $40,000 to $100,000. G. W. Riser is president, and C. B. Matthews, secretary, of the company.

The Belmont Telephone company of Bridgeport has increased its capital stock from $15,000 to $75,000. J. C. Heinlein is president, and Andrew Heinlein, secretary, of the company.

The Madison-Clark Telephone company of London has been incorporated, with a capital stock of $75,000, by William M. Jones, J. F. Rankin, R. W. Boyd, J. C. McMillan, Ed L. Barker and A. S. Bell. The new company is authorized to construct exchanges at London, South Charleston and other towns in Madison, Green, Clark and Fayette counties, and to build toll lines from London to Mount Sterling, Cedarville, Jeffersonville, Sedalia, Yatesville and Mechanicsburg, and branches to other points to be selected by the board of directors. It is possible that the new company is formed to extend the sphere of the present London Telephone company. O. M. C.

Indiana Telephone Items.

In addition to extensive extensions of old lines throughout Indiana, new companies are organizing daily. During the last week the following companies were incorporated: Carmel Mutual Telephone company, Carmel; capital, $5,000; directors, Jonathan Johnson, Thomas Husey and E. H. Collins. The Markleville Telephone company, Markleville; capital, $217; directors, Allen Boram, E. V. Boram and J. H. Slaughter. The Bellmore and Mansfield Citizens' Telephone company, Bellmore; capital, $5,000; directors, Thomas Harmless, S. R. Coleman and William Wimmer. The Hazlerigg Co-operative Telephone company, Hazlerigg; capital, $5,000. The Taylorsville Telephone company, Taylorsville; capital, $2,000; directors, S. S. Drybread, B. W. Chambers, Edward S. McSweeney and B. E. Everine.

The promoters and owners of the Indiana telephone companies who have undertaken to accomplish the withdrawal of the name of F. I. Allen for patent commissioner, on the ground that he is interested in Bell patents, have not as yet received any reply to the telegram sent President McKinley. The Independent men have quit talking on the subject and will make another attempt, which they hope will be successful. The new plan is kept a secret.

The Clinton County Circuit Court has authorized Richard Clark, receiver of the Energy Telephone company, to borrow $5,000, with which to make needed improvements and operate the plant to its full earning capacity. F.

Convention of the Independent Telephone Association.

The fifth annual convention of the Independent Telephone Association of the United States of America will be held at the grounds of the Pan-American Exposition at Buffalo on June 11th, 12th and 13th. The programme for the meeting will be arranged later. Arrangements have been made with the railroads by the management of the Pan-American Exposition to carry visitors at one and one-third fares for the round trip. The committee on arrangements is composed of S. E. Wayland of Scranton, Pa., and Robert R. Hefford and Clark L. Ingham of Buffalo, who will arrange for special rates at hotels for those attending the convention.

This event is one of great importance to Independent interests, and a large attendance is urged. The time of holding the convention will afford ample opportunity for seeing the exposition to best advantage, and the inducements offered should attract telephone men from all over the country.

NEW COMPANIES.

A stock company has been organized at Rhinelander, Wis., to install an Independent exchange. Arthur Taylor is secretary of the company.

The Advance Telephone company of Anna, Ill., has been organized, with a capital of $17,500, by F. W. Willard, Ed Samson and George A. Bell.

A telephone company has been organized at Melrose, Fla., with Dr. J. B. Curtis, president, and Rev. A. H. Waters, secretary and treasurer. The line is to run from Melrose to Waldo, via Orange Heights.

The Bell County Telephone company of Texas has been organized, with a capital stock of $120,000, to operate in Bell County, Texas. The incorporators are J. E. Boynton of Waco, Texas, and J. K. Duffy of New York.

A company has been organized at Tampa, Fla., with $200,000 capital stock for the construction of an underground telephone system. M. G. Brorine and Guy Hoffman of Ohio are interested in the projected system.

The Terrace City Telephone company, with a capital stock of $500, has been incorporated to do business in Kansas City, Mo., and Kansas City, Kan. The incorporators are Hugh C. Ward, Fred Huttig and Ferd Helm.

The Suburban Telephone company, with capital stock amounting to $10,000, has been incorporated by Edward C. Carrington, Jr., C. Ross Mace, John H. Sheridan, John W. Crouch, Robert C. McClintock, Joseph Dryer and R. Vincent, Jr.

The Preston Bend Telephone company, recently organized at Preston, Texas, with a capital stock of $5,000, by A. G. Noble and others, proposes to build a line from Denison, Texas, to various points in Indian Territory, and is in the market for supplies.

The Florida Telegraph and Telephone association has been chartered, to do business at Inverness, Fla., and neighboring towns. The capital is $5,000, with privilege of increase, and the incorporators are William K. Jackson, James P. Wilson and J. M. Young.

GENERAL TELEPHONE NEWS.

The Inland Telephone company of Middlebourne, W. Va., is about to increase its facilities and improve its plant.

The Wilson and Tarboro Telephone company of Wilson, N. C., will increase its capital stock from $10,000 to $25,000.

At Rome, Ga., a telephone ordinance has been passed, and the Southern Bell will commence extensive improvements, and a new system will be inaugurated, it is said.

W. D. Burford, local manager of the Cumberland Telephone and Telegraph company at Owensboro, Ky., has purchased a building and will expend $18,000 in improving and equipping it as a telephone exchange.

The capital stock of the Union Telephone company of Alma, Mich., has been increased $50,000 to provide for new lines to Lansing and between Edmore and Ionia, and for new exchanges at Baumster, Elsie, Ashley and Ovid.

The Southern Bell Telephone company has asked for a franchise to put in an exchange at Cartersville, Ga. If the application is acted upon favorably, it is said that it will mean a fight between the Bell and the Independent companies.

The Erie Telephone company reports net gains of 2,221 subscribers during March, 1901, and 3,020 new subscribers from January 1st to March 31st. The total number connected March 31st was 144,619 and 3,490 were awaiting connection on that date.

It is stated in New Haven, Conn., on high authority, that the Southern New England Telephone company is negotiating for a long lease of the Ansonia (Conn.) telephone system. The Ansonia is the largest Independent system in Connecticut, and it has been in operation several years.

The Queen City Telephone company of Charlotte, N. C., recently reported as having been purchased by the Curtis syndicate of New York city, has changed its name to the Charlotte Telephone company, incorporated, with a capital of $30,000, by James B. Curtis, Joseph Q. Taylor and A. A. Miller.

The Atlanta Standard Telephone company of Atlanta, Ga., at the annual meeting, discussed plans for enlarging and developing the system, by combination with suburban lines, to make the plant one of the largest in the South. A report on the development of the company will be made, which may assist in deciding upon the question of further development.

The Southern States Telephone company of Maryland has given to the Fidelity and Deposit company of that state a mortgage on its property to secure $150,000 worth of 25-year five per cent. bonds; $50,000 of this will be used to settle outstanding indebtedness, and in addition extensions will be made to the company's business and long-distance connections will be given especial attention.

Bullock-Wagner Combination.

As stated in the Western Electrician last week, the Bullock Electric Manufacturing company of Cincinnati and the Wagner Electric Manufacturing company of St. Louis have effected a combination of their selling organizations. The companies interested say that by thus combining forces they are mutually benefited, inasmuch as the products of the two companies are totally different, and where the product of one is used, the other is likely to be necessary. The product of the Bullock company consists of a complete line of direct and alternating-current machines, from a one-half-horsepower motor to a 10,000-kilowatt generator, controllers of various types and rotary transformers. The Bullock "Teaser" power system for driving large daily-newspaper presses has become well known, and is to-day installed in the press rooms of many of the leading dailies in Europe and America. The product of the Wagner Electric Manufacturing company covers a full line of static transformers of all types and of the largest sizes, ammeters, voltmeters, indicating wattmeters, switches, switchboards for all purposes and single-phase, self-starting, alternating-current motors. The absence of complicated starting mechanism especially adapts the Wagner single-phase motor to pumping plants and machinery of like character.

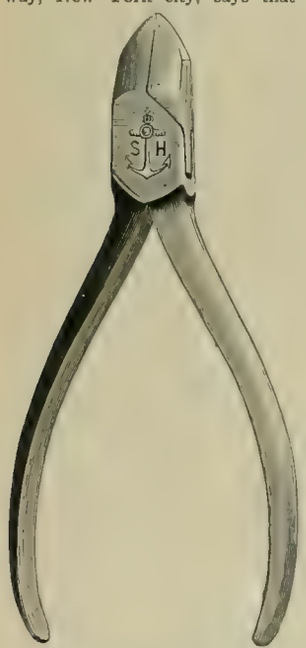
The two lines are well adapted to be sold by one organization, which will be under the management of Mr. E. H. Abadie, formerly sales manager of the Wagner company.

Edison's Storage Battery.

So far as known, no American patent has been issued yet for Edison's new storage battery. Mr. Edison's reluctance to discuss his present work is well known. Nevertheless, a New York daily newspaper publishes the following alleged interview with him: "My new storage battery will be about half the weight of those now used in automobiles. I do not use lead in the battery, but I do not care to state at present what metal is employed. The battery is permanent, and does not suffer from depreciation. Of late I have been giving my attention almost exclusively to chemicals. I have discovered a new reaction in chemistry which is going to prove very valuable. The capital stock for my new storage battery has been subscribed by the presidents of three trunk lines. There is not a share of the stock on the market. I have perfect confidence in the practical success of my new invention, and the first demonstration of the process will be made at the Pan-American Exposition. I will build a factory at Menlo Park for the manufacture of the batteries. I have made fortunes for many people out of my inventions. This one is going to make a fortune for Edison."

Smith & Hemenway Lineman's Plyer.

The Smith & Hemenway company of 296 Broadway, New York city, says that there has been a



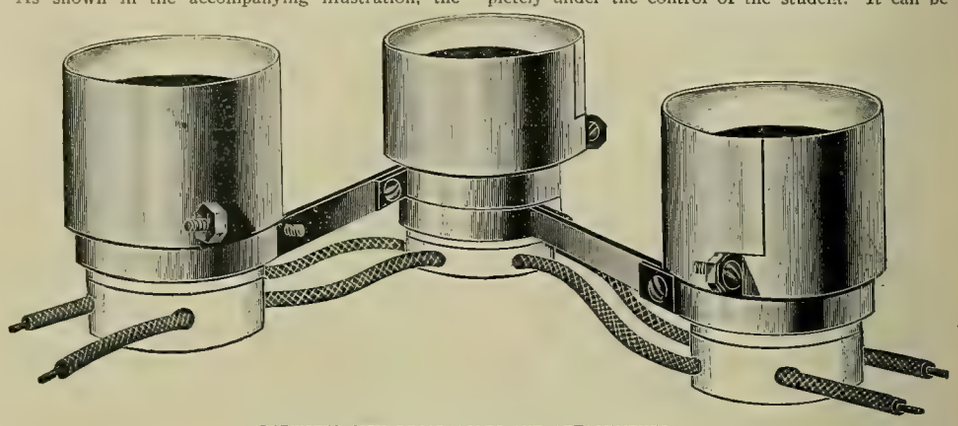
SMITH & HEMENWAY PLYER.

"long-felt want" in the trade for a first-class, tough, non-brittle, diagonal plyer for electrical and telephonic purposes. Such an article the company believes it has in its No. 342 Swedish diagonal plyer, shown in the accompanying illustration. The points of superiority asserted are that the jaws are perfectly parallel, and will cut the finest insulation. At the same time, they are stiff enough so that they will cut any kind of hardened-copper wire or light-steel or iron wire. The Smith & Hemenway company also carries a line of fine tools, described in its "Green Book of Hardware Specialties and Tools."

Brewster Sign Receptacles and Attachments.

Those who have had any experience in constructing or installing electric signs or decorations will doubtless view with favor the Brewster universal sign receptacles and attachments, recently put on the market. By means of these devices it is stated that anything in the way of electrically illuminated signs or decorations for the interior or front of buildings may be quickly made up and changed at will, at very small expense, to something entirely different, thus providing for the use of theaters, merchants, electric-lighting companies, etc., a valuable improvement over the ordinary type of electric sign or decorative work.

As shown in the accompanying illustration, the receptacles themselves are linked together by S-shaped clamp hooks which bind firmly about the receptacle, thus clamping the whole structure into a rigid outline of any design or proportion desired. For in-door use the receptacles may be readily wired, using the contacts projecting at the back of the main receptacle. For out-door use in an exposed position where weatherproof construction is desirable, the wires may be run through openings in the contact cap, provided for that purpose. The contact cap is then attached to the receptacle proper by means of a screw passing through the base of the receptacle proper, into a nut embedded in the contact cap; the space between the wires and the holes in the contact caps through which the wires pass may then be filled in with some waterproof compound, and a thoroughly watertight and safe construction obtained. Owing to the fact that the contact caps are spaced at regular intervals, the same contact caps and the same wiring may be readily used in connection with designs entirely different from the one for which they were originally made up, it not being necessary to change the wiring, excepting in rare instances.



BREWSTER SIGN RECEPTACLES AND ATTACHMENTS.

As an additional protection to the lamp and socket when used in exposed positions out of doors, a metal rain guard is provided. This rain guard is adjustable upon the projecting shoulder of the receptacle, so that, by moving it in or out, it readily adjusts itself to the neck of an incandescent lamp of any size or shape, making a practically watertight junction between the metal cap and the bulb of the lamp. These receptacles and attachments are manufactured by the Electric Motor and Equipment company, 12-14 Beaver street, Newark, N. J.

The Omnigraph for Teaching Telegraphy.

An instrument has recently been brought out which has for its use the teaching of telegraphy. Heretofore, the novice to learn telegraphy has found it necessary to spend many long hours before the ticking of a sounder became instantly intelligible to him, but with this instrument it is confidently believed by the manufacturer that one can obtain in a comparatively short time a complete knowledge of the Morse alphabet. The device, which is called an omnigraph, is shown in the accompanying illustration. It consists of a baseboard on which are secured an ordinary telegraph key and sounder. Between these a disk is mounted, formed on its periphery with teeth. A spring contact adjacent to the wheel engages the peripheral teeth of the disk. Although irregular, the arrangement of the teeth is arbitrary. If the disk be rotated by means of a small crank shaft geared with the disk shaft, the spring contact is forced outwardly by the teeth, but drops back by its own elasticity, and thus makes and breaks the circuit. The experienced telegraph operator, detecting these makes and breaks at the sounder, recognizes them as the dots and dashes of the Morse alphabet. The teeth are so arranged as to spell out the sentence, "John quickly extemporized five tow bags." If the disk be rotated forwardly, this sentence, thus oddly worded to include every letter in the alphabet, is ticked off at the sounder; if rotated in the opposite direction, the sentence will be telegraphed backward.

THE OMNIGRAPH FOR TEACHING TELEGRAPHY.

In the operation of the apparatus the disk is completely under the control of the student. It can be rotated as slowly as desired; or it can be so rapidly turned that its curious sentence will be received at the sounder with a very rapid speed. Moreover, the message on the disk is transmitted with a distinctness and faultlessness which, it is said, the most perfect operator can never hope to attain. It might seem that the student simply learns one sentence forward and backward, and that the instrument is a good teacher only within very narrow limits, but this disk can be partially rotated, backward and forward, any number of times, in any place, so that the letter to be transmitted cannot possibly be anticipated. Thus the student learns how to receive a cipher message, the meaning of which he cannot know. When sufficient proficiency has been obtained in receiving messages from the sounder, the student can learn to transmit messages in the regular method by means of the key, which forms part of the apparatus. The omnigraph is being introduced by the Omnigraph Manufacturing company of 39 Cortlandt street, New York city.

Electric Railroads of the Future.

In an article in the Independent, Albert L. Johnson, the electric-railway promoter and operator, says:

"The general trend of steam-railroad rates has been lower and lower every year. Rates, nevertheless, are still too high. The times and the people demand that the charges must be lowered. How is it to be done? I say we must start afresh—from the ground up—discarding the cumbersome and expensive mode of operation now in use. We must adopt the electric system, in which each individual car is supplied with its own motive power, and can be run as often as necessary with nothing to earn beyond its own cost of operation.

"The electric system of transportation is still in its infancy. On the line which I am now building between Philadelphia and New York I will materially reduce the existing rates of fare between New York and Philadelphia—at the most I will charge 50 cents—one-fifth of the present tariff, but, at that rate, I do not expect to cripple the steam railroads, or to cut into their normal traffic.

"The electric system will solve the problem of overcrowding in our great cities. It will move the laboring man from the physical and moral unhealthfulness of the congested tenement district.

"Excluding the milk traffic, the greater portion of the garden-truck supply of large cities is brought within their limits by teams. Electric lines, with far more facility, can handle milk, butter, the products of the farm and truck garden, practically taking them up at the farmyard gate and delivering them at the door of the consumer."

Steam-engine Combination Proposed.

A dispatch from Milwaukee, dated April 9th, states that Charles Allis, representing the E. P. Allis company, was in New York at that time with a proposition to consolidate all big machinery and stationary-engine plants of the country. The trust will, if formed, have a capital of $50,000,000, and include over 40 plants. The leading ones mentioned are Edward P. Allis company of Milwaukee; the Bass company of Fort Wayne, Ind.; the Aultman company of Canton, Ohio; the Vulcan company of Wilkesbarre, Pa.; Somers, Fitler & Clarke of Pittsburg; the Tod company of Youngstown, Ohio; the

Boern company of Cleveland, Ohio; the Kieter company of Pittston, Pa.; Hooven, Owens & Rentschler company of Hamilton, Ohio; the Lidgerwood company of New York; the Sellers company of Philadelphia, and Webster, Camp & Lane of Akron, Ohio.

Design of Polyphase Generators.

In a paper in the Sibley Journal of Engineering Professor Harris J. Ryan of Cornell University briefly describes "The Three-phase Alternators of the Metropolitan Street Railway company of New York City." The plant of this company is located on the East River at Ninety-sixth street, and has an ultimate output capacity of 45,000 kilowatts. It contains 11 engine-alternators, each normally rated at 3,500 kilowatts at a three-phase potential of 6,000 to 6,600 volts and designed to withstand an overload of 33⅓ per cent. Professor Ryan says that these alternators are the pioneers of a type of electric generator that characterizes the most modern and probably most permanent electrical engineering practice. He then makes some general observations of interest.

Five years have passed since the date at which the great power plant at Niagara Falls began operation. The performance of that plant completely demonstrated to the industrial world that the polyphase system of electric-power generation and distribution is thoroughly reliable for any electric service in any magnitude. Unlimited capital has been ready ever since to support the application of this system to all commercial undertakings involving power distribution on a large scale.

During these five years that have now passed, enormous thought and energy have been applied by the engineering world to determine to the utmost practicable extent the ultimate type and design features that are best suited for the great polyphase alternators which are now so extensively required by modern industry.

The electrical machinery at the Paris Exposition during the last summer well illustrated the remarkable manner in which the polyphase system of generation and distribution has become the accepted system, to the exclusion of all others in the larger undertakings. It showed also the degree to which design practice has become crystallized. At the exposition upward of 20 engine-dynamo units were installed, ranging in size from 250 kilowatts to 3,500 kilowatts. These generating sets were installed for the dual purpose of furnishing light and power for the exposition and to advertise their makers. With but one or two exceptions, the dynamos were polyphase alternators, usually three-phase, producing their output at periodicities varying from 25 to 60 cycles and pressures from 2,000 to 6,000 volts. They were almost without exception of the flywheel type—i. e., revolving fields with stationary armatures.

The electrical visitor at the exposition had an excellent opportunity to note the ideas of all the world's greatest electrical machinery designers, as exemplified through the machines they produced and exhibited. Such a study showed at once the consensus of all engineering and commercial opinion of to-day to be that the polyphase system will completely predominate in the future; that there is a remarkable agreement as to many of the more essential design features which polyphase generators should have, and that American design and construction practice constitutes a class by itself quite distinct from that of the several countries of Europe, the latter having many more points in common among themselves than with American practice. It is somewhat difficult to state concretely just what distinguishes our practice from that of the Europeans. Invariably the American machines are operated at lower surface velocities, producing machines that are broader axially and somewhat smaller in diameter. Our machines use the straight armature tooth and open slot, accompanied by laminated poles and field cores, which such armature construction necessitates. In opposition to this, the Europeans advocate and practice the use of T-teeth and closed slots on the armatures, permitting the use of solid poles and field cores.

There are at the present time eminent electrical machinery specialists who hold, through recent contributions to the literature, that the European practice is in advance of ours; that it is the more modern, and therefore the practice to which ours will shortly have to adjust itself. I think this opinion is almost completely in error. In Europe the designing engineer almost invariably has his own way in deciding all details as to the construction of a proposed machine. He is given an order to produce a set of plans for a machine that will render best a specified duty, proper regard being had for first cost, efficiency and maintenance cost. He produces a machine which he is prepared to champion accordingly.

In our country the electrical machinery designer possesses a different status. He is required to determine the electrical and magnetic dimensions that a machine should have on the assumption that a certain type model is to be used in building the machine. The type model is determined by the technical directors of the manufacturing committee of his company, assisted by advices from the engineering, production, repairs and sales departments. Our designers have to make up the best electric and magnetic dimensions that will accompany a type-model that is largely determined for them in advance by a composite consideration involving too many requirements and necessities for the experience and training of any one man to handle by himself.

It is perfectly natural, therefore, that our system of design and manufacture should produce an entirely distinct phase of practice from that developed in Europe. It is likewise clear that there should be many able advocates of the various kinds of European practice while but few are found to champion the American practice. A single individual is responsible for the details of construction of the European machine, and he is prepared to defend each detail, and he is doing it. In America a half dozen or more specialists are responsible for each distinct type or form of machine, and we should have to hear from them all, collectively and individually, in order to have the real reasons for the type structures and dimensions they have adopted.

In most branches of engineering practice bold compromises of conflicting requirements must be effected. The issue of success or failure is usually determined by the quality of the compromises that have been made. The alternator, which costs a reasonable price, has a fair efficiency, is durable, easily and inexpensively repaired, and which has good inherent regulation, under loads that vary in amount and power factor, is the one preferred for business. This is a machine in which any one good feature is not overdeveloped at the expense of other important qualities. It is machinery of just this class which the American system of design and construction produces. Machinery thus produced is not apt to appeal greatly to technical specialists of limited manufacturing, operating and business experience, while it does meet with highest success in practice. It is preferred from the business man's point of view. A strong check upon this estimate of our practice in polyphase-alternator construction is found in the fact that our machines are often preferred in Europe, where first cost and reliability and economy in service are carefully taken into account.

Apparatus for Power Distribution from Central Stations.[1]

By Charles F. Scott.

Part I.

The Alternator.

The alternator of 10 or 12 years ago, with its high-speed armature, with a surface winding held in place by treacherous band wires, would hardly be recognized as belonging to the same class of apparatus as the modern engine-type alternator. Belt and pulley have been discarded, and the engine supplies the shaft and bearings. In many large machines the revolving armature has given place to a revolving field, which is constructed to have mechanical safety, comparable with that of a flywheel, and, in fact, to perform the mechanical functions of a flywheel, thereby placing the flywheel exactly where it is required, without the strains which would otherwise come upon an intervening shaft. The stationary armature winding is laid in grooves or slots; it is not the hand winding of the olden time, but a succession of coils wound to exact dimensions on a lathe and insulated before being put in place, or else a succession of straight bars which can be shoved endwise into partially closed slots and joined at the ends by connectors of copper strap.

The most striking feature of the field is its simplicity and the excellence of its mechanical construction. In the construction employed by the Westinghouse company a central spider of cast-iron is surrounded by a ring of laminated soft-steel plates. These plates are punched into sections two or three feet long, which include two pole pieces. The sections have projections upon their inner sides which fit accurately in dovetailed slots in the surface of the spider; the sections are built up overlapping, so as to break joints, and when the laminated plates are built up to the proper thickness they are clamped together, a large number of bolts running through from end to end. The friction between the surfaces of the thin plates, as well as the bolts through the holes, gives a most substantial construction; the field is, in fact, a steel-rimmed flywheel. The field coils are made of copper strap, approximately one sixteenth inch thick by 1½ inches in width, wound on edge, forming a single layer. The turns are then separated by asbestos soaked in shellac, and the whole coil is then baked, forming a solid and complete whole. These are placed over the field poles and are held in place by copper or brass wedges, which are in turn held by being placed in grooves along the sides of the projecting poles.

The stationary armature consists of a laminated ring, which is surrounded by a cast-iron frame or yoke. The laminated plates are also provided with teeth and slots, which form grooves along the surface of the armature suitable for receiving the conductors.

The number of slots in which the winding is placed has an important bearing upon the electrical performance of the alternator. A common form of alternator which immediately succeeded the old surface-wound armature was provided with a number of teeth equal to the number of field poles. A coil was placed around each tooth, and a single-phase current was generated. The number of slots may be increased, so that instead of having a single coil for each field pole, there will be several coils occupying the several slots, so that the resultant action will be produced by a number of coils coming under the action of a field pole at successive moments. The various turns in a coil are in this way separated into different slots, instead of occupying a common slot. It is well known that the self-induction of a number of turns of wire is much less if these turns are not placed close together in a common coil, but are separated and form several separate coils. It is also well known that the self-induction in an armature is a very important element in the voltage regulation of an alternator. For example, the voltage of a toothed armature in which there is high self-induction falls very considerably when a load is thrown upon the alternator, while there is comparatively little decrease in voltage when load is thrown upon an alternator of similar proportions, except that the armature winding is placed in many slots. This difference in regulation is very marked when the alternator supplies current which is out of phase with the electromotive force. On this account, toothed armatures, which were quite satisfactory for carrying a load of incandescent lights, in which the current is in phase with the electromotive force and which was subject to fairly slow and gradual changes in load as lights were turned on or off, are not admissible in power service, where the character of the current, frequently being out of phase with the electromotive force, is such as to produce a greater drop in voltage, and in which the load is apt to be variable and to fluctuate over wide limits. While the number of slots in an armature is not the only element determining the regulation, yet it is a very important one, and, in general, an alternator with few slots per pole may be depended upon to regulate poorly, while one with many slots will, in general, give good regulation.

Excellent regulation is desirable, not only in order that a satisfactory service may be delivered to a fluctuating load, but also in order to insure favorable conditions for the parallel running of alternators

APPARATUS FOR POWER DISTRIBUTION.—BUILDING UP LAMINATED POLE-PIECES FOR REVOLVING-FIELD ALTERNATOR.

and in general for rotary converters or other apparatus connected with the system.

Parallel Operation of Alternators.

The problem of parallel running is one which has recently come into prominence, because it has become a necessity in the operation of large power stations. This problem has been considered from a number of standpoints. The electrical conditions, including the various proportions of the alternators, such as their self-induction and their field reaction, the flow of idle or wattless current between the armatures, the relative field strengths, are all elements which have received more or less consideration and sometimes prolonged discussion. The speed of the engines—not only the mean or average speed, but the variation in speed during a revolution, also the weight of flywheel—are elements to which attention has been quite properly directed.

I purpose, however, considering the problem from a little different standpoint from those mentioned, not taking up alone the voltage or current or speed, but going at once to that fundamental element for which everything else exists, namely, the power. We will for the present omit the functions of the system other than its function of receiving power from two or more prime movers and delivering it to a common circuit.

We will assume two similar engines carrying similar alternators upon their extended shafts which are connected to common bus-bars and supply an outgoing circuit.

We will also assume two similar engines carrying similar gear wheels upon their extended shafts which drive pinions upon a common shaft which supplies power to an outgoing belt. The number of teeth in the gear wheels may be taken as equal to the number of poles on the alternator.

There is a certain elasticity in the electrical connection between two alternators which allows a relative displacement between the angular position of the two armature windings with respect to the field poles without injury, provided the displacement does not become too great. When there is a displacement, there is a flow of current between the

1. A paper, somewhat abridged, read before the Electrical Section of the Franklin Institute, Philadelphia.

two armatures, tending to pull them to a common position, and this force is proportional to the angular displacement. In the same way, we may imagine the spokes of the gear wheels to be slightly elastic, thereby permitting a deflection amounting to a fraction of the pitch between two teeth. It is not necessary, therefore, that the two engine shafts occupy exactly the same angular position, but one may be slightly in advance of or behind the other. The forces exerted by the two engines upon the countershaft will be different and there will be a force tending to a common position of the two quite similar to that in the electrical system.

The proper condition for connecting the second engine to the common shaft by means of the gear wheel when the first is running is obvious. The pinion should not be thrown into the gear wheel unless the engine has the proper speed and the proper angular position. If the speed of the two engines is not the same just before they are connected together, there will evidently be a severe stress exerted during the extremely short time in which it is necessary to impart the necessary energy to the flywheel and other moving parts of the slower engine in order to bring it to the proper speed. A difference in speed of one per cent. may involve very great stresses, as the speed must be equalized almost instantly. It is also evident that if the arrangement is such that the pinion and gear wheel can be instantly forced together when the teeth have not the proper angular position, the result will be in the nature of a blow in order to secure the proper angular position.

The corresponding conditions in the electrical system are also quite evident. If engines and generators are not running at the proper speeds or have not the proper angular positions at the time that they are thrown together, very great stresses will be brought upon the electrical system in order to produce the proper speeds and positions almost instantly.

When the two engines are connected by gearing they must, of course, run at identical speeds. This is true, not only in respect to the total number of revolutions per minute and to the time of a complete revolution, but the angular speeds during each revolution must be identical, except in so far as the angular positions may change on account of the flexible spokes with which the gear wheels are supposed to be provided. If an engine running alone were to vary in angular velocity during a revolution, then there would be no marked effect unless the variation were quite considerable. For example, if the engine drives the shafting of a mill, the speed would fluctuate slightly; if it drives a dynamo, the voltage delivered would vary with each revolution, but would hardly be noticeable, unless the variation were sufficient to produce a fluctuation in the lights which may be supplied. In each case the engine would deliver power at a very nearly uniform rate throughout the revolution. But when two such engines are connected by gearing and one tends to be in advance of the mean position when the other is lagging behind, then they cannot deliver practically constant power throughout the revolution, for the leading machine will tend to carry the greater part of the load, and if the natural fluctuation in speed is sufficient it may even take the whole load. When a part of a revolution is passed the conditions have changed and the second engine takes the undue proportion of the load. If the two engines were belted to a common shaft, the stretching and slipping of the belt would aid the equalization of the load, so that each engine might be carrying a very nearly constant load.

In the electrical system the analogy is obvious. There will be a corresponding shifting of load from one outfit to the other, similar to that which occurred when the engines were connected by gearing instead of by alternators. If the electrical connection were made not by alternators but by direct-current machines, in which there is no requirement as to relative angular position, then each engine and generator would carry very nearly constant load throughout the revolution.

The above considerations indicate that engines for parallel running must be such that when running alone the angular displacement from perfectly uniform rotation must not exceed certain reasonable limits. These limits are determined by the number of poles in the alternator or the number of teeth in the gear, and also the angular displacement which may occur without introducing undue stresses in the connecting system, i. e., the current between the alternators in one case and deflection of the steel spokes of the gear wheels in the other case must not be excessive.

The gear wheel in one arrangement and the alternator in the other are simply means for transmitting the power developed by the engine. It is essential to keep this simple proposition clearly in mind, as it is sometimes imagined that the power in the electrical system can be regulated or controlled by means of the electrical adjustments of the alternators. In cases where this may be effected, it is because some new adjustment of the engine-governing apparatus has been caused thereby, which in turn results in a change of the power developed by the engine. The alternator, like the gear wheel, simply transmits the power received from the engine. The power developed by an engine is primarily due to the adjustment of its valves. The valves, valve gearing and the governor must necessarily be looked to as quite important in parallel operation. The requirements upon these elements for parallel running are considerably different from those in other service.

Proper division of load between engines operating in multiple must therefore be effected by the governing mechanism. It is sometimes supposed that engines will be well adapted for parallel operation if they do not vary in speed between no load and full load more than, say, one per cent. Close speed regulation may be quite unsuited for parallel running. Thus, if one engine falls from 100 revolutions to 99 revolutions per minute when loaded, and a second engine has the same excellence of regulation, but happens to have a speed falling from 100.5 to 99.5 revolutions, then it is obvious that when running at 99.5 revolutions one engine would be adapted for carrying half load and the other for carrying full load. A difference of only one-half per cent. in the natural speed of such engines may tend to a very unequal distribution of load. On the other hand, if each engine falls off four or five per cent. between no load and full load, a difference of one-half per cent., or one per cent., in their absolute speeds for a given load would cause only a trifling difference in the loads which they would carry when operating at equal speeds. It has been found in practice that usually much more satisfactory results are obtained when the speed falls off considerably, and that from three or four to five or six per cent. is desirable for good operation.

In considering the effect of fluctuation of angular velocity it was found that the load may rapidly shift from one engine to the other, due to the fact that the speeds must be maintained practically identical, although the natural tendency of the engines may be to produce fluctuating speeds. One engine is momentarily relieved of a part of its load; the ordinary requirement is a readjustment of the governor. The governor mechanism may therefore change its position to give a decreased admission of steam. A moment later the conditions are reversed, and the engine takes more than its share of the load, thereby tending to give a different adjustment to the governor. The effects of angular fluctuation, however, are necessarily small and rapid and are not so apt to produce instability in the governing mechanism as certain other causes which may exist, even though the engines have so uniform a turning effort and flywheels of so great weight that the fluctuation in angular velocity is inappreciable.

Two engines may be delivering equal power to a constant load either through gear wheels or alternators. The load may be suddenly changed. The change in load, either through a momentary increase of speed or other action upon the governors, causes them to act and readjust the valves. When an engine running singly has a change in its load, the governor changes, often going beyond the required position, then returning a little too far, and after several oscillations settling to the proper position. The engine during this time is carrying its new load constantly and seeking to adjust itself to this new load. When two outfits are running in parallel and two governors are simultaneously seeking the new position required by change in load, it is easy to see how neither governor is left free to find its new position (as it would be if the engine were running singly), because the load may be continuously shifting from one engine to the other. The two governors will have a mutual effect upon each other, as the load on each engine is not constant, but is partly dependent upon the governor of the other engine. If, therefore, the governors are oscillating back and forth about a mean position, it is easy to see how this oscillation may increase in amount. If one governor has moved beyond the proper position and is admitting too little steam, it should then readjust itself for the proper load. But at the same moment the other governor may be in a position which admits too much steam, thereby causing its engine to deliver too much power and thus carry load which should be carried by the first engine. The governor of the first engine, which is already carrying less than the proper amount, may, on account of the decreased load, seek to adjust itself for still less load. This causes a still wider divergence between the two governors, and presently they may both tend to swing back and pass the mean position. The interaction of the governors may thus continue and increase in amplitude until the shifting load from one engine to the other caused by oscillation in the governor mechanism may be far beyond permissible limits.

It will be well to consider the conditions which prevail when alternators are driven by waterwheels, where, as it is well known, parallel running is comparatively easy. Waterwheels in general give uniform rotation without the angular fluctuations which occur in steam engines having reciprocating parts and an intermittent admission of steam. The speed regulation of waterwheels is comparatively poor, and the governors are comparatively slow in action. A load gradually applied may make little change in speed, whereas a suddenly applied load may cause a momentary decrease in speed which will be quickly recovered.

The governor of the steam engine is often prevented from oscillating by making it sluggish in action by the use of a dash-pot. The dash-pot must allow the freedom of motion essential for regulation under changing load, and yet destroy the delicacy and sensitiveness which produce oscillation and hunting.

Several points in parallel running which are common both to alternators and to gear wheels have been considered. There are some elements in alternators which are not common to gear wheels. These have to do with the electromotive forces and the currents rather than with the power. If the wave forms of the two alternators are not similar, but sometimes one and sometimes the other electromotive force during each cycle is higher, there will be a local flow of current between the two armatures. Again, if the field currents are not equal, the electromotive forces would also be unequal if the generators were running separately; but if the armatures are connected with a common bus-bar, the electromotive forces are necessarily equal, and an armature current circulates between the two machines, which equalizes the induction in the two machines, as the phase of the current is such that it assists the weaker field current of one machine and opposes the stronger field current of the other machine. This is a so-called "wattless" current; its function, like that of the field current, is for magnetizing, and it does not transfer power. It, therefore, has no mechanical analogue in the gear wheels, and is not an element with which the engine need concern itself.

[*To be continued.*]

CORRESPONDENCE.

New York Notes.

New York, April 13.—A Liverpool dispatch to the Herald states that the Cunard liners will probably be equipped with Marconi apparatus for signaling purposes.

The placing of cables for the new East River bridge was begun during the present week, and the first cable was successfully raised on April 11th, the time required being seven minutes, during which time navigation was suspended. Several methods of getting the first line across have been employed in the past, and kites, swimmers and other agents have been tried, but the method employed on this occasion has, it is said, never been tried before, and it is a distinct advance over all previous ones. The method adopted was to carry the drum containing the cable across the river on a float, one end having previously been secured, and pay out the cable, allowing it to rest on the river bed until at the proper time it could be raised from the water to the desired height by means of a stationary engine and drum. The John A. Roebling's Sons company has the contract for the making and laying of these cables. The contract was awarded to the company several months ago, and the preparation of plans and other preliminary work, as well as the main part of the contract, which is to follow, is under the supervision of Mr. Charles G. Roebling, the president of the company, who is assisted by Mr. William Hildenbrand.

The Brooklyn Rapid Transit company recently appeared in Wall street as a money lender, loaning during the day $2,000,000 at four per cent. In this connection, it is to be recalled that about a year ago the Manhattan Railway company, which then had some surplus moneys on hand which it was preparing to use in the electrical development of the company, likewise appeared in the market as a lender on call, when rates were commanding a high figure. By this means the company netted a handsome profit from money which otherwise would have lain idle pending the completion of the plans looking to the change in motive power of the road. It was said in some parts of Wall street, though not confirmed, that the money loaned by the Brooklyn Rapid Transit company is part of a fund out of which it is intended in July next to declare a two per cent. dividend.

The directors of the North Jersey Street Railway company, the Consolidated Traction company and the Jersey City and Bergen Railroad company met in Jersey City this week and re-elected all the former officers of both companies. The two last-named companies, which had been leased to the North Jersey, were consolidated and the leases renewed.

The Senate at Albany has amended the Doughty automobile bill so as to provide that automobiles cannot go in any public park in New York city except under regulations prescribed by the Park Commission, and that in other cities they must conform to the regulations prescribed by similar officials.

Following the announcement of a change in regulations regarding the transportation of gasoline on ferryboats, 17 ferry lines on the North and East rivers have agreed to handle automobiles carrying gasoline in tanks.

At the annual meeting of the Nassau Electric Railroad company the following-named directors were elected: A. N. Brady, E. H. Harriman, A. R. Flower, John E. Borne, Hugh J. Grant, N. F. Brady, Joseph D. Donald, T. S. Williams and J. L. Greatsinger. The only change made in the directorate was the election of Mr. Greatsinger, the new head of the Brooklyn Rapid Transit system, to succeed Clinton L. Rossiter.

Colonel William Jay has been discharged from the receivership of the Forty-second Street, Manhattanville and St. Nicholas Avenue Railway company, and the management of the line restored to the Third Avenue and Metropolitan Street Railway companies. The application for discharge set forth that the defendant has about $92,324 cash on hand with which to retire the receiver's contracts, and is in condition to borrow such additional sums as may be necessary.

A syndicate is acquiring water rights at the mouth of the Paulins Kill, in Warren County, N. J., and the Washington Mills have just been bought. Civil engineers are already at work laying out plans for

a large electric-light plant. The object of the syndicate is to furnish power for electric lighting to Columbia, Portland, Water Gap, Hainsbury and Delaware, and also for trolley lines from Portland to Bangor and up through the Delaware Water Gap and the Paulins Kill Valley. M. L. G.

New England News.

Boston, April 13.—On January 31, 1901, the Massachusetts Electric Companies owned the following stock: One thousand shares Hyde Park Electric Light company; 32,870 shares Lynn and Boston Railroad company; 57,441 shares Brockton Street Railway company; 2,497 shares Newport and Fall River Street Railway company; 751 shares common and 299 shares preferred stock of the Newport Street Railway company; 2,000 shares Newport Illuminating company; 26,837 shares Lowell, Lawrence and Haverhill Street Railway company; 120 shares Beverly and Danvers Street Railway company; 180 shares Gloucester and Rockport Street Railway company, and 1,000 shares North Woburn Street Railway company. The general balance of the company on January 31, 1901, was as follows:

ASSETS.

Sundry street-railway company stocks	$30,336,869.11
Notes receivable	211,400.00
Cash	880,864.32
Debit accounts	67,697.05
Expenses	15,139.15
Old Colony Trust company dividend account	3,936.30
Preferred dividend January 1, 1901	351,339.33
	$31,867,245.26

LIABILITIES.

Preferred shares	$15,057,400.00	
Common shares $14,293,100; less $575,000 in treasury	13,718,100.00	
Coupon notes	2,700,000.00	
Accounts payable	4,892.93	
Unpaid dividends	3,936.30	
Profit and loss	382,916.03	
		$31,867,245.26

The Massachusetts legislative committees on metropolitan affairs and street railways have been given a ride over the northern section of the Boston Elevated Railway company's elevated system, which is rapidly nearing completion. They were escorted by President William A. Bancroft, Colonel William A. Gaston, and other officers of the company. Between City and Sullivan Squares, Charlestown, a speed of 40 miles an hour was attained. The legislators especially commented on the solidity of construction of the roadway and the tastefulness of the cars and stations. They inspected the great terminal at Sullivan Square and the schoolrooms in which motormen and conductors are taught the difference between the management of surface cars and elevated trains.

The annual report of the Boston superintendent of lamps, William D. Lang, gives the following facts: During the last year the maintenance of electric lamps cost $22,352 more than it did the previous year; electric lamps cost $389,046, against $311,942 paid for gas and naphtha lamps; and of the 14,546 street lamps in the city, 3,416 are electric arc and 28 are incandescent electric. On October 10, 1900, the number of arc lamps furnished by the Boston Electric Light company having reached 2,750, the price to the city was reduced from 35 to 34½ cents per lamp per night, and the price for arc lights connected to the city's underground wires was reduced to 33½ cents per lamp, per night, according to the company's contract with the city.

The Union Stop and Signal company, organized at Portland, Me., to manufacture electric and mechanical devices, has filed a certificate of organization at Augusta, Me. It has a capital stock of $50,000, of which $600 is paid in. The president is W. B. Everett and the treasurer is J. C. Brady, both of Fall River, Mass.

On April 9th Seth W. Fuller, dealer in electrical supplies at 46 Arch and 185 Devonshire street, this city, suffered a slight loss by water during a fire in the upper floors of the same building.

Judge Fessenden of the Suffolk Superior Court has sent 40 of the famous Boston gas-explosion cases to an auditor, who will hear arguments on the question of the liability of the three defendants—the Boston Gas Light company, the West End Street Railway company and the Edison Electric Illuminating company. The parties in interest will be given until April 15th to select an auditor. After the auditor has reported, the cases will go to a jury. The remaining 100 cases will probably remain in statu quo until these have been decided. These suits are the outcome of the underground explosion that occurred on March 4, 1897, at the corner of Tremont and Boylston streets, when several persons were killed and injured and electric cars were demolished. The gas company has been successful in its efforts to have the West End and Edison companies as codefendants in these suits. B.

Southern Developments.

Charlotte, N. C., April 13.—Plans for the projected development of Mott's Falls, 30 miles from Charlotte, involving, according to estimate, about $800,000, are progressing, and a franchise in Charlotte has been applied for by F. Van Deventer of Knoxville, Tenn., and associates. Mr. F. E. Boardman of Knoxville, who is interested, states that his company could save Charlotte 50 per cent. on power, and the company proposes, if a franchise is granted, to have the power in Charlotte within 90 days. The estimated power is placed at between 15,000 and 20,000 horsepower. The company proposes, also, to supply power electrically to mills between Charlotte and the power plant.

The Southern Milling company has been chartered at Chatham, Va., with $25,000 capital. In addition to a milling business, the company has the right to conduct an electric-light plant for lighting the town of Chatham. J. H. Hargrave is president of the company.

The Hampton Roads Investment and Improvement company has been chartered in Virginia, and has purchased 68 acres between Hampton and Newport News, Va. The company proposes to manufacture gas and electric power and do a real-estate business. The capital is $75,000, and Dr. C. Perkins is president of the company.

The property of the Salisbury (N. C.) Gas and Electric Light company has been turned over to Edwin I. Frost of New York and others.

The incorporators of the projected electric road between Elkin and Sparta, N. C., chartered by the last Legislature, are having the route surveyed. Hugh Chatham and others are interested.

Messrs. Seasongood and Meyer of Cincinnati, Ohio, who made a deal for the $15,000 of electric-light bonds of Fayetteville, N. C., have withdrawn their bid. It is stated that these parties were informed of the call feature in the act authorizing the issue. A longer time has been granted the Cape Fear Electric company in which to fulfil its contract for supplying Fayetteville with waterpower. The withdrawal of the bid on light bonds for Fayetteville implies no disparagement of their value.

The North Augusta Electric and Improvement company has been commissioned in South Carolina, with a capital of $1,500,000. Alfred S. Elliott of Wilmington, Del., and others are interested. L.

From the Buckeye State.

Columbus, Ohio, April 13.—The Cleveland, Painesville and Ashtabula Railroad company has been incorporated, with a capital stock of $10,000, to build an electric line from Painesville to a point in Ashtabula county, passing through Lake and Ashtabula counties. The incorporators are Harrison B. McGraw, W. H. Zoplin, A. A. McCaslin, E. M. Granger, F. D. Everett and S. M. Hildreth. The road will connect with the Cleveland, Painesville and Eastern at Painesville.

The Cleveland, Painesville and Eastern Railroad company has had its charter amended so as to allow it to extend its lines from Painesville to Fairport, and also from Painesville to Ashtabula. J. A. Biedler is president, and Fred S. Borton, secretary, of the company.

The Central Heating and Lighting company of Toledo has been incorporated, with a capital stock of $25,000. The charter allows the use of steam, hot water or electricity. The incorporators are Charles S. Ashley, Willard Robinson, Albro Blodgett, J. M. Born and George A. Tuttle.

J. C. Parker of Sandusky has secured the right-of-way for an electric road from Sandusky to Tiffin, by way of Bellevue, and is now engaged in financing the company which will build it.

Albert Johnson, a brother of Mayor Tom L. Johnson of Cleveland, and Martin Mullen are said to be promoting a plan to establish an electric-railway system in Cleveland, to be operated on a three-cent fare. Mr. Johnson denies that he has anything to do with it, but Mr. Mullen says he expects to carry the matter through.

The electric-light plant at Hubbard has been destroyed by fire, entailing a loss of $10,000, with $3,000 insurance.

When the proposed extension of the Cleveland, Painesville and Eastern road is completed to Ashtabula, it will connect there with a road to Conneaut. This is a plan to connect Cleveland and Buffalo, and the right-of-way is now being secured between Painesville and Ashtabula.

Plans are still under way for the connection of the cities of Pittsburg and Cleveland. This will be done through the Northern Ohio Traction company and connections it will make with roads running to Warren, and thence east to other points. There are several links to be built, but there are already plans for these, and they will probably be built at an early date.

The Toledo and Findlay Traction company of Findlay has been incorporated, with a capital stock of $1,500,000, the incorporators being Henry Burkhold, George B. Kerper, G. B. Kerper, Jr., E. V. Bope and C. F. Smith. Mr. Kerper purchased the Toledo, Bowling Green and Fremont road a few days ago, and he already controlled the Findlay street railway, which had been extended some distance from the city, in order to connect with the Toledo road. These properties both pass into the possession of the new company, and the connecting link will be rebuilt at once. There are also plans to extend south from Findlay, but they have not been made known.

The City Council of Parkersburg has granted a franchise to the Marietta Electric Railway company, which proposes to build a line between the two towns.

R. Rosenstock of Cleveland has been securing right-of-way in Union County for a line which he says will run from Toledo to Portsmouth, by way of Columbus. He says that it will start from Findlay, which will be the southern terminus of the Toledo and Findlay Traction company's line.

The Sharon and State Line Electric Railway company of Youngstown has been organized by the Penhale-Devitt syndicate, with a capital stock of $10,000, which will be increased later on. A line will be built from Sharon, Pa., to the Ohio state line. This syndicate is now building a line from Youngstown to Newcastle, by way of Sharon.

It is rumored that the Everett-Moore syndicate of Cleveland is negotiating for the Toledo street railway. This would be natural, owing to the fact that the syndicate is planning a system along the lake shore, and now owns the greater part of the interurban lines between Cleveland and Toledo.

Edgar W. Collins has been promoted from the position of local manager of the Postal Telegraph company's office at Cleveland, to superintendent of the second district of the western division, with headquarters at Cincinnati.

Daniel R. Crissinger and other Marion (Ohio) men are promoting a road from Marysville to Marion.

The Canton-Akron Railway company, incorporated last week, will have a capital of $600,000.

O. M. C.

Information from Indiana.

Indianapolis, April 15.—The Evansville Electric Railway company has notified the secretary of state that it has increased its capital stock from $50,000 to $600,000.

The Fountain County commissioners have granted a franchise to the Crawfordsville Traction company to construct and operate an electric road from Hillsboro through the county to the coalfields.

The farmers of Madison and Henry counties, along the line of the proposed road from Newcastle to Pendleton, held another meeting during the week, at which favorable reports were made. The landowners from Newcastle to Cadiz, more than half the distance, have offered to give the right-of-way free of cost, and so also have the majority of those along the balance of the route. It is the purpose to induce some promoter to put in the line by offering a free right-of-way. The line would afford a comparatively direct route from Newcastle to Indianapolis, by means of the Union Traction line from Pendleton.

Kokomo merchants have taken preliminary steps toward building an electric line from that city to Greentown. It is highly probable that the road will be constructed this season. The country is rich, and Greentown is without railway facilities.

The Indianapolis and Greenfield Interurban company has secured a franchise from the council of Dublin, near Cambridge City. The road will be extended from Greenfield to Knightstown, thence through Dublin to Cambridge City, and ultimately further east, until it connects at Richmond with interurban roads running east to Dayton, Ohio.

The Commercial Club at Bloomington has received a proposition from Civil Engineer Scott of Chicago concerning the construction of a steam-electric road between Bloomington and Martinsville and thence to Indianapolis. Another offer has been received from the promoters of the Columbus and Terre Haute railroad. Each proposition calls for a subsidy.

Benson and Clara E. Bidwell of Chicago and Charles F. Bidwell of Toledo have again filed suit against the Indianapolis Street Railway company in the federal Circuit Court. They charge that the defendant is unlawfully using certain devices that belong to the plaintiffs for the operation of trolley cars. The court is asked to grant an injunction. A similar suit was brought against the company some time ago, but was dismissed by Judge Baker on the ground of the insufficiency of the cost bond.

There is no longer any question concerning the building of an electric railway from Shelbyville to Indianapolis. At a meeting held by the company during the week the estimate of the construction and equipment of the road was ratified. Contracts for the construction will be let as soon as the preliminaries can be arranged. The line will parallel the Big Four through the towns of Fairland, London and Acton, over a private right-of-way. It will then diverge, reaching Indianapolis by way of New Bethel. The company that will build the line is composed principally of Shelbyville men, E. K. Adams being the president and T. E. Goodrich, the secretary. The company hopes to have the line in operation by December 1st.

It is now conceded by the citizens generally of the numerous Indiana towns and cities through which the interurban lines pass that they have not suffered in the least in a business way by the opening up of these lines to Indianapolis and other cities. On the contrary, they find a gradual building up of business from one intermediate point to another. F.

Northwestern Notations.

Minneapolis, April 13.—The Cloquet (Minn.) Electric company has been incorporated, with $50,000 capital stock, by local capitalists of that city, and the existing plant has been transferred. The system will be improved and extended.

The Montana street station of the Electric Light and Power company of Butte, Mont., was stopped in its operations for a short time recently by a cat becoming wedged behind the high-tension switchboard controlling the shorter transmission line, carrying 15,000 volts. An Indian got caught in the same place last year and had all the hair on his head burned off.

The electric-light plant of Glencoe, Minn., has been leased to A. D. Le Vesconte of Minneapolis.

The Waterloo (Iowa) Gas and Electric company

plans to expend $125,000 in the construction of a big power plant. The new plant would furnish power for the street-railway company.

Eastern capitalists have recently secured control of the Power and Light company of Helena, Mont. The company has applied for franchises for lighting, both gas and electric, and for a street-car system. The new company proposes to compromise the old claim against the city for $10,500, for lights furnished, taking $7,150, and to give a bonus on the gross receipts of the company. The company agrees to reduce the fare on the street-railway line to five cents as soon as the company shall carry 900,000 passengers in one year. Last year the company carried 700,000, and it is thought that it will not take long to reach the figure set.

The Electric Light and Power company of Fairhaven, Wash., has transferred its property to the Northern Railway and Improvement company, which has been furnishing power for some time.

The Seattle (Wash.) Electric company has bought the Renton coal mines for $134,311, and now has a fine source of supply for fuel. The company plans to use the entire output of the mines in time.

Alexander Hughes of Fargo, N. D., will establish a lighting and steam-heating system in Glendive, Mont., at once.

Work has been started on the proposed electric line from Charles City to Greene, Iowa.

The Edison Light company of Des Moines, Iowa, has resumed work of placing its wires in the business district underground. The company will expend $10,000 this year in the business section.

Electrician William McDaniels has been appointed to succeed L. H. Ong as superintendent of the Mason City and Clear Lake electric railway at Mason City, Iowa.

The new machinery has been placed in the power house on Mill Creek of the Gas and Electric company at Walla Walla, Wash., and the plant is about ready for operation.

The Woodland and Hunter's Park street-car line in Duluth, Minn., is again threatened with a shutdown. This line is owned by a separate corporation from that operating the remaining lines in the city. The Duluth Street Railway company, which has operated the Woodland line, offered to buy it, but could get no satisfactory price. The line ran down and the tracks got in such poor shape that the company thought it unsafe to continue the operation without improvements. This the owners refused to do. A compromise was effected, and the line was operated through the winter. But the same question is again to the fore. The Duluth company offers $5,000 for the line and franchise. The Woodland company offers to sell for $15,000.

The break of two insulators at the Snoqualmie Power company's plant and the grounding of the power cables between the switchboard and the transformers tied up the street-car service in Tacoma, Wash., for four hours recently.

There are three different propositions for electric railways in and around Lead, S. D. The N. E. Franklin company of Deadwood and the Gesky company of Lead are both applicants. It is certain, also, that the Homestake company will ask for a franchise.

The Western Electric company of Chicago has been awarded the contract to install an electric-wiring and conduit system for the St. Paul postoffice, at $2,835. R.

PERSONAL.

Walter H. Chamberlin of Chicago, assistant commissioner of patents, has handed his resignation to the new commissioner, F. I. Allen.

Edward W. Merry, who has been in the employment of the Wisconsin Telephone company at Neenah, Wis., has gone to Kaukauna, Wis., to take charge of the telephone exchange in that city.

At the annual meeting of the Merchants' Club of Chicago on April 13th Mr. B. E. Sunny, western manager of the General Electric company, was elected a member of the executive committee of the club, to serve two years.

James Tomney, treasurer of the Holmes Electric Protective company of New York city, died at his home in Brooklyn on April 11th. Mr. Tomney was 51 years of age and had been treasurer of the Holmes company since its organization in 1883. He leaves a daughter and two sons.

ELECTRIC LIGHTING.

The electric-light station at Canton, W. Va., was burned recently.

An issue of $60,000 bonds is being considered for a lighting plant at San Jose, Cal.

T. S. Hughes and J. G. Russ will establish an electric-light plant at Clifton, Tenn.

The mayor of Hot Springs, Ark., is receiving estimates for the erection of a lighting plant.

It is proposed to enlarge the municipal electric-light plant at Alexandria, Va., at a cost of $20,000.

The town of Roanoke, Ala., has issued $10,000 bonds, bearing five per cent. interest, for a lighting system.

The Winthrop company of Winthrop Harbor, Ill., has been incorporated, with $25,000 capital, to operate a light, heat and power plant. The incorporators are Sol Rosenblatt, Garnett Hogan and Albert K. Hutchinson.

A special election will be held at Chillicothe, Mo., on April 30th, to vote on an issue of $25,000 electric-light bonds.

An election is to be held to decide on an issue of $12,000 electric-light-improvement bonds for Greenport, N. Y.

A bond issue of $80,000 for a municipal water and light plant at Colorado Springs, Colo., has been decided upon.

The city of Winchester, Tenn., will issue $30,000 of bonds for the erection of an electric-light plant and waterworks.

A lighting plant and waterworks will be built at once at Laurel, Md. Information may be obtained from Edward Phelps, mayor.

The Seattle Electric company of Seattle, Wash., will erect a brick and steel power station, to cost $150,000, in the near future.

Henry Crittendon and others have organized a $25,000 company for the establishment of an electric-light plant at Greenville, Miss.

The city of Granite Falls, Minn., has been authorized to issue $6,000 in bonds for the purpose of improving the electric-light plant.

The Vale Electric Light and Lumber company, with a capital of $50,000, is about to install a lighting plant at Manchester Center, Vt.

A special election at East Grand Forks, Mich., has resulted in favor of the issuance of $15,000 bonds for waterworks and an electric-lighting system.

The Port Arthur Light and Power company of Port Arthur, Texas, has been incorporated, with a capital stock of $25,000, by E. J. Baker, G. M. Craig, Frank Cummings and others.

The Abbeville Electric Light and Power company of Abbeville, S. C. (incorporated), will issue $10,000 of bonds for improvement purposes. C. G. Sayre is general manager of the company.

Adam Schantz of Dayton, Ohio, has purchased a site at Daytona, Fla., and will erect a cold-storage plant and electric-light plant for furnishing electricity to the town and to operate an electric road.

The Au Sable Electric Light and Power company of Au Sable Forks, N. Y., has been incorporated, with $25,000 capital, by James Rogers, George Chahoon and J. Monroe Sheffield of Au Sable Forks.

The Citizens' Gas Light and Fuel company of Peoria, Ill., has been incorporated, with an authorized capital of $250,000, to furnish light, heat and power. The incorporators are C. F. Newman, W. S. Walice and C. S. Shirtcliff.

The Montgomery Light, Water and Improvement company of Montgomery, W. Va., has been incorporated, with an authorized capital of $50,000, by B. H. Earley of Dego, J. C. Montgomery, L. C. Montgomery and J. W. Montgomery.

Wallace C. Johnson of Niagara Falls has applied to the Board of Trustees of the village of Middleport, N. Y., for an electric-light franchise, agreeing that if the franchise is granted that he will have all work completed and light furnished on or before October 1st, next.

The International Electric company, with an authorized capital of $3,000,000, has been incorporated in New Jersey, to build and operate power plants for lighting, heating and power service. The incorporators are Adrian H. Miller, Charles M. King and Stephen C. Smith.

Reister Russell, Frank Zouck, T. Rowe Price, W. L. Shriver and others have incorporated the Reisterstown and Glyndon Water, Light and Power company of Glyndon, Md., with a capital stock of $25,000. Frank Zouck, Glen Morris, Md., may be addressed for information concerning the plans of the company.

The establishment of a $20,000 electric-light and power plant is contemplated at Harrisonburg, Va. The Shenandoah River will be harnessed at Grottoes and the electrical energy transmitted to Harrisonburg by underground cable. Information concerning the installation may be obtained from the mayor of Harrisonburg.

The United Telegraph and Telephone company of Baltimore, which recently secured control of the large Independent telephone systems in Maryland, Pennsylvania and West Virginia, will, it is announced, soon take over the United Electric Light and Power company of Baltimore, which furnishes the lighting for that city.

ELECTRIC RAILWAYS.

The Nevada County Traction company of San Francisco, Cal., has been incorporated, with a capital of $100,000, by J. Martin, R. R. Colgate and C. A. Grow.

It is reported that the American Railway company is seeking a 50-year franchise for an elevated road in the southern section of Chicago. The route proposed is to extend "southerly, southeasterly and southwesterly" from Van Buren street to Sixty-third street, between Western and Wabash avenues. South of Sixty-third street the line may be built anywhere within the city limits.

It is reported that the Carrollton, Worthville and Owenton Electric Railroad company will build an electric road from Milton to Owenton, Ky., a distance of 40 miles.

The Los Angeles and Pasadena Electric Railway company has been incorporated in California, with an authorized capital of $1,000,000, by A. McNally, D. B. Dewey, J. W. Hughes and others.

The City Council of Charleston, S. C., has granted a franchise to the Charleston Consolidated Railway company to build its proposed line to the exposition grounds. P. H. Gadsden may be addressed.

The Freeport Electric Railway company of Rockford, Ill., has been incorporated, with $50,000 capital stock, to construct an electric railway from Freeport, Ill., to Rockford. The incorporators are T. M. Ellis, J. H. Catlin, C. F. Wilson and T. D. Reber.

The Cleveland capitalists, headed by L. J. Wolf, who recently bought the Elgin City, Carpentersville and Aurora, the Aurora and Geneva and the Aurora City electric railways, and are building a line from Elgin, Batavia and Aurora, through Wheaton, to Chicago, have purchased the Aurora, Yorkville and Morris railway, including Riverview Park. The road is bonded for $150,000 and capitalized at $150,000. The price paid is said to have been $225,000.

The rights-of-way and franchises for the Rochester and Eastern railway in Western New York having been practically all secured, application will soon be made to the Railroad Commission for a charter. The road will have a traffic arrangement with the Rochester City railway, and the Geneva, Waterloo, Seneca Falls and Cayuga Lake Traction company, so that passengers can be carried from the center of Rochester to the villages of Waterloo or Seneca Falls and the shore of Cayuga Lake, opposite the village of Cayuga. It is rumored among those interested in the road that if the Rochester and Buffalo electric road is built a traffic arrangement will be made between that company and the others interested, so that passengers can enter a train at Buffalo and go through to Cayuga Lake without changing cars.

AUTOMOBILES.

The Chicago Automobile Club held the first run of the year on Sunday, April 14th. The start was at 2 p. m., from the clubrooms in Steinway Hall, and about 20 miles of boulevards was covered, the party disbanding in Ashland boulevard.

A recent special police order is directed toward the enforcement of the regulations concerning lamps, gongs and brakes on automobiles and bicycles on public streets in Chicago. The order also has for its object the prevention of excessive speeds by such vehicles.

Announcement is made of an issue of $1,675,000 six per cent. short-term bonds by the Electric Vehicle company. The bonds bear interest from May 1, 1901, and mature April 30, 1904. They have been underwritten at 90 by a syndicate which agrees to take all that have not been subscribed for at that figure by the present shareholders. The sum to be realized from these bonds, $1,507,500, will more than pay off the existing debt of the company, and the balance will be used as working capital.

PUBLICATIONS.

A catalogue of electrical and steam machinery has been issued by Rossiter, MacGovern & Co., dealers in second-hand engines, boilers, generators, condensers and general equipment for lighting and power stations.

"Modern Heat" is the title of an attractive pamphlet describing the apparatus manufactured by the American Electrical Heater company of Detroit, Mich. Soldering irons, portable stoves, sad irons of all kinds, radiators, griddles and many other heating appliances are illustrated, and, in addition, a complete telegraphic code is included in the circular, together with price-lists.

The Stanley Electric Manufacturing company of Pittsfield, Mass., has issued a new bulletin. This one is No. 116, and illustrates and describes a new type of S. K. C. static ground detector, designed for circuits carrying very high voltages. This is said to be the first instrument of the kind combining thorough reliability with absolute immunity for switchboard attendants from danger of shock. The instruments are charged statically through the medium of condensers; thus live wires are kept out of and entirely away from the instrument. Those familiar with ground detectors and their uses and advantages will be prompt to appreciate the advantages of this instrument.

As a monthly supplement to London Engineering, that well-known journal has begun the publication of Traction and Transmission. The initial number for April contains a number of valuable contributions on electric-railway and allied topics by H. F. Parshall, B. Alfred Raworth, Alfred H. Gibbings, R. Mauermann, J. Sigfrid Edstrom and others. Several plates and diagrams serve to illustrate the articles. The new magazine is printed in large type (pica), on heavy paper, with wide mar-

gins, and has the air of thoroughness and solidity, characteristic of the best English engineering literature. It is, however, high-priced, and is evidently intended to reach a comparatively small class of technical readers rather than the great mass of English ratepayers who need enlightenment on the possibilities of electric traction.

The American District Steam company of Lockport, N. Y., is distributing a carefully prepared booklet illustrating and describing its systems and apparatus for heating from central stations. This company exploits the Holly system of direct and exhaust-steam distribution for heating and power and the catalogue treats of valves, mains, heaters, methods of insulation and meters. Many valuable hints on operation and maintenance of steam-heating systems are given, together with a review of the advantages of steam over hot-water installations.

The Stanley Electric Manufacturing company has issued two new bulletins descriptive of alternating-current apparatus. One is devoted to the illustration and description of the S. K. C. frequency changer. These machines may be employed to transform from one frequency to another, and at the same time, if desired, to effect a transformation of voltage and a variation in phase relations. A single field coil is used, the machine being essentially a synchronous motor at one end and an alternating-current generator at the other. The field coil is wound on a copper spool to guard against injury to the winding by a sudden opening of the field circuit. In another bulletin is described a high-voltage testing set for tests of insulating materials and other high-tension work. A voltage of 120,000 is provided for, a highly insulated spark gap being included in the equipment and serving virtually as a voltmeter. A curve shows the voltages at which sparking should take place from 5,000 to 150,000 volts.

SOCIETIES AND SCHOOLS.

The New York Electrical society will hold its next meeting at Havemeyer Hall, Columbia University, Thursday, April 25th, when Mr. C. F. Scott, chief electrician of the Westinghouse Electric and Manufacturing company, will lecture on "Alternating-current Motors."

MISCELLANEOUS.

The Manchester Technical School, Manchester, England, is to have a department especially equipped for insulation testing.

Acting Consul-general Westacott of London, under date of March 16, 1901, reports that an inquiry has been made at that office for the names of firms manufacturing American coal-cutting machinery. He requests that all replies be addressed to the United States consulate-general, London.

On May 7th and 8th examinations will be held in all postal free-delivery cities in the country by the United States Civil Service Commission, for the position of inspector of mechanical and electrical engineering in the supervising architect's office at Washington. The position pays $2,190 per annum. Information concerning the examination can be obtained from the commission at Washington.

It has been discovered, so it is said, that the opacity of substances to Roentgen rays depends on their atomic weight. The greater this weight, the higher is the opacity. The opacity is independent of physical condition, that is, for instance, it is the same for ice as for water, and is not affected by temperature; it is also independent of atomic arrangement and chemical combination. This interesting law was announced by M. L. Benoist to the Paris Academy of Sciences on February 11th.

TRADE NEWS.

C. L. McDonald, secretary of the St. Louis Steam Forge and Iron Works, St. Louis, Mo., wishes prices on motors and generators.

The Monarch Electric and Wire company of Chicago has been incorporated by Samuel J. Howe, Ralph R. Kelly and Mark C. Keller, to manufacture electrical goods and supplies. The capital stock is $25,000.

The Pfeiffer Chemical company, 508-512 North Commercial street, St. Louis, Mo., is in the market for generators, motors and electrochemical apparatus.

The western office of the Standard Underground Cable company, under the managership of J. R. Wiley, has been removed from 542 to 322 Rookery building, Chicago.

The Cutler-Hammer Manufacturing company of Milwaukee has opened a branch office at No. 403 Fisher building, Chicago. This office will be in charge of Mr. C. H. Norwood.

The Chicago office and salesroom of Pass & Seymour, which is in charge of John W. Brooks, sales agent, has been moved to 130 West Jackson boulevard, where larger quarters have been secured.

The Iron Age says that the Westinghouse Electricitaets Gesellschaft, with a capital of 1,000,000 marks, has been organized in Berlin, Germany, to manufacture Westinghouse electrical specialties.

The National Battery company of New York, with a capital of $500,000, has been incorporated, to deal in batteries. The incorporators are W. B. Greely, C. A. Wendall, R. S. Nichols, Francis P. McManus and John M. Scobel of New York.

Contracts have been placed by the Westinghouse Electric and Manufacturing company of East Pittsburg for the erection of a large plant for the manufacture of newly patented friction-draft gear. The main building will be of brick, 800 by 200 feet in size.

For the convenience of its eastern customers, the Cutler-Hammer Manufacturing company of Milwaukee is carrying a stock of standard apparatus at its Westfield (N. J.) factory and at its New York office, 136 Liberty street, New York city. The company also has facilities at its Westfield factory for manufacturing any special electric motor-controlling devices promptly.

A. L. Dyke, formerly with the St. Louis Automobile and Supply company, is now located in the Linmar building, St. Louis, and is offering to the trade automobile parts and supplies. Mr. Dyke has had his goods on the market for over two years and he is now able to supply a complete line of all the component parts and fittings necessary to building a first-class automobile. He has recently issued a 16-page catalogue descriptive of his goods.

The New York Sun is authority for the statement that a gigantic plant for the manufacture of insulated-copper wire is to be located in Newark, N. J. The backers of the project have not been divulged yet, but three of the principals are said to be affiliated with the United States Steel corporation. A site has been procured, and it is said, on good authority, that $1,000,000 will be expended on the plant. Orders for machinery are said to have been placed, and it is reported that building operations will be begun about July 1st. The new company will, it is said, have a capital of $10,000,000, and fully 3,500 hands will be employed.

Press dispatches from Boston state that the main building of the large works of the B. F. Sturtevant company at Jamaica Plain was burned on April 14th. The loss is said to have been $350,000, fully insured. The company had recently added $75,000 worth of tools and machinery, and had a large amount of electrical work ready for shipment. It also had a large number of engines and blowers for the government for use on battleships and cruisers in course of construction, all of which were destroyed. It is reported that the business will be carried on without much delay. Over 700 men were thrown out of employment temporarily.

The Bullock Electric Manufacturing company, through its secretary, James Wilson Bullock, has acquired control of 15 acres of land directly opposite the present plant at East Norwood, Ohio. Upon this tract the Norwood Foundry company will erect a foundry building, 200 feet long by 150 feet in width, a pattern-storage house of fireproof construction, 50 by 150 feet in size and three stories high, and a modern office structure. All these buildings will be built of buff pressed brick, with steel frames and trusses, to conform to the present buildings of the Bullock company. The foundry will be equipped with three electric cranes, the largest of which will have a capacity of 50 tons. The side bays, which will be 25 feet in width, will be served by hand traveling and jib cranes. The plant will be of the most modern character, and electricity will be used for power and lighting throughout. While this foundry will be operated under the name of the Norwood Foundry company, it will serve primarily the needs of the Bullock Electric Manufacturing company. It will also be in position to handle outside orders in the most satisfactory manner. That it will be operated successfully is guaranteed by the fact that it will be under the direction of Hoffinghoff & Laue of Cincinnati, a firm whose skill in handling foundry work is everywhere acknowledged.

BUSINESS.

The Electric Appliance company, Chicago, is advertising its new hotel telephone system, which it claims has a big field, replacing the present telephone and annunciator service now in vogue in hotels and apartment houses.

The Central Electric company of Chicago carries in stock large quantities of construction material, such as cross-arms, pins, brackets, insulators, wires, etc. By making a specialty of prompt shipments this company is in a peculiarly good position to handle large construction orders.

The Chicago office of the New York Insulated Wire company, of which James Wolff is in charge, has been removed from its former location at 320 Dearborn street, and now occupies much larger quarters in the Electrical building at Jackson boulevard and Desplaines street. The increased space will enable a more varied stock to be carried, and should therefore result in more prompt shipments than heretofore.

The Western Electrical Supply company of St. Louis has just issued to the trade two catalogues, one on direct and the other on alternating-current fan motors and ceiling fans. The company is offering for alternating currents the new model 1901 Emerson desk-fan motors and ceiling fans. It has handled this fan for some years. This year's fan has a few minor improvements over last year's, but nothing radical, as the manufacturer claims it has a fan as nearly perfect electrically and mechanically as can be made. Especial attention is called to the Parker noiseless blades with which all the Emerson fan motors are equipped. For direct-current work the Western company is offering the Peerless desk-fan motors and ceiling fans, and it is now prepared to make shipments of these fans for any voltages. The Peerless fan is said to be simply and strongly made, graceful in appearance and practically noiseless in operation. It has self-oiling and self-aligning bearings, self-adjusting carbon brushes, and is believed to have the highest possible efficiency.

The Crocker-Wheeler company, whose works are at Ampere, N. J., reports that the orders booked for the month of March exceed, by a considerable percentage, the largest manufacturing business which the company has had at any time during its previous history. Among the more important contracts which have been closed are those for 500 horsepower in crane motors for the Philadelphia Engineering Works; for the new United States mint at Philadelphia, 19 motors, aggregating 115 horsepower; for the Newton Street Railway company, Newton, Mass., one 400-kilowatt, engine-type railway generator; for the Guggenheim Smelting Works, Perth Amboy, N. J., two 520-kilowatt, engine-type generators for electrolytic use; for Alsen's American Portland Cement company of West Camp, N. Y., three 400-kilowatt, engine-type power generators, and one 100-kilowatt, engine-type lighting and power generator, besides 43 motors, aggregating 2,000 horsepower; for the John B. Stetson company, Philadelphia, Pa., two 300-kilowatt, engine-type lighting and power generators, and for the Western Union Telegraph company, 26 machines for telegraphic work.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 9, 1901.

671,438. Trolley Finder for Electrical Railroads. Paul Goldsmith, Troy, N. Y. Application filed August 16, 1900.

Two outwardly flaring arms are each provided at their lower ends with an offset part. Each of the finder arms has on the outer face where offset two guide arms that are arched to meet at the ends and to pass over the journal connection between the finder arms and axle, and where united are provided with an insulated and grooved wheel. A frame having each of its sides at its upper end passed between the guide arms of the outer side of each of the finder arms is journaled on to the latter. When a circuit wire leaves the trolley it will, by the guide arm with which it comes in contact, be guided into the groove of the insulated wheel, and thus stop the car, putting the wire in a position to be operated upon by the trolley finder as actuated by the frame.

671,458. Electric Telephone Receiver. Ernest H. Strauss and Frank J. Stein, Chicago, Ill. Application filed August 13, 1900.

A magnetic system is fixed to a cup-shaped case provided with a screw thread around its lower exterior portion. A tubular insulating casing around the magnetic system engages with this screw thread. An insulating cap engages with a screw thread around the upper portion of the case, and extends over the joint formed between the tubular casing and the cup-shaped case.

671,473. Holder for Telephone Receivers. Thomas Emerson, Newport, R. I. Application filed September 27, 1900.

A telephone is provided with the usual forwardly and upwardly directed arm with which the transmitter is connected, and with the usual fork from which the receiver is suspended. A rod, connected with the arm transversely thereof and transversely adjustable thereon, is provided with an upwardly directed extension, and a receiver holder is connected with the extension. A transverse arm mounted on the rod turns thereon, and beneath its rear end the cord of the receiver is passed.

671,482. Electric-railway System. Paul E. Herkner, Berlin, Germany. Application filed November 30, 1900.

Magnetizing windings are provided for increasing the adhesion between the track and the car wheels. Circuit connections unite the magnetizing windings and the windings of the motors to the controller contacts, the controller being arranged to utilize the magnetizing windings as controlling resistances in circuit with the propelling motors.

671,489. Booster-crusher. Mathias Pfatischer and Charles H. Bedell, Philadelphia, Pa., assignors to the Electro Dynamic company, Philadelphia, Pa. Application filed August 24, 1900.

A motor generator is actuated and included in a circuit supplied from a variable source of electrical energy. A field-magnet-controlling device for the motor generator governs the direction of the electromotive force produced by the motor generator, and electromagnetic means are supplied for actuating the controlling device.

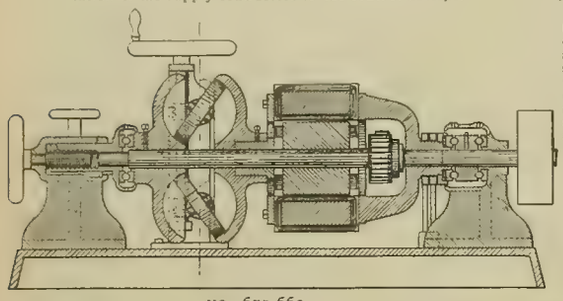
671,490. Controller for Electric Motors. William B. Potter, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed December 30, 1897.

In a controller for electric motors, which is arranged to open the circuit between its series and parallel positions, a separate switch establishes a series parallel relation of the motors, and a resistance switch controlled by the series parallel switch includes an auxiliary resistance in parallel with the main resistance to increase the current-

carrying capacity of the resistance when the motors are connected in parallel

671,491. System of Train Control. William B. Potter, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed June 12, 1899.

In a polyphase electric-railway installation a car system is supplied with current through a number of contact devices carried by the car and engaging corresponding supply conductors arranged along the railway. The controller is provided with a reversing switch, and an auxiliary reversing switch is connected in series with the controller-reversing switch, so that, by proper adjustment of the auxiliary reversing switch, the controller-reversing switch may always be thrown in the same direction to propel the car in a given direction irrespective of the relation of the supply conductors to the contact devices.



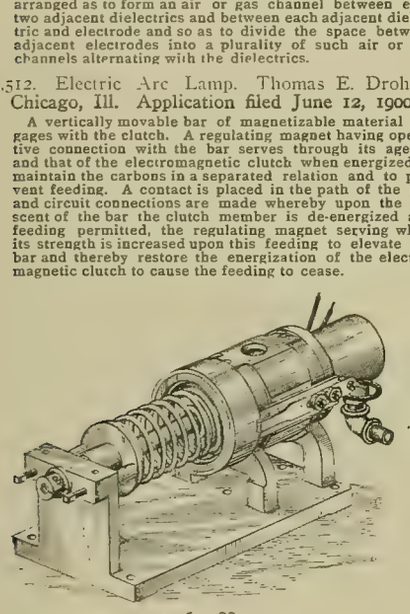
NO. 671,662.

671,507. Apparatus for Electrically Treating Gases. Reginald J. Yarnold, Streatham, England. Application filed August 29, 1899.

Several separated channel-forming dielectrics are interposed between each two adjacent electrodes and so arranged as to form an air or gas channel between each two adjacent dielectrics and between each adjacent dielectric and electrode and so as to divide the space between adjacent electrodes into a plurality of such air or gas channels alternating with the dielectrics.

671,512. Electric Arc Lamp. Thomas E. Drohan, Chicago, Ill. Application filed June 12, 1900.

A vertically movable bar of magnetizable material engages with the clutch. A regulating magnet having operative connection with the bar serves through its agency and that of the electromagnetic clutch when energized to maintain the carbons in a separated relation and to prevent feeding. A contact is placed in the path of the bar and circuit connections are made whereby upon the descent of the bar the clutch member is de-energized and feeding permitted, the regulating magnet serving when its strength is increased upon this feeding to elevate the bar and thereby restore the energization of the electromagnetic clutch to cause the feeding to cease.



NO. 671,883.

671,515. Contact Shoe for Electric Railways. George T. Hanchett, Hackensack, N. J., and John M. Murphy, Torrington, Conn., assignors to the Murphy Safety Third Rail Electric company, New York, N. Y. Application filed July 27, 1900.

The current collector comprises a suitable hanger frame including a laterally projecting base carrying a longitudinally extending support suspended from it, a link member pivotally connected to each end of the support, a drag plate pivotally hung at one end on one link member, its free end extending in the direction of the other link member, and a second drag plate disposed parallel with the first drag plate pivotally hung from the other link member and having its free end extending in the direction of the first.

671,603. Electric-lamp Receptacle. Wilbert E. McDonald, Chicago, Ill. Application filed September 22, 1897.

A spherical holder forming an essential part of an iron conduit consists of two equal sections and contains a lamp socket. A projection from one-half of the holder contains a threaded aperture for fastening the conduit to the holder in alinement with the division between the two sections.

671,618. Flexible and Adjustable Supporting Device for Electric Lamps. William F. Brewster, New York, N. Y. Application filed November 30, 1900.

A series of lamp sockets or receptacles, links or mechanical connections is provided with set screws, for adjustably uniting such lamp sockets or receptacles. Suitable devices form complementary sections of a letter, figure or design, in such positions as to render optically continuous the lamps and the spaces between adjacent lamps.

671,619. Flexible Supporting Structure for Electric Lamps. William F. Brewster, New York, N. Y. Original application filed November 30, 1900. Divided and this application filed January 22, 1901.

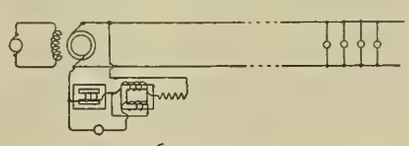
This invention consists of a connecting device for electric-lamp sockets or receptacles consisting of a metal strip, a ring at one terminal integral therewith, means for causing the ring to grip and hold a socket or receptacle and means for adjustably connecting the opposite end of the strap to a second connecting device.

671,660. Electrically Operated Fan. Richard W. Schmelz, Brooklyn, N. Y. Application filed November 6, 1900.

Two solenoids are connected with a support at opposite points. A fan rod is pivotally suspended between the solenoids, and provided with a segmental armature head which passes through them. A switch bar pivotally suspended from the fan rod between the solenoids is provided with an armature arranged transversely thereof. Contact devices are arranged between the armature and the solenoids. A cross bar connected with the switch bar below the armature is provided with projecting pins or stops.

671,662. Electric Motor. Henry P. White, Kalamazoo, Mich., assignor of three-fourths to Charles D. Fuller, Kalamazoo, Mich. Application filed October 5, 1899.

The subject of this patent is a motor comprising a rotative armature and rotative field which turn in opposite directions. Shafts are connected with and driven by the armature and field. Friction disks are connected with shafts and rotate about a common axis. Several oscillatory disks have opposite peripheral engagement with the opposing faces of the disks and rotate on axes transverse to their axes of rotation, and means are provided for simultaneously oscillating the several oscillatory disks about their transverse axes. (See cut.)



NO. 671,730

671,715. System of Electrical Distribution. Charles I. Young, Philadelphia, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed August 8, 1899.

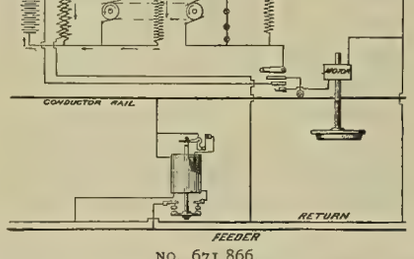
A governing mechanism is provided for engines driving generators comprising an inertia element acting to increase the speed of the engine when its shaft receives a sudden impulse in the direction of its motion and to decrease the speed of the engine when its shaft receives a sudden impulse in the opposite direction. An independent centrifugal element acts to decrease the engine speed when it becomes too high and to increase it when it becomes too low.

671,725. Heater for Electric Glower Lamps. Frederick M. Goddard, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed July 20, 1899.

A thin, flat body of insulating, heat-resisting material has grooves in one of its faces and integral projections alternating with the grooves on opposite edges and a heating conductor lying in the grooves and looped under the projections.

671,730. Frequency or Speed Indicator. Ralph D. Mershon, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed July 12, 1899.

A speed or frequency indicator for dynamo-electric machines comprises a local circuit supplied with alternating currents, directly or indirectly, from the main generator of the system, one or more inductive windings and an ohmic resistance in the local circuit, the ohmic resistance being of such proportions as practically to control the amount of current flowing in the local circuit, and an indicating instrument connected in shunt to all or a portion of the inductive winding or windings. (See cut.)



NO. 671 866.

671,732. Wireless-telegraph System. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Marie V. Gehring, Philadelphia, Pa. Application filed October 18, 1900.

The coherer in this system comprises non-conducting tubes, conducting plugs and their connections. Segmental non-conducting plates are fixed to the opposite faces of the plugs and the conducting particles interposed between the plugs. Means are provided for reversing the position of the tubes whereby the conducting particles will be alternately brought into contact with the plugs and their non-conducting plates.

671,762. Junction Box. Edwin T. Greenfield, New York, N. Y. Application filed March 2, 1901.

Outwardly extending necks integral with the box have their inner surfaces flared or bell-mouthed, the exterior inner portion of the necks being of larger diameter and adapted to receive the ends of conduit pipes so that the inner surfaces of the latter, when in position, shall be flush with the inner bore of the necks.

671,763. Junction Box. Edwin T. Greenfield, New York, N. Y. Application filed March 2, 1901.

A bell-mouthed bushing for a junction box has its outer interior diameter greater than the diameter of the bushing proper; a conduit pipe and set-screws for securing the bushing to the conduit are provided.

671,776. Annunciator. David Rousseau, New York, N. Y. Application filed July 21, 1899.

A coil is carried in a non-magnetic frame. A pair of armatures is pivoted on a magnetic base, co-operating with the ends of the core of the coil. An annunciator drop is maintained in a normal, retracted position by the armatures, and restoring cams on the annunciator drop restore the armatures during the resetting operation.

671,813. Temperature Alarm and Indicator for Car-axle Boxes. Robert G. Callum, Washington, D. C., assignor to the Callum Fire Signal company, Washington, D. C. Application filed October 5, 1899.

A thermostat is secured to or near each axle-box of a car. Independent circuits are provided, each controlled by a thermostat, and an annunciator within the car has a drop for each circuit. A second circuit includes an annunciator in the cab of an attached locomotive controlled by any one of the thermostats on the car.

671,835. Hydraulic Press for Splicing Electrical Conductors. Thomas J. McTighe, New York, N. Y. Application filed March 30, 1900.

A stationary frame carries a stationary die. A second die is movable independently of the frame. A gap is provided for the removal of the work transversely from between the dies, also a movable pressure-resisting closure for the cap.

671,866. Electric-railway System. John M. Murphy, Torrington, Conn., assignor to the Safety Third Rail Electric company of New York. Application filed August 4, 1898.

Automatic circuit-shunting devices are arranged to be governed by a source of energy on the car. This source of energy includes a rotary transformer having means for varying the magnetizing force for the armatures, these means being adapted to be brought in line with the main or feeder current when the controller is set to operate the shunting devices from the source of energy on the car. (See cut.)

671,876. Self-locking Insulator. Willard P. Beardsley, Altoona, Pa. Application filed March 19, 1900.

The body is formed with a central vertical socket, and has external screw threads at its top and a passage or chamber with a straight and vertical wall and an irregular wall opposite thereto formed with a bearing piece placed above the floor of the chamber. A locking pawl formed with a heel extends under the bearing piece, and a pin pivotally connects the pawl to the bearing piece. A spring moves and maintains the pawl in a locking position.

671,883. Electric Switch. Francis Head, Philadelphia, Pa. Application filed January 28, 1901.

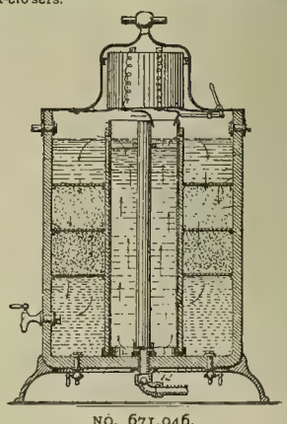
A rod is operated by variations in fluid pressure. The rod completes an electric circuit between contact points. A force is exerted opposing movement of the rod by the fluid and a device holds the rod stationary until the pressure has increased to a point beyond that at which it would otherwise have overcome the opposing force and have moved the rod. (See cut.)

671,891. Electric Toy. Arthur A. Kent, Lebanon, N. H., assignor of one-half to Frank B. Kendrick and William F. Davis, Lebanon, N. H., partners, under the firm name of Kendrick & Davis. Application filed January 29, 1901.

A motor comprising stationary field magnets and a revolving armature is mounted upon a spindle which receives and supports color disks or other suitable visual devices. An automatic switch controls the current to the armature, and comprises contacts connected with the terminals of the armature winding and mounted upon and revolving with the spindle. Stationary brushes are connected with a suitable source of supply and engage and disengage the contacts during the revolution of the armature, and are held in disengagement therefrom when the motor is stopped and its armature attracted and held in its normal position by the field magnets

671,898. Thermometric Alarm System. Norman Smith, Oneonta, N. Y., assignor to N. S. Murphy, Centralia, Pa. Application filed May 25, 1899.

Several circuit-closers, each comprising a number of series of contacts, are provided, together with means for engaging the contacts. An indicator comprises a number of groups of visual indicator elements, one group connected to the corresponding series of contacts of all of the circuit-closers. Separate means are provided for completing the circuits through the last-named indicator elements and all of the corresponding contact points of each circuit-closer. A second group of indicator elements having individual connections with the corresponding contacts of their respective circuit-closers is provided, the circuits of the second group being adapted to be completed by their respective circuit-closers.



NO. 671,946.

671,907. Controller for Motors. Frederick B. Duncan, Madison, Wis., assignor to Northern Electrical Manufacturing company, Madison, Wis. Application filed July 9, 1900.

A movably mounted core for a solenoid responsive to variations in the current is provided with an engaging part. Another engaging part is associated with the controlling arm, the two parts being brought into engagement when the core is attracted by the solenoid and becoming disengaged when the current through the solenoid falls below a predetermined point.

671,946. Electrolytic Water-purifying and Filtering Apparatus. Charles E. Holland, New York, N. Y. Application filed November 28, 1900.

The subject of this patent is a purifier comprising an exterior shell and an inner insulating cylinder and passages for the flow of water from the purifying apparatus into the reservoir constituted by the shell. A tubular electrode within the insulating cylinder constitutes one of the electrical elements, and a central vertical bar within the tubular electrode constitutes the other. Means are provided for conducting the water upwardly through the tubular electrode. Connections are made between a battery and the electrodes. (See cut.)

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Montgomery Waterpower and Electrical Plant.

By H. C. Abell.

Probably one of the most interesting, instructive and modern plants in the South is that of the Montgomery Light and Water Power company, which will supply light and power in the city of Montgomery, Ala.

Power House and Dam.

The power house and dam are situated on the Tallapoosa River, about 30 miles from the city of Montgomery. The spillway of the dam is 640 feet long, with an average height of 40 feet, built of rubble masonry, on solid-rock foundation, finished on top and back with two feet of concrete, a section being shown in Fig. 1. The downstream side of the power house and dam is shown in Fig. 2 and the up-stream side in Fig. 3.

The dam is built in a curve of one degree and 30 minutes at 3,800 feet radius, and will raise the water sufficiently to give a level surface for seven miles up the river, with an average width of 3,200 feet, giving a large storage capacity. At the end of the dam is the heavy bulkhead wall (Fig. 4), 210 feet long and 38 feet wide at the base, into which are built four intake pipes (wheel cases), 12 feet in diameter, for the main waterwheels, and two pipes, 36 inches in diameter, for the two exciter wheels, also head gate, rack bars, etc.

A very neat arrangement in front of the head gates for shutting the water off in case of necessary work on the rack frame, bars, or head gates consists of a channel iron built into the masonry, into which stop logs can be slid, as shown in Fig. 4. Near the end of the bulkhead wall three gates have been put in on the butterfly principle, to allow sufficient water to go through to operate the turbines of the Tallassee Falls Manufacturing company's cotton mill, 3½ miles below. The bulkhead wall acts as the north wall of the power house, the rest of the walls being built of brick on stone foundation.

The power house is 137 feet long by 53 feet wide, inside measurements, with a brick wall through the center, separating the wheel room from the generating room, as shown during the process of construction in Fig. 5, page 282.

Over the wheel room is a second story, the full length of the building, divided into four rooms, for the step-up transformers, lightning arresters, high and low-tension switchboards, storeroom and office. In the generator room a Whiting traveling hand crane of 15 tons' capacity has been installed, as shown in Fig. 6.

Generation.

The three main waterwheels for this plant were furnished by the S. Morgan Smith company of York, Pa., and are of the McCormick type. Each of the 42-inch turbines is enclosed in a horizontal steel case, as shown in Fig. 7. The water is supplied by the open forebay, and the wheels are driven under pressure due to 18 feet of head above, with a draft-tube vacuum, due to about 22 feet of fall below.

Each turbine is direct-connected to an 875-kilowatt generator by means of an insulated coupling. Each generator is guaranteed to deliver at 200 revolutions per minute 1,250 horsepower at the generator shaft at seven-eighths gate under a normal working head of 40 feet, operating with an efficiency of 82 per cent. and regulated by a Lombard waterwheel governor. The governor will be capable of completely closing the gates of its corresponding set of waterwheels in 10 seconds, upon the whole load on the turbine being instantly thrown off, and of holding the speed of the waterwheel within three per cent. of normal upon an instantaneous change of 50 per cent. of the load.

In addition to the wheels just described, there are two pairs of 18-inch wheels, of the same manufacture, used in operating the exciters, for furnishing the exciting current to the three-phase generators in the station, each to deliver 85 horsepower at 500 revolutions per minute and regulated by a small Walsh governor.

The electrical equipment at the generating station is of the Stanley manufacture throughout. There are three generators of the three-phase, revolving-field type, of 875-kilowatt capacity each, wound for 2,000 volts and designed for 7,200 alternations per minute at 200 revolutions per minute, the wave form not to vary over five per cent. from that of the true sine curve.

The two exciters are 60-kilowatt, 85-volt, four-pole machines, directly connected to the exciter turbine running at 500 revolutions per minute. Each exciter is sufficiently large to excite fully the fields of four generators of the size and type mentioned above.

There are three banks of three step-up transformers (nine transformers in all), each of 289-kilowatt capacity, of the Stanley water-cooled, oil-insulated type, raising the voltage from 2,000 to 30,000 volts, the current having 60 cycles and the circuits being delta-connected.

There are three sets of switchboards at the power house. The generator switchboard consists of three generator panels and one exciter panel, with suitable measuring instruments, synchronizers, ground detectors, plugs and switches, and designed so that any generator or set of generators in multiple may operate on either of the two lines. The low-tension switchboard consists of three panels, each equipped with an ammeter, fuse blocks and a three-pole, double-throw switch, in order to throw any set of the three transformers on to either line. The high-tension board consists of nine panels, each with a high-tension circuit-breaker and ammeter, making a

Fig. 1. Section of Dam.
Fig. 2. Power House and Down-stream Side of Dam.
Fig. 3. Up-stream Side of Dam.
Fig. 4. Bulkhead Wall.

MONTGOMERY WATERPOWER AND ELECTRICAL PLANT.

perfectly flexible system, so that any three transformers can be banked together and any banks thrown in multiple on either line.

A fourth wheel case has been set, the foundation bed, etc., having been prepared for the fourth generator, which can be placed whenever there is a sufficient demand for the power.

TRANSMISSION.

The transmission line is about 30 miles long, 35-foot poles being used, spaced 100 feet apart. It is composed of two three-phase circuits, each circuit

FIG. 5. MONTGOMERY WATERPOWER AND ELECTRICAL PLANT.—POWER HOUSE IN COURSE OF CONSTRUCTION.

consisting of three No. 5 B. & S. hard-drawn copper wires, one circuit being transposed eight times and the other twice in the entire distance. The insulators used are of exceptionally good quality, being the six-inch, triple-petticoated, Boch patent type, manufactured by the R. Thomas & Sons company of East Liverpool, Ohio.

A telephone line is strung on brackets five feet below the lowest cross-arm of the high-tension circuits and transposed every second pole.

DISTRIBUTION.

The distributing station in Montgomery is so arranged that in case of accident to the transmission line or waterpower equipment, steam engines can be started, and all the lighting, street-railway and small-power business taken care of. The dynamo and engine room is 127 feet long by 56 feet wide. A plan of it is shown in Fig. 8, page 283. An addition has been built to receive high-tension apparatus.

The high-tension switchboard at the distributing station is similar to the one at the generating station. There are six step-down Stanley transformers, each of 382 kilowatts' capacity, stepping down from 27,000 volts to 2,300 volts, and from three-phase to two-phase. The distributing switchboard, a front view of which is shown in Fig. 9, consists of three receiving panels and three distributing panels, each distributing panel having two single-phase circuits, four of 100 amperes' capacity each and two of 50 amperes each, the Stanley regulator being used. The wiring of one distributing and one receiving panel is shown in Fig. 10.

Fig. 8 explains the arrangement of the engine and dynamo room at the distributing station. (D) is a steam engine 24 inches by 48 inches. (E) is a steam engine 32 inches by 60 inches. (F) is a steam engine 20 inches by 60 inches. (A), (B) and (C) are 250-kilowatt, synchronous motors, two-phase, 60 cycles, turning at 450 revolutions per minute. (A) and (B) will run the 500-volt, direct-current apparatus through the countershaft, operating the street-railway machines Nos. 1, 2, 3, 4, 5 and 7 and the 500-volt power machine No. 6, (C) being in reserve.

The synchronous motors will be run as alternating-current generators by the engines in case of accident to the waterpower plant. The motor switchboard is so arranged that the current from these machines can be thrown into the receiving panels of the distributing switchboard. These generators will then take care of the total lighting and small-power business, as the arc lamps are to be changed to alternating current.

The scheme of operating one machine either as a motor or generator was first used by Mr. Henry L. Doherty at St. Paul, Minn., the entire switchboard for that plant having been specially designed by Mr. L. G. Van Ness.

The synchronous motors, arc lamps and motor switchboard are furnished by the General Electric company.

The city will be divided into six circuits, fed by separate sets of primaries. On each circuit the same size transformers are used as much as possible, and banked, feeding a three-wire secondary. Between two transformers on the two outside wires of the secondary mains junction boxes will be inserted, thus preventing the crippling of the whole bank should the fuse on any of the transformers blow. The 500-volt, direct-current power motors will be replaced with alternating-current apparatus wherever possible, and separate power circuits used for the city system.

The company hopes to do a large power business, as it is equipped with first-class apparatus, being a fair example of the numerous up-to-date plants controlled by Emerson McMillin & Co. The company will soon be able to furnish power to either large or small consumers at attractive rates. The contractor and engineer for the entire equipment of the Montgomery company is the International Hydraulic company of New York.

FIG. 6. MONTGOMERY WATERPOWER AND ELECTRICAL PLANT.—GENERATOR ROOM IN POWER HOUSE.

Plans have been submitted to the Chicago commissioner of public works showing the proposed asphalt street which the South Side Elevated Railroad company proposes to build under its structure in return for leave to add a third track, as mentioned in a recent issue of the Western Electrician.

Recent Development in Central-station Equipment.[1]

BY P. JUNKERSFELD, B. S.

The wonderful advances in the application of electricity and the constantly increasing appreciation of the additional comforts and increased facilities for industrial progress have created an urgent and enormous demand for the economical generation and distribution of electrical energy. Millions and millions of capital are being invested annually in generating plants and systems, and while the state of the art is constantly changing, it yet seems probable that at least some of the more recent developments will not soon be superseded.

In the largest cities of the country electrical energy, in the form of three-phase, 25-cycle currents, is now generated and transmitted to rotary-converter sub-stations which distribute direct current to an Edison three-wire network at 250 to 300 volts for lighting and general power work. The same form of electrical energy is also transmitted to similar sub-stations which distribute direct current at 550 to 600 volts for street-railway work. It is thus possible to centralize and to have a single large central station for both classes of service. If one

FIG. 7. MONTGOMERY WATERPOWER AND ELECTRICAL PLANT.—TURBINES IN HORIZONTAL CASES.

generating station is provided for each class of service and the generators are similarly wound, the two stations may be interconnected and the necessary investment greatly reduced, as the same reserve capacity would answer for two stations. This method is followed to some extent in New York city, where three different generating stations varying from 50,000 to 100,000 horsepower each are in different stages of development.

In Chicago, the local conditions in electric-lighting and general power work are such that a considerable amount of direct current is distributed from the main generating station, in addition to the large amount of three-phase, 25-cycle current that is transmitted to rotary-converter sub-stations. A limited capacity in double-current generators is installed, which answers as reserve for both direct-current and three-phase, 25-cycle, alternating-current supply.

The generation of high-potential, three-phase currents and transmission to sub-stations makes it possible to locate a single large generating station at some distance from the center of the existing load, where it is easily accessible by rail or water, and where real estate is cheaper. The development of new direct-current demand is also no longer confined to the particular localities covered by or in proximity to an existing network, but is dependent only on the amount of business that can be secured in one locality which will warrant the installation of a rotary converter, that can be placed in a comparatively small room. The cost of transmission lines to such sub-stations is, under most conditions, a comparatively small part of the total.

The normal full-load rating of generators now being installed in New York and Chicago varies from 3,500 to 5,000 kilowatts, and the machines are driven by vertical, cross-compound engines of the well-known Reynolds-Corliss type, guaranteed to give at their most economical cut-off a steam economy of 12 pounds or better per indicated horsepower. In some of these cases it is contemplated to improve this economy by using superheated steam. In all of the above-mentioned stations the boilers are equipped with stokers or traveling grates and all coal is handled by means of conveyor systems.

The very large amount of power to be handled in any one of these stations necessitated the development of elaborate switchboard apparatus. Under these conditions, a breakdown and short-circuit is usually disastrous to all apparatus and cable within a radius of several feet. It is necessary to isolate as much as possible all connections pertaining to each unit or out-going transmission line, and to provide switches of such design that they may be safely opened on short-circuit when current up to the full capacity of station is being supplied to the bus-bars—a condition that is liable to obtain at any time. The general design for this purpose is such that each element of a three-phase circuit is enclosed in a separate fireproof compartment, where the circuit is broken under oil. These oil switches or circuit-breakers are electrically operated from

1. Abstract of a lecture delivered April 17, 1901, before the Engineering College, University of Illinois. Mr. Junkersfeld is connected with the Chicago Edison company.

some convenient central point. To provide an additional factor of safety, two of these are frequently connected in series. They are sometimes equipped with overload, reverse power or time-limit relay attachments, dependent upon the particular conditions under which they are installed in generating or sub-stations.

In such central stations, where series arc lighting and alternating current for incandescent lighting must be maintained in addition to direct-current service from an Edison three-wire network, a number of solutions, more or less successful, have been presented. In the present state of the art the decision on this question would depend largely upon the relative amounts of energy required for the three different classes of service for existing and probable future demands. A frequency of 25 cycles is much better adapted for rotary converters than any other, but it is not suitable for alternating-current distribution. A frequency of 60 cycles is best adapted for alternating-current distribution, but is less desirable for transmission and conversion to direct current. A compromise frequency of 40 cycles is sometimes employed, but with such apparatus as at present available, this does not merit serious consideration except in special cases.

Where the demand for direct current predominates very largely it is found advisable to develop the 25-cycle system, which is best adapted, all things considered, to the use of the rotary converter. This system has at the same time also the highest efficiency of transmission and conversion. In such cases series arc lighting is supplied by motor-driven arc machines.

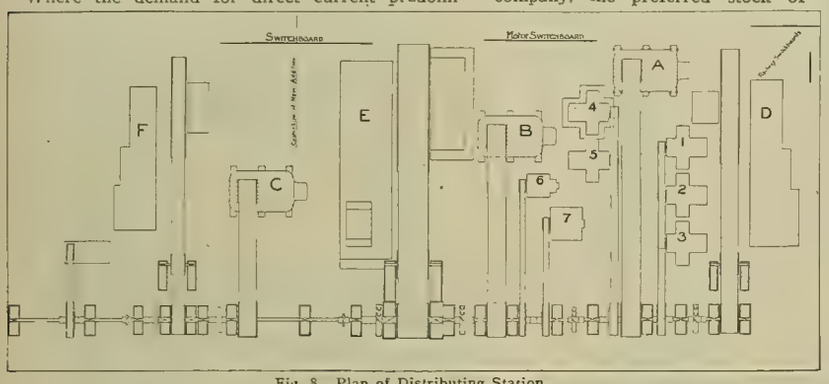


Fig. 8. Plan of Distributing Station.

MONTGOMERY WATERPOWER AND ELECTRICAL PLANT.

In cases where the demand for alternating-current distribution is a large part of the total a frequency of 60 cycles is employed, and that needed for direct-current service converted by means of rotary converters or motor-generators. The latter, while more expensive and less efficient, are under some few special conditions more satisfactory than 60-cycle rotary converters. This frequency has marked advantages in the large number of cases where series arc lighting is an important factor.

Series alternating-current arc lighting, since the development of the constant-current transformer and still more recent alternating-current series arc regulator, has become very popular for street lighting and also promises well for some classes of commercial lighting.

One of the more recent developments in the distribution of alternating current has been the four-wire, three-phase system in one of the outlying districts of Chicago. As in most similar cases, the territory had previously been covered by single-phase lines. Generators were installed which deliver three-phase, 60-cycle current from Y-wound armatures supplied with a fourth terminal. These deliver a maximum of 4,150 volts, or 2,400 volts, between neutral point and any one of the outside terminals. There is thus available a voltage best suited to single-phase lines in the immediate locality, and a higher voltage for four-wire, three-phase transmission to centers in more distant localities. A distributing sub-station is established and equipped with switching apparatus and regulators on outgoing feeders, which are arranged in such a way that the load on the three phases is nearly equal. In many cases four-wire, three-phase lines can be equipped with feeder regulators at the generating station and run to some center from which single-phase taps are taken. With ample generating capacity, and 4,000 volts for three-phase transmission to motors, there is practically no interference with lights due to heavy starting currents of motors. Transformers and motors of standard voltages are used. Automatic feeder regulators are now being developed which will insure constant pressure at centers of distribution.

Distributing systems and apparatus have been developed to such a state that it seems necessary to look elsewhere for further improvements in the near future. The steam turbine at present gives promise of revolutionizing power-station design. A steam economy equal to that of the best reciprocating engines has already been obtained. The first cost of a turbine and its generator would be very much less than present generating units of same capacity. The space occupied would probably be about one-third, while the attendance is reduced to a minimum.

Another promising development is that of the Nernst lamp, which, even in its present state, gives the same candlepower when consuming one-half the wattage of the most efficient incandescent lamps now on the market. The first cost is still considerable, and the general adaptability of this lamp is not yet established, but such obstacles as still exist will undoubtedly be surmounted at an early date.

General Electric Stock.

The Commercial Bulletin of Boston intimates that the General Electric company is preparing to return its capital reduction, made in 1898; 66⅔ per cent. to be in a stock dividend, each holder of three shares getting two shares. It is expected that the company will maintain eight per cent. dividends and may possibly go to 10 per cent. Last year's earnings equaled 28.6 per cent. on the common stock.

A circular letter issued on April 18th from the office of the General Electric company announces that, upon the written request of any holder of preferred stock of the company, the preferred stock of such holder shall be received in exchange for common stock, and that certificates for common stock shall be issued therefor, share for share, upon surrender and cancellation of the certificates for the preferred stock received upon such exchange. The time of making such exchange has been limited to the period beginning May 15th and ending August 1st. Holders of preferred stock desiring to avail themselves of the opportunity of making such exchange must, within the period above prescribed, present to the Farmers' Loan and Trust company of New York city their certificates, duly indorsed in blank, together with a written request for such exchange in the form furnished. The certificates for common stock will be issued only in the name of the registered holders of the preferred stock surrendered for exchange.

Opening of the Pan-American Exposition.

Niagara Falls, April 24.—Owing to the damage and delay caused by the great snowstorm that swept over Western New York, it has been decided by the management of the Pan-American Exposition to dispense with all formal ceremonies on May 1st and consolidate the program intended for that day with the program on Dedication Day, May 20th. This means that the members of the National Electric Light association will have double pleasure in coming to Buffalo and the Falls to attend their annual convention. They can kill several birds with a single stone by being present at the opening and dedication of the exposition and attending their convention. The gates of the exposition will be thrown open May 1st without ceremony. The progress has been such that there will be plenty for visitors to see at that time. Two shifts of men will be worked day and night until the exposition has been completed. D.

Electric-railway Projects in Chicago.

The first business meeting of the new City Council of Chicago was held on April 22d, and among the 194 orders and ordinances brought forth were several relating to the traction interests of the city. Mayor Harrison suggested an ordinance for the repeal of the South Chicago City Railway company's franchise, on the ground that the corporation had failed to pay 50 per cent. of the $50 car license due the city. This is the fourth ordinance of the kind introduced by the mayor, and the companies have always settled with the city before the measures were called up for passage.

An ordinance in the interests of C. L. Bonney was introduced which gives to the Chicago General Street Railway company the right to parallel the 22 different surface lines of the Chicago City Railway and the Union Traction companies. The company offers seven tickets for 25 cents, in lieu of compensation, to the city, outside of the regular $50 car license.

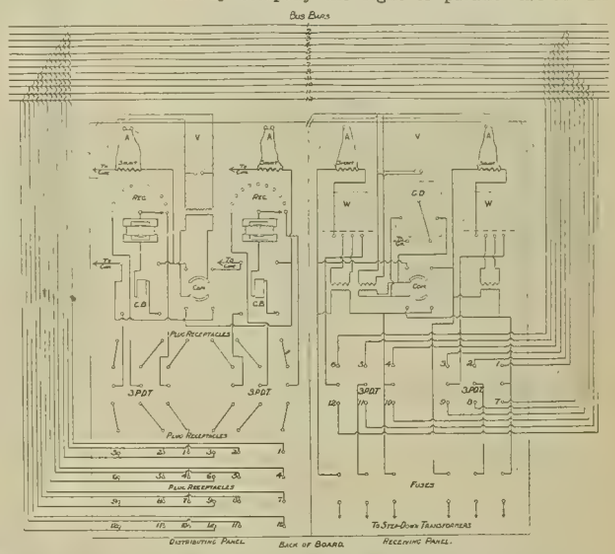


Fig. 10. Switchboard Wiring at Distributing Station.

Alderman Badenoch introduced an ordinance for a 50-year franchise for the American Railway company, which proposes to erect an elevated road beginning south of Van Buren street, between Wabash and Western avenues. This road is to be built either to connect directly with the Union Loop or with the Metropolitan elevated, and will tap the stock-yards district, Englewood, Auburn Park and the southwestern suburbs. It is also said that the road may be extended to South Chicago. The measure was sent to the committee on railroads for consideration.

St. Lawrence Power Company Seeks Canadian Charter.

The St. Lawrence Power company, now building a plant at Massena, N. Y., is said to be seeking incorporation, with extensive powers, from the Canadian Parliament. Massena is 60 miles from Montreal, where it is the company's purpose to establish a manufacturing community. The remarkable powers asked by the new company from the Canadian government would enable it to manufacture, use, supply and dispose of electricity, water, gas and hydraulic and other power; to maintain works for the production, sale and distribution thereof, and for these purposes to construct and operate canals, watercourses, raceways and waterpowers in or adjacent to the St. Lawrence River at any points eastward from Dickenson's Landing, and construct dams, wing dams, sluices, conduits and buildings. The company also wishes authority to acquire patent rights, manufacture and dispose of pulp wood, calcium carbide, acetylene gas and other carbide products, mine minerals, to construct furnaces, ovens, etc., to construct tramways, wharves, to own vessels, to conduct a towing business on the St. Lawrence and adjacent waterways, and to do other things.

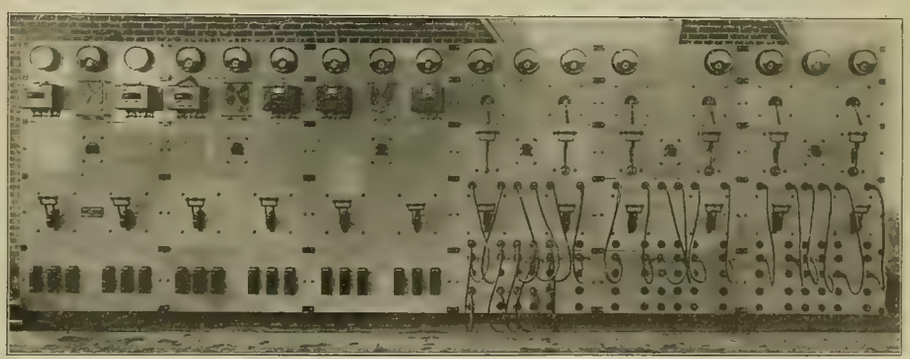


FIG. 9. MONTGOMERY WATERPOWER AND ELECTRICAL PLANT.—SWITCHBOARD AT DISTRIBUTING STATION.

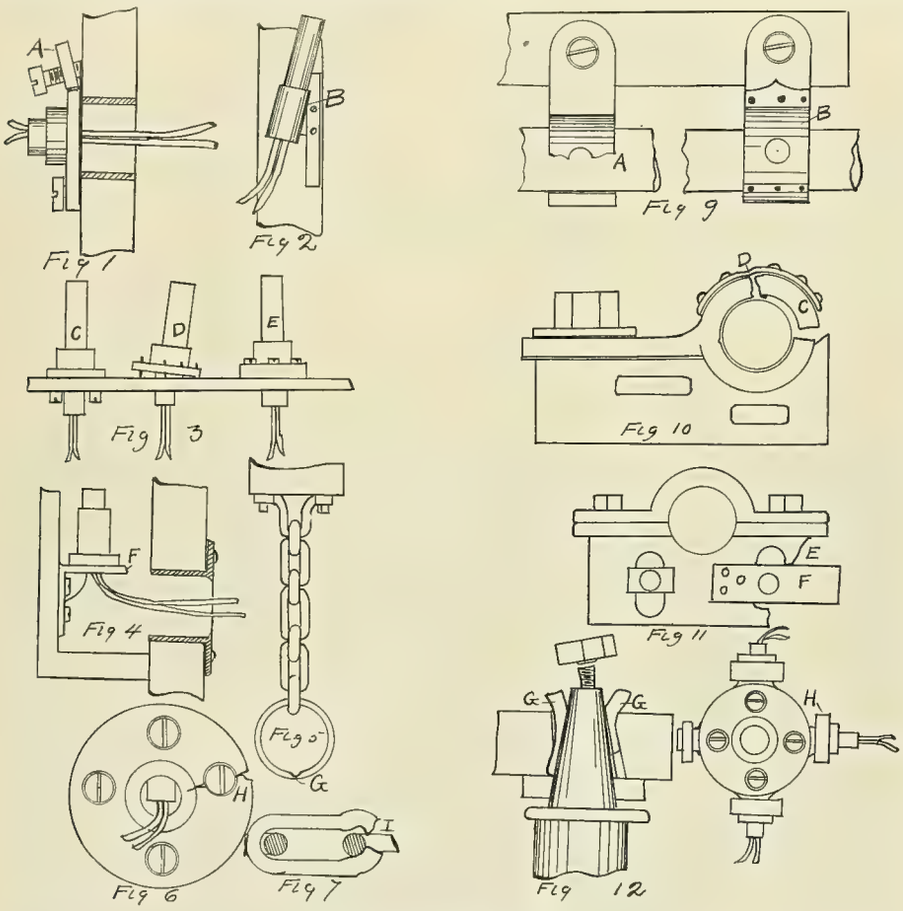
Japanese Electrical Work.

By R. G. Mayse.

Japan promises to be a great field for electrical apparatus before many years. The Japanese are thriving, enterprising and ingenious, and although perhaps incapable of comprehending the full scope of some of the modern electrical mechanisms produced in the shops of Europe and America, they are quite capable of handling anything which has yet been sent to the shores of the busy island empire. The writer arrived in Nagasaki in March, at a time when everybody was busy, new enterprises were being established, mines opened, shops put into working order and many of the former idle industrial plants were started. I visited many of the homes, shops and public buildings in which electrical devices had been or were being set. Although the Japanese electrical machinists are competent to cope with most of the electrical furnishings which have been sent to them from American and other shops, they lack carefulness in construction and adjustment.

In one place where I observed some of the mechanics at work, I noticed that one of the switch outlets was broken off, as at (A), Fig. 1. This was due to the use of a threaded bore, which the Japanese almost completely through the metal. The Japanese are not as careful as they might be in adjusting screws to the flanges of sockets. In Fig. 6 I show at (H) the way in which I observed a great many of these sockets rendered useless. A screw of too large diameter would be used and the machinist in driving the screw home would, as a rule, split the flange. There is considerable electrical apparatus going into Japan, and in time the Japanese machinists will learn better how to handle these devices without causing trouble and delay, as well as expense for new fittings. The Japanese make chains for service in electrical devices, and they do not use the middle shoulder brace, which is now being employed in most chains. The result is that many of the chains become broken in the fashion shown in Fig. 7, in which one link has pulled itself through another.

I visited a number of shops in which mechanical and electrical work was in progress, and I found women and children at work about as often as men. The women are a strong, healthy lot, and they can forge metals and do mechanical work as well as the men. They work a little cheaper in price and are therefore hired more frequently. The average pay is from 10 to 20 cents a day for the ordinary ma-



JAPANESE ELECTRICAL WORK.

himself had put into the original set-screw hole, so that, when turning in the screw, the pressure resulted in the snapping off of the flange, as shown. Again, I saw one of the trunnions broken off, as at (B), Fig. 2. These defects could have been avoided if care had been used. The Japanese machinist appears to be careless with his wrench and has a tendency to apply more muscle than is actually required, with the result that many a set-screw is turned off and many little parts fractured.

I saw some brass trunnions set as at (C), Fig. 3, while in the same vicinity some were fixed to the base by means of copper pins; these pins pulled out, allowing the part to tip, as shown at (D). This trouble was overcome by using little screws, as in (E).

In Fig. 4 is a Japanese way of running a wire through a socket in a wall from the bracket (F). So long as the adjoining parts are free from woodwork, there is not much danger from sparking and fire, but if there is any wood near by, with a plan of this sort, a fire may be started. In Fig. 5 is a Japanese idea for suspending a series of wires to the walls by means of running them through rings. I noticed that some of these rings were worn, as at (G), to a point almost ready to break through if pressure were applied. This wear is due to the mechanical movement of the wire in the ring, which in course of time cuts a groove, like (G), sometimes

chinist, while the high-class ones get about double this amount.

Referring briefly to supporting devices as employed by the Japanese in hotels, shops, residences and mills, your correspondent observed that many were made on the order of that shown in Fig. 9. In some cases the cap piece (A) was snapped off, leaving the shaft exposed. I noticed that in some instances the machinists had forged pieces of sheet-metal like (B), Fig. 9, and riveted them to position. In Fig. 10 is shown how the Japanese electrical machinist undertakes to repair a section of a bearing of a motor or dynamo. In this case a dynamo shaft wabbled to such extent that a piece of the cap of one of the shafts was broken off. This piece was placed in position and sustained there, like (C), by means of a strap of metal (D), the latter being riveted as shown. The trouble is that the cap fails to rest close to the shaft and foreign matter is allowed to get in and cause the parts to get gummy and heat.

Another specimen of Japanese ingenuity which I saw in an electrical machine shop is presented in Fig. 11. A section of the box for a bearing was broken off, as at (E), and in order to provide a hole for the securing screw, the piece of iron (F) was bored for the bolt and secured with wire pins to the box back, as sketched. This is about the way the Japanese manages to overcome all defects. He can work it out in some way and keep the machinery going. He is a better machinist than the Chinese or the Filipinos, but he has much to learn as yet.

In Fig. 12 is illustrated the way they do when they are obliged to build up a shaft bevel in order to get a suitable fit of the cone in the bore. Pieces of leather, rawhide or metallic substance are put in, as at (G), (G), and the nut is screwed down tight upon these. Of course, this answers the purpose for a time, but sooner or later these pieces work loose and trouble results. A proper fit does not occur until the end is bushed or correctly fitted. In Fig. 12 is also shown how the Japanese run sets of wires from a common center. They use a disk which is set-screwed to place, and around its circumference are flanges (H), through which the required number of wires are passed to the objective point.

Wireless Telegraphy in the Mediterranean.

A correspondent of the London Times, on board the British man-of-war Andromeda, sends his paper an account—not a "wireless special"—of some of the haps and mishaps of wireless telegraphy in practice. "The standard of wireless telegraphy in the Mediterranean fleet is very high, indeed," he contends, "and, deficiencies notwithstanding, the system is nearer to perfection in the Mediterranean fleet than anywhere else. There is, however, still much to be learned, still room for a thousand improvements. We have been able to exchange notes of congratulation at great distances, to pick up scraps of news about complications in China, riots in St. Petersburg, battles in South Africa, naval promotions, and the like, but it has very often come in a scrappy way. Sometimes when the Diana could not hear us because her receivers were out of order, we could hear her asking the Theseus or Vindictive where on earth or sea the Andromeda might be; sometimes the instruments have simply babbled, owing to one or two messages crossing one another; sometimes we have the tail end of a message without the beginning; sometimes vital words are omitted. For example, to-day (it is March 29th by this time) we are perplexed by a message obviously referring to a battle in South Africa, of which, since it begins in the middle, we know no more than that the English have lost fewer men than the Boers, from which we presume that they had won. But to say this is not by any means to suggest that the whole system is not already marvelous and capable of practical use. In fact, we are putting it to very practical use already, and it tells us all sorts of things useful to know which we could not have known without it."

Combinations of Engine Builders.

It is announced that arrangements have been made consolidating the Fraser & Chalmers company of Chicago, the E. P. Allis company of Milwaukee, the Gates Iron Works of Chicago, the Dixon Manufacturing company of Scranton, Pa., and the Pennsylvania Iron Works of Philadelphia. The combination, the name of which has not yet been decided upon, will probably have its main offices in Chicago and will be capitalized at $25,000,000. Each of the firms mentioned has a specialty of its own, and the five do not compete with one another excepting in minor lines. The combination will not be in the nature of a trust, as no monopoly of the field will be attempted, and it is not the intention to admit other manufacturers. The number of men employed will be about 10,000.

There is also talk of another combination, which is to manufacture steam engines exclusively. This latter corporation, if it is formed, will be capitalized at $30,000,000 and will be known as the American Steam Engine company. Among the concerns mentioned in connection with the federation are the following-named: Corliss Steam Engine Works of Providence, R. I.; American Wheelock Engine company of Worcester, Mass.; Hamilton Corliss Steam Engine company of Hamilton, Ohio; Southwark Foundry and Machine company of Philadelphia; Lane & Bodley company of Cincinnati; Rice & Sargent of Providence, R. I.; Robert Wetherill of Chester, Iowa; Cooper Corliss company of Mount Vernon, Ohio; Vieter Manufacturing company of Milwaukee.

Severe Storm in Ohio.

The storm that swept over Ohio and parts of adjoining states on Friday night of last week greatly interfered with telephone and telegraph service in the storm area. This was especially true of Northern Ohio lines. For some time it was almost impossible to secure communication with Cleveland, Akron and other cities in that portion of the state. It was not so bad east or south, although there was damage in all parts of the state. All telephone companies having long-distance lines suffered, and in some of the cities poles were blown down and wires were snapped. The telegraph companies suffered great inconvenience. For the greater portion of Saturday communication by wire between Chicago and eastern points was absolutely lost. Thousands of messages were delayed for 24 hours or more. Board of Trade business, in particular, was greatly hampered.

Bleaching by Electrolysis.

A recent consular report from Eibenstock, Saxony, gives a detailed description of an apparatus for producing bleaching liquor from brine, the product being sodium hypochlorite, which is attracting considerable attention among manufacturers of textiles. The process has been perfected by Dr. Oettel, a German professor, together with Haas & Stahl, electricians in Aue, Saxony.

The ordinary apparatus, a perspective view of which is given in Fig. 1, is extremely simple, being essentially a trough or box of slate, swung on trunnions in a suitable frame, with an inlet for the brine and an outlet for the sodium hypochlorite, resulting from the passage of a current of electricity through the brine as it runs through the box. The poles or electrodes are placed at opposite ends of the box, as shown by the engraving. Thermometers are suspended at the inlet and at the outlet, in order to show at a glance the strength of the sodium hypochlorite, it having been found that every rise of one

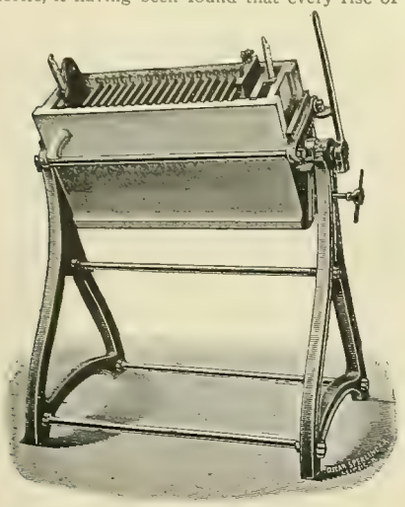


FIG. 1. BLEACHING BY ELECTROLYSIS.—ORDINARY APPARATUS.

degree Fahrenheit corresponds to, approximately, seven grains of free or active chlorine per gallon.

In order to clean the apparatus, the thermometers are removed and the trough reversed and cleansed with a hose pipe. The electrodes last about one year and can be easily replaced. The bleaching liquor, the product of the apparatus, is eminently suitable for bleaching raw cotton, yarn, cloth, lace, and the finest embroidered fabrics made of cotton, linen, jute or flax, pulp, paper, etc. It advantageously replaces chloride of lime for all purposes. The advantages claimed for this system are: (1) The electrolyzed solution possesses high decolorizing or bleaching power; (2) the goods treated in the ordinary process of bleaching are not injured, and there is scarcely any appreciable loss in weight; (3) lime or magnesia salts are not deposited on the cloth, thereby eliminating trouble in subsequent dyeing and printing; (4) the liquor is of constant strength, and can be used as fast as made, if desired; (5) the cost of production is low.

The apparatus is constructed in three sizes, to produce, respectively, 350, 650 and 1,000 gallons of electrolyzed solution in 10 hours, containing 186 grains of active chlorine to the gallon, prepared from brine of a strength of six degrees Baumé.

For purposes of comparison, it may be stated that

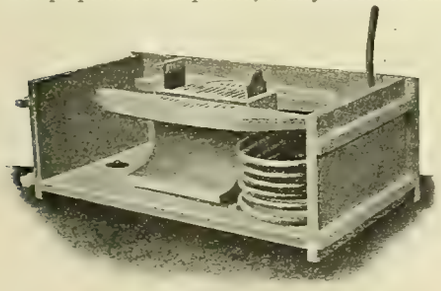


FIG. 2. BLEACHING BY ELECTROLYSIS.—APPARATUS FOR PRODUCING STRONG LIQUOR.

650 gallons of the electrolyzed solution contain 20 pounds of active chlorine; to obtain from chloride of lime 20 pounds of active chlorine, it would be necessary to use 70 pounds of bleaching powder, and the resulting 650 gallons would be found to give considerably inferior results. The reason of this difference lies in the constitution of the electrolyzed liquor, which has been found to contain free chlorine, free hydrochlorous acid, sodium hypochlorite and chlorate of soda. It is chiefly the free hydrochlorous acid which causes the rapid bleach. This solution is absolutely harmless to the fibers of the threads, the best proof that they are in no way injured being that goods bleached by electrolysis lose only about two per cent. in weight, as against some eight per cent. for chloride-of-lime bleaching.

When making further comparisons between the new and the old methods, it is well to bear in mind the well-known fact that chloride of lime quickly loses its strength. It is invariably assumed to be of some given standard; but, as the hydrometer test is deceptive and other tests are troublesome, guessing is sometimes resorted to, and cloth is often spoiled. In this apparatus the difference between the readings of the two thermometers is a ready and infallible test, though that is scarcely needed after once regulating the flow of the brine and the electric current. The electrolyzed liquor is always of one strength; mixing or reducing is not necessary, neither does the apparatus need any attention. Rock salt or sea salt may be used in addition to waste salt for mixing brine, providing it contains no mineral injurious to the subsequent processes.

Fig. 2 represents a later apparatus, which produces a bleaching liquor some six times stronger than that shown in Fig. 1.

High-speed Electric-railway Trials to Be Held in Germany.

The German government has granted its support to the establishing of a very high-speed electric-train service out of Berlin, and under government patronage. A society, embracing many prominent manufacturers and capitalists, has been formed to study the subject. A sum of £37,500 has already been subscribed and more will be forthcoming as needed. The minister of war has put at the disposal of the society the military railway line between Berlin and Zossen, which is 33 kilometers long. The minister of railways lends engines and cars, and the War Office supplies soldiers to guard the line. The electric-railway engines are to run at a speed of 200 kilometers (114 miles) an hour, whereas the fastest trains in Germany at present run at 80 to 90 kilometers. Two of these engines are now being finished. They are of two distinct kinds, so that experiments can be made with both to see which is the better type. One of them is being built by Siemens & Halske of Berlin and the other is to be built by the General Electrical company of Niedershoenweide. Both will be ready in June or July, and in the late summer or in early autumn the experiments are to be made. Current, it is said, is to be taken at 12,000 volts from a point 11 miles from one end of the line.

The vehicle constructed by the General Electrical company is to carry 50 passengers; it is 22 yards in length, and stands on two trucks, each of which has three axles, and of these six axles four are driven by three-phase motors. The company has invented a special arrangement of springs for the motors to rest upon, and for this ingenious invention a patent has been applied for. Each motor is capable of exerting up to 750 horsepower, so that the vehicle is propelled by a power totaling, if need be, as much as 3,000 horsepower. Such high power, says the London Leader, will probably only be necessary when first setting the vehicle in motion, or when fighting against a strong wind, or when getting up full pace on a lengthy journey. In the center of the vehicle there is a compartment which contains all the machines and arrangements necessary for the brakes, light, heating, and so forth, as well as for the regulation of the speed, and for the propulsion of the vehicle either forward or backward.

Chicago Electrical Association.

No meeting of the Chicago Electrical association having been held on April 5th, the next regular meeting was held in the association's rooms on the evening of April 19th. H. S. Dimick presided, the paper of the evening being entitled "Boosters and Their Operation." The paper had been prepared by G. M. Finney, but owing to Mr. Finney's absence from the city, it was read by F. S. Hickok. The different types of boosters, such as shunt, compound, differential, modified-differential and constant-current machines were described and their action explained. The different uses of boosters for railway, lighting and elevator service were dwelt upon and a number of sketches showing diagrams of connections were used in explaining the operation of the machines.

Searchlight Illumination at Niagara.

By Orrin E. Dunlap.

There is little doubt that the searchlight illumination of the Falls of Niagara, which is to be seen in all its glory this summer, will add materially to the attractive features of the Niagara frontier. The famous cataract is glorious by day, and when under the illumination of powerful searchlights, it is a truly remarkable sight. The illumination that

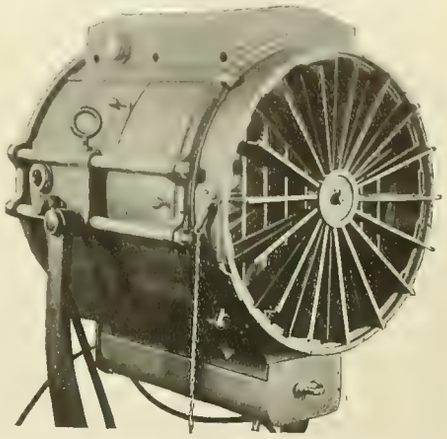


FIG. 1. SEARCHLIGHT ILLUMINATION AT NIAGARA.—TYPE OF PROJECTOR EMPLOYED ON ELECTRIC TOWER.

will first be seen will be done by the Michigan Central Railroad company, and it is barely possible that the commissioners of the free parks will also recognize the advantage of making the spectacle as attractive by day as by night. It mars no natural beauty to direct powerful lights upon the plunging

FIG. 2. SEARCHLIGHT ILLUMINATION AT NIAGARA.—CREST OF THE HORSESHOE FALLS.

waters in order that admiring humanity may be entertained.

As a feature of the Pan-American Exposition powerful searchlights will be placed on the electric tower in the grounds at Buffalo and also on the observation tower at Niagara Falls. They will exchange beams of light, as it were, and it is expected that the spectacle will attract great attention. It is believed that the Niagara light will be visible as far as Toronto.

Referring to the illustrations, Fig. 1 shows the type of searchlight to be placed on the towers mentioned, while Fig. 2 shows the crest of Horseshoe Falls illuminated by the beam from a projector.

Baudot Type-printing Telegraph in Europe.

The Baudot multiplex type-printing telegraph (a French invention) is said to be operating very successfully during the greater part of the day on the Berlin-Paris telegraph line. It has been demonstrated that the whole telegraph business between Berlin and Paris, which heretofore required five telegraph lines, can now be easily done over one by means of the Baudot system. The operation is said to be perfect and uninfluenced by minor interruptions of the conduit. The work for the operators is not more arduous than with the Hughes apparatus. In speaking of the above system, Consul-general Guenther of Frankfort, Germany, says: "The new successes in quick and multiplex telegraphy will create a peculiar situation for the administration of the telegraphic service. If the Baudot system be introduced all over Germany, and, in addition, if the quick telegraph of Pollak and Virag be utilized for newspaper telegrams, and if Professor Slaby succeeds in applying his discoveries concerning multiplex-spark telegraphy to ordinary wires, then it will be only a question of a short time when the existing telegraph business will hardly keep all the lines busy."

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Pan-American Exposition, Buffalo, N. Y., May 1st to November 1st.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Independent Telephone association of the United States, Pan-American Exposition grounds, Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

The change in the date of the formal dedication of the Pan-American Exposition to May 20th adds a new possibility to the convention of the National Electric Light association, which is to be held in Niagara Falls on May 21st, 22d and 23d. The contiguous dates will make it convenient for many of the visitors to witness the interesting opening ceremonies at Buffalo, thus adding another pleasure to their trip. Two weeks later will come the convention of the Independent Telephone Association on the exposition grounds, so that the exposition will have an especial attraction for electrical men for some time to come.

Once more the annual report of the British government telegraph service calls attention to some of the beauties of public ownership, confirming the charges of inefficiency and unbusinesslike management brought by Professor Fleming and others. Despite the wonderful growth of revenue, the service has not only failed for many years past to contribute anything in payment of interest on the original outlay, but it has also run up a very large deficiency on the expenditure account—a deficiency which threatens to grow with the growth of business. "No explanation is offered," says the London Electrician, "and, strange to say, Parliament never asks for any." In the United States the telegraph service is far from perfect, but we have at least competition in efficiency if not in rates, and no taxpayer pays for telegraphic facilities which he does not himself employ.

Many solutions of the smoke problem in Chicago and other cities have been proposed at various times, and "the man behind the shovel," the fuel employed and the construction of plants have been alternately criticized and defended. One plan of recent suggestion has at least the merit of novelty. It is to connect all furnaces in Chicago with an elaborate smoke-pipe system, through which, by exhaust fans, all the smoke shall be conducted to a disgorging point in the sand hills of Indiana, 40 miles from the center of the city. No smoke pollution, no stacks and a steady draft are the advantages claimed for this proposition. "Of course," says the inventor ingenuously, "it would cost the city a great amount of money to build it, but the taxpayers would be the gainers, for they would save the money they otherwise might spend for worthless smoke-consumers." And thus another twentieth-century beatitude is planned for an admiring public—and for the pipe manufacturers and fan builders.

Testifying before the Industrial Commission at Washington the other day, Mr. Alton D. Adams of Boston, an engineer and writer on electrical subjects, gave figures from plants in the state of Massachusetts to show that capital invested by a municipality in electric-light plants was more productive than when similarly invested by private interests. Mr. Adams thought that more careful management of municipal plants accounted in part for the difference. There was no tendency under municipal ownership to pay large dividends or to charge high prices for lighting in order to do so, he said. Of course, the fact that there are no dividends to be paid by city plants is one of the stock arguments of municipal-ownership advocates. But to assert that municipal plants are more carefully managed than private installations is very curious, for experience has shown that exactly the reverse of this is true. It is precisely because business, and not political, methods prevail in private-owned plants that the latter are so much superior in efficiency when compared with the municipal variety.

Exports of American electrical apparatus are still on the rising tide. The latest returns of the Treasury Department show that the exports of electrical machinery during the eight months ended February, 1901, reached a total valuation of $3,777,673, against $2,432,912 for the corresponding period of last year, while the exports of other electrical apparatus, including telegraph and telephone appliances, which are classified under the head of scientific instruments, increased from a value of $4,062,196 to $5,003,025 during the same period. The fact that these exports were widely distributed makes it apparent that economy of production is a great factor in securing foreign markets for American manufactures. The one lesson our manufacturers need to learn, it would seem, is the necessity of manufacturing especially for foreign trade, and the great increase of requests for information from our consuls as to the kinds of goods wanted in particular markets, and also as to manufacturing processes employed in this or that line of industry, encourages the hope that there is beginning to be a general perception of this important fact.

By the death of Professor H. A. Rowland the country has lost perhaps its greatest physicist—a man worthy to be ranked with the great leaders of thought in the international realm of science and an honor to his own country. Professor Rowland was a man of intense nervous energy, greatly devoted to the problems of pure science and impatient of mediocrity. He was, moreover, an inventor, like Lord Kelvin and von Helmholtz, and leaves to the world apparatus of great value as well as the record of his researches. He died, at the comparatively early age of 52, too young—not for his fame, which is assured, but for the lack of the work that he might have given to the world in the next twenty years. No doubt Professor Rowland shortened his life by overwork, and the example of von Helmholtz, dying at 73, and Kelvin, still vigorous in his 77th year, shows that the highest type of scientific attainment is not incompatible with longevity. Like Maxwell and Hertz, Rowland died untimely, but he lived long enough, nevertheless, to perform work in light, heat and electricity of the highest order. A sketch of Professor Rowland's accomplishments and honors was given in the last issue of the Western Electrician. It was hastily prepared just before the paper went to press, and we cannot refrain from adding at this time a very inadequate word of tribute to a great man's genius.

Gas engines of various types are certainly making a remarkable advance as prime movers, but it is rather early to assert, as Mr. Berthelot, the French chemist, is reported to have done, that steam is already growing obsolete. Electricity, he thinks, will always cost too much to become the motive force of common industrial life. The future motive power will be petroleum and gas, says the Frenchman, and the steam engine will be relegated to museums, where other anthropological curiosities are collected.

Another enthusiast, excited by the recent oil discoveries in Texas, does not, indeed, rail against steam, but has visions of the great future of oil as fuel. "Liquid fuel is to be the fuel of the twentieth century. Smoke, cinders, ashes and soot will disappear, along with war and other evidences of barbarism. The new oil well means a cleaner as well as a better civilization, and Texas is to have a big share in the glory of bringing it about. The discovery of this enormous well so near the seacoast indicates that we are just entering the real era of liquid fuel, and that the next few years you will see the locomotives passing through Corsicana using oil for fuel, and the ocean steamers will be using it, too."

However, coal is still good, reliable fuel, and the steam engine is a useful piece of apparatus. Gas and oil engines and liquid fuel are cordially welcomed, but their future is perhaps not so all-embracing as some of their more optimistic supporters contend. Neither is electricity to be so cavalierly dismissed as a power-transmitting agent, as Mr. Berthelot seems to suppose in his airy fancy. Coal for the furnace, steam for the engine and electricity for the transmission is still a reliable combination in power plants. This is not to say, of course, that gas engines may not be substituted for steam to advantage in many cases. But let us not be altogether off with the old love before we are on with the new.

Methods of Charging for Public Supply of Electricity.[1]

By W. W. Lackie.

In order to get at the basis upon which the various methods at present in use are founded, it is necessary to consider (1) the cost of the different parts that go to make up an electric-power station and (2) the cost of generating the energy. No two cities will give the same cost for all the different items that go to make up either of these, but in order that we may have figures that will not only be of interest, but with which I will be able to deal with some ease and freedom, I will take the costs of the Glasgow corporation electricity department. The approximate costs per kilowatt capacity are:

(1) Land and buildings	£14	0	0
(2) Machinery	25	0	0
(3) Accumulators	2	0	0
(4) Mains and cables	44	0	0
(5) Meters	4	0	0
(6) Instruments	0	18	0
(7) Counting-house furniture, etc.	0	2	0
Total	£90	0	0 per kilowatt.

The first item, land and buildings, is, of course, particularly subject to variation, according to the local price of land, labor and building, but the above is the approximate average cost of the three generating stations in Glasgow. The next item, machinery and plant, includes boilers, steam piping, engines, dynamos, traveling cranes, switchboards, and all accessories to complete the station proper. The outside work consists of feeders and distributing mains. The fourth item is the largest at present, although no doubt this will be very much less in due course. We next come to consider the annual cost of each of these items—i. e., the depreciation to be allowed on each of them. It has been the custom in Glasgow to rate and allocate this depreciation as follows:

(1) Land and buildings	1	per cent. on	£14	0	0 = £0	2	9
(2) Machinery	7½	per cent. on	25	0	0 = 1	17	6
(3) Accumulators	10	per cent. on	2	0	0 = 0	4	0
(4) Mains	2½	per cent. on	44	0	0 = 1	2	0
(5) Meters	6	per cent. on	4	0	0 = 0	4	9
(6) Instruments	5	per cent. on	0	18	0 = 0	0	11
(7) Counting-house furniture	5	per cent. on	0	2	0 = 0	0	1
			£90	0	0	£3	12 0

This gives an annual cost per kilowatt of £3 12s., or an average of just four per cent. on the capital. There is further interest on the capital at the rate of 3.1 per cent., and a sinking fund to be allowed for, at the rate of one per cent., which together make a total of 8.1 per cent. on the capital, or a cost of £7 5s. 9d. per kilowatt of plant, no matter whether the plant is used for supplying one unit or 10,000 units. It is therefore clear that any consumer who applies to the supply company, and causes one kilowatt of plant to be put down, and whose bill is under £7 5s. 9d. per annum, does not pay the bare cost of the upkeep of the plant, not to mention the actual cost of generation—i. e., the cost of coal, oil, etc. These are the chief items which go to make up what are called the standing or stand-by charges. Other items which might fairly be added to the stand-by charges are the rent, rates and taxes, and part of the management expenses. If these items are added the above figure is increased by £1 10s. 3d., and the standing charges are brought up to £8 16s. If the items last mentioned are omitted, it simply means that the actual cost of the unit [kilowatt-hour] will be increased.

The items included in the actual generation of the current practically vary in proportion to the units generated, and were in Glasgow for the last year:

Coal	0.54d.
Oil, etc.	0.06d.
Wages	0.26d.
Repairs	0.42d.
Per unit	1.28d.

I understand that Mr. Wright of Brighton not only puts under the head of standing charges the items I have mentioned—viz., depreciation, interest, sinking fund and management—but he also includes stand-by coal charges used for banking fires, etc., and all wages of workmen. In this I think Mr. Wright is taking an extreme view, and I submit that a portion of the wages of firemen, enginemen and engineers should go to the running expenses.

The maximum demand of all the consumers added together is equal to about 70 per cent. of their aggregate application, and the maximum demand made on the station is about 50 per cent. of the total power applied for. If the standing charge of £8 16s. per kilowatt of plant in the station is to be proportional to the consumer's application, the charge should be £4 8s. per kilowatt of application; if according to the maximum demand of the consumers, the charge will be £6 4s.—plus in both cases a charge to cover the cost of generation per unit. Take it that it is to be proportional to maximum demand—i. e., each consumer is to pay £6 4s. per kilowatt, plus in both cases a charge to cover the cost of generation per unit of maximum demand as his share of standing charges, plus a sum of, say, for the present, 2d. per unit to cover the cost of generating the current. The system of charging adopted in Glasgow allows of this £6 4s. being paid practically in three ways, certainly in two. It may either be paid in 12 equal monthly installments of 10s. 4d. per kilowatt, or it can be paid in 365 equal payments of 4d.—i. e., on the first 365 units per kilowatt, plus in each case 2d. per unit. This last case we are all familiar with. It corresponds to the first system of charging for 200-volt supply offered by the corporation, which is that for a quantity not exceeding the maximum demand for 365 hours per annum the charge is 6d. per unit, and all above this quantity 2d. per unit. The first method of paying off the standing charges is also offered, but the corporation having introduced the maximum-demand system and maximum-demand indicators, and wishing to do without the latter, have no alternative but to charge on the consumer's application. The charge is also slightly higher, being £6 15s. 5d. per kilowatt of application. If all the consumers would agree to pay on their application, I have no doubt this charge would be nearer the figure I have stated—viz., £4 8s. per kilowatt. This system of charging is by no means new. Dr. Hopkinson drew attention to the matter in his classical paper, read before the Junior Engineers, and Arthur Wright was the first, I believe, to make use of this idea. In a return made by the town clerk of Gloucester, last year, it appears that, out of 60 local authorities owning electricity supplies, 40 of them use Wright's indicator and system of charging.

In some cases motive power is quoted at a lower uniform rate, but the sole reason for doing so is that the chances are that motive power will be used for some four or five hours per day throughout the whole year; but it seems unfair that a similar benefit should not be extended to long-hour consumers using current for lighting purposes, seeing that the cost of generation is the same whether the energy be used for power or lighting.

The third method offered by the Glasgow corporation is a uniform rate, and is as follows for a 200-volt supply. Current is supplied at a uniform rate of 2d. per unit, provided the consumer agrees to pay for a quantity corresponding to his maximum demand for the equivalent of five hours per day for 365 days in the year—i. e., for 1,825 hours per annum. Under this method the applicant's standing charges are spread over at least 1,825 hours, and on a charge of £6 4s. therefore only amount to 0.8d.—that is, supposing his consumption exactly equals 1,825 hours of maximum demand. The actual average works costs per unit are 1.28d. for an average of 2½ hours per day consumption on the whole station, so that it is not underselling the current if a five-hour-per-day-per-annum consumer gets it at 2d.

It may be asked why it is necessary to adopt this method of charging for a supply of electricity when gas is supplied at a uniform rate. I think we only need to apply the maximum-demand system to a gas supply to see the reason and the necessity for this, especially at the commencement of an electrical installation; for later on it may be possible to level things down a little and to make the system of charging more like a uniform one. I take the gas accounts of the Glasgow corporation gas department for last year from the Gas World Year Book. The capital in works and plant is £1,315,680. These works and plant, I roughly calculate, supply what it would take 112,000 kilowatts of electric plant to supply. The cost per equivalent of a kilowatt is therefore only £11 15s., as against the electricity plant £90. The amount written off for depreciation was £35,716, or 2.7 per cent. Interest and sinking-fund account for £69,933, or 3.1 per cent. This makes a total of 5.8 per cent., or an annual cost of 13s. 7d. for gas plant as against the annual cost of £7 5s. 9d. per kilowatt for electrical plant. If the management expenses are added to this, the sum of 13s. 7d. is raised, approximately, to 14s. 6d., which, if divided into 365 equal payments, is less than ½d. The actual costs of making gas are given as:

Coal, etc.	1s.	8	d. per 1,000 cubic feet.
Distribution, etc.	0s.	2¼	d. per 1,000 cubic feet.
Sundry charges	0s.	1½	d. per 1,000 cubic feet.
And the gross cost of gas is	1s.	11¾	d. per 1,000 cubic feet, say 2s.

The charge for gas on the maximum-demand system would therefore be something like this: 2s. 0½d. for the first 365 hours of maximum demand, and 2s. for all used above that. You can therefore understand why a uniform charge of 2s. 2d. is adopted.

I would like to give you one other set of figures in this connection. The capital of the gas department is £1,315,680, and the revenue is £631,644, or nearly 50 per cent. of the capital. The capital of the electricity department was at May 31st last £322,000, and the revenue £44,141, or only 13.7 per cent. of the capital. This also shows the difference between the two supplies. No doubt, the capital of the gas department is very low, for the department has been in existence for 39 years, and has regularly written off large sums for depreciation, which go to reduce the capital. The electricity department will have a similar benefit. These figures must be taken as only approximately correct, as there are other items which enter into the gas accounts, such as the sale of residuals.

I now wish to consider briefly the question: In what direction are we to look for a reduction in our present price and a nearer approach to a uniform rate? The first item on the capital-cost sheet is land and buildings. This, for several reasons, should be at least halved, making it £7. The cost per kilowatt for plant would come down to somethink like £16. Accumulators will at least be quartered. Mains and cables should approach £33. (The result of an increased pressure of supply would have materially lowered this item, had not the price of copper nearly doubled itself just as the 200 and 250-volt lamps were coming.) Meters will be increased, and may be doubled. The other two items will at least be halved, and we hope in the course of time to have a capital cost per kilowatt of:

	Capital Cost Per Kw.			Depreciation.			
1. Land and buildings	£7	0	0	1	per cent.	£0	1 4
2. Machinery and plant	16	0	0	7½	per cent.	1	4 0
3. Accumulators	0	10	0	10	per cent.	0	1 0
4. Mains and cables	33	0	0	2½	per cent.	0	16 6
5. Meters	8	0	0	6	per cent.	0	9 6
6. Instruments	0	9	0	5	per cent.	0	0 5
7. Counting-house furniture	0	1	0	5	per cent.	0	0 0½
	£65	0	0			£2	12 9½

Allowing the same rate of depreciation, the sum of £3 12s. is reduced to £2 12s. 9½d. Adding on, as before, 3.1 per cent. and one per cent. on a smaller capital, we have the standing charge of £7 5s. 9d. reduced to £5 6s. 1d., and adding on management expenses, the sum will not be more than £5 10s. This will have the effect of reducing the sum of £6 4s. per kilowatt of maximum demand in my first figures to £3 17s. per kilowatt. The selling price per unit will no doubt be reduced, too, but it will only be by decimals of a penny. Let us assume it will be reduced to 1¼d. per unit. On the Glasgow prices and methods of charging, the figures then would be 3¾d. per unit for a quantity equal to 365 times the maximum demand, and 1¼d. per unit thereafter; or, if every consumer would agree to it under the fixed-charge method, £2 15s. per annum or 4s. 7d. per month per kilowatt (i. e., 1.8d. per eight-candlepower lamp fixed) of application, plus 1¼d. per unit, or 1¼d. all round for a five-hour-per-day consumer. Further, the depreciation written off from year to year and the sinking fund will go to reducing the capital, so that even these figures may be further reduced.

A uniform charge may be adopted before these prices are realized, but it will undoubtedly require to be one in which consumers are classified according to their probable hours of lighting. Even then there will be cases where consumers should be charged higher or lower rates than those used for the bulk of the consumers. From a table made out by the Reason Manufacturing company, classifying consumers of electric energy in Brighton, it is shown that in the case of shops, for instance, six per cent. of them use the light for under one hour, and six per cent. use the light over four hours. The great majority use it between two and three hours. Such a method as this averaging would mean that in Glasgow—

Shops would be charged	5 d.	Offices	6 d.
Private houses	4 d.	Theaters	3½d.
Hotels and clubs	3 d.	Hospitals	3 d.
Public houses	1½d.	Schools and churches	5 d.

In Aberdeen the charges for lighting are 6d. per unit for the first 365 hours of maximum demand, and 3d. per unit thereafter, and for motive purposes 4½d. and 1½d. Other municipalities under this system are:

Brighton	7d. for the first 365 hours and 1½d. thereafter.
Bradford	4½d. for 3 hours, 2½d. for 4 hours, 1d. for 8 hours.
Manchester	5d., or £7 per annum per kw., plus 1½d. per unit.
Shoreditch	5d. for 730 hours and 2d. thereafter.
Stafford	7d. for the 1½ hours in winter and ½ hour in summer, and 3d. thereafter.

Edinburgh is a notable exception to all other cities. A uniform rate is charged there of 3½d. per unit for lighting and 1½d. per unit for power, with discounts, I believe. The success that has attended electric lighting in Edinburgh is no doubt partly due to the high price of gas—viz., 3s., as against Glasgow gas at 2s. 2d.—and to the liberal use of electricity in street lighting. Not only has this raised the load factor of the station (i. e., the ratio of the number of units generated to the number that could be generated if the greatest load remained on for 24 hours per day throughout the whole year) 50 per cent. higher than we have in Glasgow, but it has been the means of their selling a greater number of the low-rate units, which are the units on which there is by far the greatest profit. Still, it is probable that in Edinburgh there are consumers who should only be charged 1½d. per unit, and others 5d. per unit. In two supply stations meters registering at different rates have been used, the object being to charge the low rate all day long and then sixpenny or standing-charge units between the hours of sunset and sunrise. This, of course, tells hard on the long-hour consumers who use the power late in the night, and I cannot see why they should not be treated equal with the consumer who uses it for long hours during the day. One other point. You must all remember that a supply in Glasgow, London and Manchester is different from that in any other city, in so far as it has to meet a day-and-night demand and foggy days, and nothing tends more to give the supply a bad reputation than failing on such a day, just when it is most required.

1. Abstract of a paper read before the Glasgow section of the British Institution of Electrical Engineers.

The Supreme Court of the United States has affirmed the judgment of the Supreme Court of Nebraska against the Western Union Telegraph company and in favor of the Call Publishing company of Lincoln, Neb., that the rates on news matter to that paper were unjust and unreasonable as compared with the same service to the Nebraska State Journal, published in the same city. Justice Brewer, in announcing the opinion of the court, said that the principles of the common law are operative upon all interstate commercial transactions, except as modified by congressional enactment.

DEVELOPMENT OF THE TELEPHONE FIELD.

New President of the American Telephone and Telegraph Company.

Frederick P. Fish of Boston, the celebrated patent lawyer, has been selected as president of the American Telephone and Telegraph company, succeeding the late John E. Hudson, who was also, it may be remarked, a lawyer. In both cases the chief counsel of the company was promoted to the presidency—a significant commentary on the importance of the company's legal interests. Mr. Fish was elected a director of the company, and also of the old American Bell Telephone company, which is winding up its affairs, at a meeting in New York on April 17th. Mr. Fish agreed to accept the duties of the presidency on July 1st, if possible, although it will be some time after that before he will be entirely free from existing legal engagements.

Mr. Fish, who is about 42 years of age and a graduate of Harvard, is the undoubted leader of the patent bar of the United States. His home is in Boston, but he maintains offices in both Boston and New York, spending about half his time in each. Mr. Fish has long sustained intimate relations with the important electrical interests of the country. In addition to many years' connection with the American Bell Telephone company, he has been chief counsel for the General Electric company since its organization, serving at times as a director and officer of the company, with a large salary. Mr. Fish is also a member of the joint board of patent control of the General Electric and Westinghouse Electric and Manufacturing companies. Walter C. Fish, manager of the Lynn works of the General Electric company, is a brother of Frederick P. Fish. Now that Mr. Fish has accepted an executive position that will demand all his time, it is assumed that the General Electric company will be deprived of his valuable services.

Mr. Fish has been connected with many of the most important patent cases brought before the United States courts, such as the Bell and Berliner cases in the telephone field and the incandescent-lamp patents in electric lighting. He has also conducted notable patent litigation for the knitting-machine and shoe-machine manufacturers of New England. He is himself a New Englander by birth. His remarkable ability as a patent lawyer is recognized from one end of the country to the other by persons conversant with the patent situation. Those who know him well also declare that his traits of character as a man are no less engaging than his intellectual attainments are conspicuous.

Telephone Wires in Manchester, England.

The city surveyor of Manchester has presented an important report to a meeting of the special committee which has been formed to consider the question of dangers arising from telephone wires passing over trolley wires. He stated that 7,798 telephone wires pass over the existing trolley lines in the city, and 3,781 over intended lines. There are also in the city about 60 miles of telephone wires laid under the public streets. These are in cables running from the telephone exchange in Portland street to buildings in each local area where subscribers are situated. Each cable is opened out on the top of a building in a local area into overhead wires connecting to the nearest chimneys or corners of surrounding buildings in which subscribers are located. The best method of dealing with the overhead telephone wires would be to subdivide the distributing areas by laying short lengths of underground service pipes from the nearest existing underground-cable route to smaller distributing areas off the main thoroughfares. By this arrangement the wires crossing the electric-railway routes would be no longer required, as the telephone instruments would be served by short distributing wires in self-contained areas and cross minor streets only. The overhead cables were, of course, insulated, and contained about 104 wires each. Assuming that the insulation was perfect in every case, the danger due to these cables would be minimized.

Independent Service for Lynn.

On April 16th the Lynn (Mass.) aldermen unanimously granted the People's Telephone company permission to establish a local telephone service in that city, in spite of the strong opposition of the New England company. The vote was unanimous. The company is authorized to lay conduits and its rates are fixed as follows: Office telephone, special lines, unlimited, $42 a year; three-party lines, $36 a year; five-party lines, $30 a year; residences, special lines, unlimited, $36; three-party lines, unlimited, $30; five-party lines, unlimited, $24. The company must file a bond of $10,000 within 30 days, to guarantee the performance of the contract.

Independent Telephony in Texas.

Austin, Texas, April 18.—The Independent telephone movement is having a wonderfully rapid growth in Texas. It was only about two years ago that the first steps were taken in Houston toward providing effective competition against the Southwestern Telegraph and Telephone company's interests in the state. At the present time probably the most notable Independent telephone corporation operating in Texas is the Lone Star Telephone company, which has a capital stock of $500,000. The principal stockholders of this company are C. N. Haskell of Ottawa, Ohio, O. L. Brailey of Wauseon, Ohio, H. M. Daugherty of Columbus, Ohio, H. M. Aubrey and Z. B. Campbell of San Antonio, Texas. This company is now building toll lines to connect all the principal cities of the state. It expects to have 1,000 miles of first-class four-wire copper toll lines in operation in Texas by the close of the present year. In addition to this Independent toll system, allied Independent companies have local telephone exchanges in operation at San Antonio, Houston, Waco and Corsicana, and are erecting exchanges at Taylor, Tyler, Temple, Denison and Sherman. Work will commence at Austin on a local exchange by one of these Independent companies by May 1st. The rates charged by these Independent companies are lower than those of the Bell company, and the service is equally as good. The Bell interests are much aroused over the inroads that are being made by these competing companies in their Texas business, and a general reduction in rates on the part of the Bell people is predicted, in order that they may be able to hold their own. H.

Illinois Telephone Company's Tunnel.

Mr. McGann, commissioner of public works of Chicago, has been investigating anew the work and plans of the Illinois Telegraph and Telephone company, which started to build a tunnel system under the streets of Chicago nearly two years ago. It was found that although the ordinance was granted by the council in February, 1899, only 720 feet of tunnel has been constructed. Work stopped over a year ago, and all that has been done since has been to pump out the shafts and tunnels once a week and keep the machinery in order. The construction, the inspecting engineers say, has been of a high character. Manager Wheeler of the company is reported as having said that the company expected to have telephones in working order this year. "The delay in active work in the tunnels has been unavoidable," said Mr. Wheeler. "We have to be sure of our surveys, and this has taken time. Surveyors have gone over the routes a number of times at night, to be certain of them. We have men working at our exchange, and the instruments installed at the end of the year will exceed the number which the ordinance requires to be installed in five years. The tunnel work will proceed very shortly and will be pushed."

Changes in Bell Exchange Companies.

The rumors of a large telephone combination, to embrace all the Bell operating companies, that were current early in this week, have simmered down to the announcement that John I. Sabin, president of the Pacific States Telephone company at San Francisco, is to become president of both the Chicago Telephone company and the Central Union Telephone company. The information has been given out by John M. Clark, who is now president of the Chicago Telephone company, but who will, it is said, be succeeded on May 1st by Mr. Sabin. Mr. Clark will become chairman of the board of directors of the company and will also retain his interests in the corporation. It is said that W. A. Jackson, the present head of the Central Union company, will be transferred to some other field of the service. Mr. Clark is reported as saying that, although Mr. Sabin may be elected president of the two companies, "there will be no merging of interests, or, in fact, any combination of any kind."

Proposed Telephone Legislation Withdrawn.

On April 16th the Massachusetts legislative committee on mercantile affairs held an executive session, during which it was voted to give leave to withdraw all petitions for telephone legislation. This includes a bill to provide a fixed rate of $100 per annum for use of telephones for a vocal radius of 25 miles from cities of 500,000 inhabitants, $75 within the same radius of cities of 100,000 to 500,000 people, $50 within the same radius of cities of 20,000 to 100,000 people, and $25 within the same radius of cities of less than 20,000 people; a bill to remove wires from the streets of Lowell, and a bill by which the state gas and electric-light commissioners shall have supervision of all companies transmitting intelligence by electricity.

Telephone News from the Northwest.

The Zenith Telephone company of Duluth has filed a trust deed to the Minnesota Loan and Trust company of Minneapolis, as security for $100,000 bonds. The company makes the issue of bonds to extend its toll system.

The Webster Telephone company is pushing work on the installation of its local exchange at Webster, S. D., and hopes to have it completed by May 15th.

The Dakota Central Telephone company has secured sufficient patronage at Bryant, S. D., to justify a local exchange.

The Canton Co-operative Telephone company of Canton, S. D., declared a dividend of 12 per cent. at its recent annual meeting. The company contemplates building a toll line to Moe, 12 miles south.

The Twin City Telephone company has arranged to locate a sub-exchange on the East Side in Minneapolis in the Chute block at University and Central avenues. This company is about to install a 32-connection exchange in the courthouse at Minneapolis. The company is pushing work on laying conduits and erecting poles. It is expected to have every portion of the city connected within 60 days, and the present number of subscribers doubled.

A. B. Kerlin of Park Rapids, Minn., proposes to form the Iron Range Electric Telephone company, to build toll lines and establish local exchanges at Hibbing, Grand Rapids, Cass Lake and Bemidji, Minn.

The People's Telephone company of West Superior, Wis., will construct toll lines to Carlton and Cloquet, Minn., and towns on the Iron Range. This will give the new company quite a lead over the old Bell company, as the new company has the only connections with the county offices. The Zenith City Telephone company of Duluth will form a local company at Cloquet, and have work started immediately on a local exchange. This company works in unison with the People's company of Superior, both being under the same control.

The Rocky Mountain Bell Telephone company has distributed poles between Whitehall and Logan, Mont., and will soon stretch the wires.

An Independent telephone system is assured for Rhinelander, Wis. Considerable stock has been subscribed, and 112 connections pledged. The Wisconsin Telephone company, which has been indifferent to Rhinelander so long as there was no other connection, now announces that long-distance connection will be made at once.

The local exchange at St. Peter, Minn., contemplates building a long-distance line northwesterly to Sauk Center, Minn.

A rural telephone system is being formed by farmers living near Ogden, Iowa.

Bethesda, Iowa, though one of the smallest towns in the county, has five different telephone lines connecting there, representing a total of over 100 telephones.

The plan of the Independent toll-line telephone companies of Iowa to take over the preferred stock issued by the Mutual Telephone company of Des Moines, Iowa, and thereby control that system, has been abandoned for the present. The companies are in much the same condition, finding that their business has increased beyond their ability to carry it on.

The Citizens' Electric Light and Telephone company has been granted a franchise at Clear Lake, S. D.

The Forman Telephone company will build a toll line from Forman to Havana, N. D., in July.

The Dakota Central Telephone company will complete direct connection between Mitchell, S. D., and Pierre and Huron at once.

The Steele County Telephone company is about to begin work on the local exchange at Blooming Prairie, Minn. As soon as that is completed, a line will be extended to Corning.

The Wisconsin Telephone company will start work putting its wires underground at Appleton, Wis., about the first of May.

A telephone line is projected from Grand Marais, Minn., down the north shore of Lake Superior, to connect with the line to Duluth.

The local exchange at New Paynesville, Minn., will be improved and extended.

H. J. Ramsett has disposed of his interest in the Willmar telephone exchange of Willmar, Minn. He is succeeded as secretary by D. N. Tallman.

Work will soon be begun on the new exchange for Melrose, Minn.

Long-distance lines will soon be completed between Springfield and Running Water, S. D., and between Tabor and Bon Homme, S. D.

The Rocky Mountain Bell Telephone company proposes to give Butte, Mont., nickel-in-the-slot instruments for residence use.

The Dakota Central Telephone company will erect a brick office and exchange building at Huron, S. D.

The Winona Telephone company of Winona, Minn., will extend wires to Rochester, Minn.

Independent telephone companies of Iowa propose to form a company to build a copper metallic trunk line across the state from Davenport to Omaha. Fred C. Hubbell, H. E. Teachout and J. W. Hill of Des Moines are interested. R.

Ohio Telephone Notes.

The Ohio Telegraph and Telephone company has asked for a franchise in Chillicothe. The same in-

ducements are held out there as in other places, that the company does not desire to put in an exchange, but is simply building a long-distance line through the country. The council has as yet taken no action in the matter, but will take time to investigate just what such a franchise means. It is claimed that it carries with it an arrangement by which the Bell franchises are renewed where they are about to expire.

Roy Moore has been elected general manager of the Newark Telephone company, Newark, Ohio.

The Port Clinton Telephone company, Port Clinton, Ottawa County, has been incorporated, with a capital stock of $40,000, by J. S. Brailey, R. S. Barber, Fred J. Ballenger, H. A. Barber, J. C. King and others. The company will build a plant at Port Clinton. Several of the incorporators are members of the Barber-Brailey company, Wauseon, who are engaged in the construction business.

The Central Union Telephone company is building a line from St. Marys to Gahanna, a distance of four miles. The patrons will have direct connection with Columbus.

The Lancaster Telephone company has been granted a franchise in Fairfield County. An exchange will be built there.

From Cleveland it is stated that the new Independent exchange at Detroit, Mich., will be in operation early in September. The United States Telephone company will then connect with it, and the greater part of Michigan will be reached. An arrangement has been made with the eastern consolidated companies to connect with western companies, through Pittsburg and the United States lines. An injunction gotten out by the Bell Telephone company some time ago, has prevented the connection of the Pittsburg and Ohio lines up to this time.

O. M. C.

Indiana Telephone Items.

During the last week articles of incorporation were filed with the secretary of state by the Emporia and Anderson Telephone company. The company will construct and operate a telephone system, with headquarters at Emporia, in Madison County. The directors are Samuel Mitchell, M. M. Gustion, John Summerville, V. P. Gale and Daniel Rector.

The Butler Telephone company of Butler, DeKalb County, has been incorporated, and has increased its capital stock from $10,000 to $25,000.

The Mutual Telephone company at Logansport is showing fight and has notified the city officials to remove all city wires and cross-arms from its poles or stand prosecution for damages. The City Council recently passed a city ordinance, under which it was expected that the Central Union company could operate without competition, but the notice to vacate indicates that the Mutual company will continue to make the fight.

A romantic courtship is reported to have culminated in marriage near Columbus, Bartholomew County. The bride and groom are Miss Alice Johnson of Butler and Louis Walker Lane. Their courtship was carried on entirely by telephone, and the young people never met until the day of their betrothal. Miss Johnson was employed in the telephone exchange at Columbus, and Mr. Lane had charge of the Hope exchange. They became acquainted over the wire.

F.

Yurgae Signalphone.

There seems to be a constantly increasing demand for a satisfactory telephone for interior use—one that shall be low in price, easily installed, economically maintained, and yet of sufficient efficiency not

YURGAE SIGNALPHONE.

only to meet all the requirements of interior service, but also to allow its use in connection with the central-exchange lines, if necessary. All these points, it is asserted, have been wrought out in the instruments manufactured by the Yurgae Signalphone Manufacturing company of Milwaukee, Wis. These instruments are furnished in a number of styles, adapted to a large range of requirements. Hotels, manufacturing plants, office buildings, etc., are taken care of by the interior or hotel telephone, while the signalphone, illustrated herewith, is designed to operate more particularly in connection with fire-alarm and police-call systems, messenger systems, etc. In a little booklet published by this company the apparatus and its manifold uses are described in a concise and convincing manner. The company, though comparatively new in the field, already has a number of plants in operation, all of which are said to be giving satisfaction. Among these may be mentioned the Plankinton and St. Charles hotels at Milwaukee; Wisconsin Central railway at North Fond du Lac, Wis.; Milwaukee Electric company, Browning Manufacturing company, Johnson Electric Service company and Christensen Engineering company; also a trial system for the Western Union Telegraph company at New York city. The fact that the instruments can be installed on the wires of any existing messenger or call system, thereby giving telephone service in connection with the other without any additional wiring, would seem to be a desirable feature. Another advantage claimed for this system is that it may be operated with a common battery, thereby entirely doing away with local batteries and the attendant expense and labor.

GENERAL TELEPHONE NEWS.

The Fairview Telephone company of Fairview, Tenn., has been chartered by H. F. Tilgham, J. C. Paris and others.

The Camden Telephone company of Camden, Tenn., has been incorporated by W. L. Morris, T. J. Lowry and others.

The Kenton Telephone company, Kenton, Ohio, is in the market for apparatus to be used for country party lines.

The Henderson Telephone company of Henderson, N. C., will increase its capital stock to $100,000 and enlarge its system.

The Clarendon Telephone company has been incorporated at Clarendon, Texas, with a capital of $3,000, by R. W. Talley and associates.

Perry M. Colson is about to organize a stock company to build a telephone line from Gainesville, Fla., to Montbrook, Cedar Keys and other points.

Minister Smith of Liberia reports from Monrovia, February 26, 1901, that Mr. T. J. R. Faulkner, a civil engineer from the United States, has placed that city in telephonic communication with White Plains, a settlement 25 miles up the St. Paul's River. This is the longest line in the country.

A press dispatch from Atlanta, Ga., credits D. M. Therrill of that city with having perfected a system of long-distance telephony by which the conversational limit is extended to 2,300 miles. It is said that during recent tests of this apparatus conversations were satisfactorily carried on over one circuit from Atlanta to Troy, N. Y.

The Hillsboro Telephone company of Hillsboro, Ohio, has recently organized and elected the following-named officers: President, Irvin McD. Smith; vice-president, Frank Durnell; secretary and treasurer, H. P. Morrow; directors, Irvin McD. Smith, John R. Horst, Julius C. Feibel, J. W. Evans, Frank Durnell, George L. Garrett and C. E. Brown.

The Alabama, Mississippi and Tennessee Telephone company has extended its toll line from Dallas to Sarepta, Miss., at which place it connects with the Sarepta and Water Valley telephone line. This connects the Pontotoc and Water Valley telephone exchanges and gives the latter connection with the Amory, Aberdeen, West Point, Starkville and Columbus exchanges.

The Georgia Telephone company of Savannah, Ga., has made rapid progress since its system was completed in June, 1900. It is said to give better service and to have a larger list of subscribers than the competing organization. To promote the use of residence instruments, the company has made a rate of $65 a year to cover the installation of both a residence and a business telephone.

An employe of a Stockholm (Sweden) telephone company has invented a device by which it is said that the telephone user can tell when a third person is listening to his conversation. The visible part of the device consists of a small metal box attached to the wall near the telephone. By pressing a button the device is connected with the telephone. The intrusion of "Central" is indicated by the illumination of a red Maltese cross behind the glass of the "detector," which remains lighted as long as "Central" is on the wire.

At the meeting of the Chicago City Council, on April 22d, a resolution was introduced charging that the telephone companies of Chicago are furnishing their service to the public "at rates and conditions that are extortionate and oppressive." The resolution states that as the Supreme Court of Illinois and the federal Supreme Court had decided that the rates charged by public-service corporations could be regulated, the council judiciary committee should be ordered to draft and report an ordinance fixing reasonable rates. The resolution also called for the formulating of regulations for the telephone companies to which the latter shall be subject in the transaction of their business in the city of Chicago. This resolution was sent to the judiciary committee.

MANUFACTURERS AND DEALERS

The Western Telephone Construction company has removed its factory from Chicago to Winthrop Harbor, Ill. After May 1st the company's offices and salesrooms will be located in the Fisher building, Chicago.

The Independent Telephone Construction company has been incorporated in Chicago, with a capital of $2,500, to manufacture telephone supplies. The incorporators are James P. Harrold, Worth E. Caylor and William Mannhardt.

The Kansas City Telephone Manufacturing company of Kansas City, Mo., has recently removed from 18 West Missouri avenue to larger quarters at 516 Main street. The new location comprises three floors and permits of a much more extensive display of the company's apparatus. This company has installed many private telephone systems in Kansas City and a large number of country public exchanges throughout Kansas and Missouri, and the present move has been made necessary by a constant growth in the company's business.

Mr. Walter S. Roberts, vice-president of the Southern Telephone Construction company of Knoxville, Tenn., was in Chicago this week on business. This company is constructing a number of exchanges and many miles of toll lines in Florida, Alabama and Texas, all of which are equipped with the Swedish-American apparatus, for which the Southern company is agent in the South. Mr. Roberts reports business as "more than booming," and regards the southern states as the most promising in the Union. Industries of all kinds are just developing there, and in his opinion that section of the country is scheduled for a period of remarkable prosperity.

The F. Bissell company of Toledo, Ohio, is offering to the trade a telephone cable combining the following features: Dry paper, single or double wrapped, twisted in pairs, length of twist not to exceed three inches, formed into a core and loosely arranged in reversed layers. The cable runs 500 megohms per mile insulation resistance, and its static capacity is absolutely guaranteed. The fact that this cable is of a very high grade and moderate in cost is emphasized by sales recently made by the company to many large consumers. The Bissell company reports its business as unusually brisk in this line, but says that its arrangements are such that it can make prompt shipments.

The Pacific Electric company of La Crosse, Wis., is calling attention to Johnson's automatic intercommunicating switch, which is used in connection with intercommunicating telephone systems, and which it manufactures. By the use of this device, when one uses his telephone and hangs up his receiver the line is automatically opened, so that it is impossible for the line to become "dead" from the carelessness of the operator in leaving his plug or switch in contact. Besides telephones, the company also manufactures a switchboard of from 10 to 200 numbers on the same principles. Instead of a lever or plug, the company uses a push-button switch to connect the telephones. The switch has a magnet device which makes a sure contact and allows no failure for the automatic action of the telephone.

The Kellogg Switchboard and Supply company of Chicago reports a steady increase of business in all departments. A few months ago 10,000 square feet of additional floor space was added to its already large and well-equipped factory, and arrangements have been recently made for the addition of 21,000 more. This space will be equipped with the most modern machinery, and it will facilitate the handling of orders with even greater promptness than heretofore. The small switchboards of the Express type which this company recently put on the market have proven very popular and are in great demand, orders for over 50 having been received since March 15th. In order to meet the demand for silk and cotton-covered wire and switchboard cable, the insulating department has been increased to double its former capacity, and is prepared to fill orders for any size or kind of silk and cotton-covered wire on short notice. The company also announces that it owns 90,000 of the finest cedar poles in Michigan, which it is prepared to supply in carload lots at lowest prices. Orders for small switchboards were recently received from the following-named places: Williamsburg, Pa., Russell, Iowa, Somerset, Pa., Chrisman, Ill., Webster, S. D., Granbury, Texas, West Chester, Pa., Bartlesville, I. T., Bishop Hill, Ill., Woonsocket, S. D., Tama, Iowa, Royersford, Pa., Columbus Junction, Iowa, Little Rock, Ark., Marco, Ind., Shawnee, Ohio, Canadian, Texas, Troy, Ind., Savannah, Ill., Chadwick, Ill., Black River Falls, Wis., Astoria, Ill., Concordia, Kan., Ashland, Ky., Blue Rapids, Kan., Greenleaf, Kan., Huntingburg, Ind., Virginia, Ill., Logan, Kan., Hurley, S. D., Sparta, Ill., Miltonville, Kan., Scandia, Kan., Streitsville, Ohio, Lexington, Miss., Story City, Iowa, Versailles, Mo., Dalton, Ohio, Doylestown, Pa., West Grove, Pa., Westphalia, Ind., Linton, Ind., Clifton, Kan., Sandborn, Ind., Estelline, S. D., San Francisco, Cal., Joy, Ill., Blue Earth, Minn., Augusta, Ill., Sullivan, Ind., Dawson, Minn., Wellsboro, Pa.

The Ansonia (Conn.) Telephone company has been sold to the Southern New England Telephone company, as foreshadowed last week. The majority of the Ansonia stock has now been transferred.

Apparatus for Power Distribution from Central Stations.

By Charles F. Scott.

Part II.

The Rotary Converter.

The rotary converter is a machine of very considerable interest, as it has only recently entered the commercial field, and as it proves to be of so great importance in linking the alternating and direct-current systems, as well as presenting many features of engineering interest. The machine combines the function of alternating-current motor and direct-current generator. The same armature and the same winding are used in both functions, thereby not only combining two armatures into one, but combining them in such a way that an armature of given size has a greater output as a rotary converter than it would have either as a motor or a generator. The common facts regarding the rotary are well known. Thus, the alternating current may be introduced as two-phase or three-phase; there is a definite ratio between the alternating electromotive force and that delivered by the commutator; the electromotive force of the direct current may be varied by any suitable form of alternating-current regulator; a middle wire carried from the secondaries of the lowering transformers may enable a 220-volt rotary with two sets of brushes to be used for supplying a three-wire distributing system; the machine may be used in conjunction with the storage battery; it is capable of very great overloads, and is eminently suited for the variable demands of railway service.

It is, however, when we come to consider the rotary converter as a part of a working system that features of particular engineering interest appear. The converter must run as a synchronous motor, and many of the conditions which pertain to the parallel operation of generators apply also to the running of the rotary. The manner of connecting it to the circuit when it is started by a separate motor, or by a direct current to its own commutator, is similar to the connection of an alternator to the bus-bars, in that the machine to be connected must have the proper speed, the proper phase relation and the proper electromotive force before the switch is closed. The armature of the converter by its inertia tends to run at a uniform speed. If the speed of the generator is fluctuating, then the armature of the converter will attempt to follow that of the generator and will be successively accelerated and retarded. If the armature of the converter were without weight, it would be free to follow the fluctuations, but as that is not the case, it cannot fluctuate exactly with the generator armature, and its inertia will cause it to lag behind the position of the generator armature. At a given moment the armature of the converter may be retarded and running below the mean speed. It will tend to continue at this speed until the generator speed has increased and supplies the necessary energy for quickly accelerating the speed of the rotary. A slight change in the angular velocity of an engine during each revolution therefore tends to cause corresponding fluctuations in the speed of the converter which demand that the flow of energy to the converter be intermittent, as its armature acts as a flywheel. This increases the current to the converter, and as its armature cannot follow simultaneously the angular positions of the generator armature, it is sometimes in advance and sometimes behind the proper position for commutation, thereby tending to cause sparking or flashing at the brushes.

The converter does not take kindly to these fluctuations and treat them passively. It has a freedom of action of its own. When the generator attempts to force the armature to oscillate rapidly by the mean position there are various reactions within the converter which may respond to the tendency to vibrate or oscillate, and the armature may act as a pendulum and increase its amplitude of vibration. As the result, each oscillation may be a little greater than the one preceding, so that each time the armature falls behind or advances beyond the mean position it is a little further than before, until stable conditions are reached, and it continues to vibrate through a fixed arc, or until the amplitude is so great that the armature is no longer able to remain in synchronism.

A means of preventing hunting which has proven to be very effective utilizes a very simple principle, namely, that of introducing a resistance to the oscillation of the armature, and thereby preventing the wide fluctuation in the same way that a dash-pot tends to prevent ordinary mechanical oscillation. The current in the armature produces a comparatively slight magnetic field which is stationary with respect to the field poles when the armature rotates synchronously, but when the armature oscillates back and forth, thus being alternately generator and motor, the armature current causes a varying field, which induces currents in the faces of the field poles which hinder the oscillation of the armature. If there are other metal parts near the armature surface, such as brass or copper bobbins for the field coils, currents may be induced in them. An efficient form is a copper shield around the field pole near its face and extending over the face of the pole along the sides. The shields act as an electric damper whenever the armature begins to oscillate.

The converter will be much freer to set up oscillation if the force tending to hold its armature in close accord with that of the generator is comparatively weak. The force is smaller when the regulation of the generator is poor, and the electrical connection between generator and rotary is much more rigid when the generator regulates well. The angular displacement between the positions of the two armatures will be accompanied by a comparatively large current from the generator of good regulation, which will tend to prevent the fluctuations of the rotary.

From the above considerations it is clear that alternators driven by belt or by waterwheels tend to give more favorable conditions than those directly connected to engines for driving generators which supply current to rotary converters, as the angular speed will usually have greater regularity. Other rotary converters and synchronous motors, as they are generators of electromotive force in common with the alternators, may become disturbing elements, and a converter which may run smoothly under other conditions may behave very badly when a synchronous motor or another converter connected to the circuit at some distant point is not operating properly. This is, however, not true of induction motors. They have an opposite effect, and their presence on a system facilitates the operation of the rotary and also the parallel running of the generators.

Alternating-current Motors.

The power service of a central station is of great and increasing importance. For railway work the direct-current motor is used, and choice must be made between a number of stations generating direct current at 550 volts or a large alternating-current power station, with sub-stations for converting to direct current. The latter method has been adopted in New York city, where large plants are now being installed.

For general power service, in which stationary motors are used, both direct-current motors and alternating-current motors are available. The direct-current motor is well known, and places a high standard of excellence for its rival to equal or surpass.

The alternating-current motor is not so well known, and the theoretical explanations and formulæ by which it is often elucidated only make it more vague to many minds. The old controversy of induction vs. synchronous motors is solving itself. There are few, if any, who seriously advocate synchronous motors of very small size, say, below 50 or 75 horsepower. In larger sizes the induction motor has been growing in favor, until it is quite generally preferred up to several hundred horsepower, although there still exists a difference of opinion regarding very large sizes.

It is quite probable, however, that the synchronous motor will not be wholly displaced, for there are a few cases in which some of the peculiar features of the synchronous motor are so useful as to more than compensate for the increased mechanical and electrical complication, the greater difficulty in operation, the increased liability to interruption of service and the many injurious effects which it is capable of producing upon the system.

The induction motor, the form which is the one in common use for general power purposes, is unique in its mechanical simplicity. However confusing the theory may be, dealing with difference of phase, wattless currents, shifting fields, mutual induction, magnetic leakages and power factors, it is mechanically simple. But these theoretical features do not interest the customer any more than the thermodynamic principles and the heat cycle of a gas engine concern the man who wants it to run his printing press.

In electrical characteristics the induction motor and the direct-current motor present some marked differences. In some features one, and in some features the other, excels. A fair comparison must not be limited to a single element. The induction motor is not to be fairly judged by considering only its efficiency, or its power factor, or its starting torque, or its starting current, or its speed regulation, or its overload capacity. Nor is this all; it is not merely efficiency in power, but effectiveness in service; not electrical excellence, but mechanical reliability which is of first importance, particularly when motors are to be distributed broadcast in cellars, restaurants, offices, shops and factories, consigned to the tender mercies of janitors and office boys. The delay resulting from an accident to a motor in a machine shop or a printing office may cost as much as the motor itself or the power required to run it a year.

Although electrical performance is not the principal element in a choice between the direct-current and the alternating-current motor, yet it is important. The full-load efficiencies of commercial motors are fairly equal, but at small loads the induction motor has a higher efficiency, notably in the small sizes where the brush friction of direct-current motors is relatively high.

The induction motor is admirably adapted for meeting emergency conditions, not only on account of its mechanical construction and absence of commutator, but also on account of its electrical characteristics. It may carry an overload of two or three times its normal load for a short time without injury, and in case of accident, in which the motor is overloaded and brought to rest, no damage will occur for a few moments, not until the motor becomes overheated. The current to the motor at rest is limited by its self-induction. Under similar circumstances, a direct-current motor would take an enormously great current (unless the current is automatically interrupted) and damage would result immediately. If, for any reason, the voltage be lowered or even interrupted for a moment, the induction motor will decrease in speed momentarily, but may continue its work without stopping, or, if it should come to rest, it may immediately start when the current is again supplied. This feature has proved to be of very great advantage in some important installations. Under similar conditions, with most direct-current motors, the services of an attendant would be required for starting. The induction motor of the forms we are considering is ideal in that it admits of no adjustments nor tampering by the ignorant or curious. There are no brushes nor field rheostat to adjust, and the starting device, even if it be improperly set, will only cause the motors to start with greater current than would otherwise result, whereas a similar mistake with other motors might prove disastrous.

The speed of the induction motor has a perfectly definite limit within a few per cent. of its ordinary running speed; no accident can cause it to be higher. It is not uncommon for a failure in the field of a direct-current motor to result in a high armature speed, which brings very serious results.

The Central Station of the Future.

The progress in central-station engineering indicates that the various characteristics of the alternating current which make it adapted to the generation and distribution of electric energy have caused it to be recognized and adopted, so that we may look to the alternator as the form of generator which will be used in the future central station. When, however, we reach the consumption circuits, we find a divergence of practice, for the alternating current and the direct current are both adapted for this service. Each has its own particular characteristics and types of apparatus; each has its particular points of merit, and each has points in which it is not so good as the other. The alternating current, however, possesses certain fundamental advantages, such as reduced cost for transforming apparatus, both in original investment and in attendance, reduced cost of conductors, as the distributing system is supplied from numerous widely distributed transformers, instead of being supplied from sub-stations, increased efficiency, and an ideally simple motor. The item of conductors for the distributing circuits becomes of very great importance where the conductors must be placed underground, and the cost of the copper alone may be small compared with the cost of the ducts or conduits in which the conductors are placed. Such items as these differ so widely in different cases that no general statement as to relative values can be made, but each case requires special consideration.

A peculiar difficulty confronts the engineer at the present time which makes the problem a double one. It is necessary, on the one hand, to utilize as far as possible the apparatus which now exists. This sometimes means the co-operation in one general system of many stations which were once entirely independent, each with its own particular class of apparatus and distributing circuits. This in itself is no easy task, but it is not sufficient to simply attain present results. There should be a plan which will lead to the ultimate system which will be the best. If apparatus is employed which is less efficient, more complicated and less reliable than other apparatus, it is usually simply a question of time when the change must be made from one to the other. It is obvious that the system and the apparatus which are most simple and reliable in their operation are those which will probably be adopted ultimately. The alternating system, therefore, has naturally the first claim to consideration, and upon the broad principles of simplicity it is the one which has the first place, and the burden of proof lies with the direct current to show adequate compensation for the cost and complication which its introduction involves.

We have considered the central station almost entirely with respect to the methods and the apparatus by which the energy of the engine is distributed for various industries and domestic uses, both for lighting and power.

The function of the electrical system is to convey power from the point where it is produced to the many points where it may be required. It is a distributor; it performs many of the same functions in a power system as the pipes in a system for supplying water.

Back of any electrical system there must be a supply of power, and any method by which the cost of power may be reduced must therefore be regarded as being of the very highest and far-reaching importance. The steam engine is recognized as less efficient for developing mechanical energy from coal than the gas engine, but while the latter involves great possibilities, it has not been used to any appreciable extent. Mr. Westinghouse is quick to appreciate the future possibilities of experimental beginnings; he recognized the possibilities of the alternating current, and it was he who was foremost in upholding it during the years of opposition and controversy. Electrical engineering in America is doubtless many years in advance of what it would have been except for his foresight and energy. He is now exploiting the gas engine and is bringing it to a state of mechanical perfection, in which its inherent possibilities may be realized and an advance made in the cheapening of power which will effect an industrial revolution.

A few years ago one would have scarcely imagined that there could be operations more diverse and

having so little in common as the lighting of our streets and houses, the lighting of street cars, the driving of printing presses and elevators and fans, the heating of street cars and cooking utensils and the making of ice, and yet to-day all of them may be effected by the current from a single power station.

The combinations of capital which tend to the concentration of the power and electric interests of a city into a single system; the development of electrical apparatus to meet the requirements of such a system; the prospect for cheapening of power; the development of the various means by which power may be utilized, are all factors which indicate that it is the central station of the future, from which is to come the energy upon which industrial life and social activity and advancing civilization depend.

[*The end.*]

Spies Bug-proof Bell.

The vibratory bell shown in the accompanying illustration is manufactured by the Spies Electric company of Chicago. Besides being thoroughly bug-proof, it is said that this bell contains many new and desirable features, each the result of a thorough consideration of the requirements of apparatus of this kind, and which is intended to meet the demand for a strictly high-grade device. The frame is so designed as to dispense with the ordinary removable cap or casing, thereby preventing the liability of tampering with the internal mechanism. This construction also precludes all possibility of dust, bugs, etc., gaining access to the working parts, and is a feature which is said to be covered by patents. It is also claimed that this bell may be operated with a very small expenditure of electrical energy, and is therefore peculiarly well adapted for operation over long lines and with small battery power. The arrangement of the striker is such that false signals or jingling of the gongs as a result of jarring or shaking is practically eliminated. The finish and general workmanship of the apparatus are both excellent.

SPIES BUG-PROOF BELL.

Carlisle & Finch Magneto Sparker.

A magneto sparker for gas and gasoline engines has been put on the market by the Carlisle & Finch company of 229-231 East Clifton avenue, Cincinnati, Ohio. This device consists of three permanent magnets, attached to soft-iron pole-pieces. The pole-pieces are carefully bored out, so that the armature runs as close as practical, and the whole is supported on a neat and simple stand, so arranged that the magneto swings on a pivot. This is made use of to tighten the belt as it becomes loose. A thumb-screw and lock-nut permit of tightening the belt just enough, and it may be slacked off again at will. If it is desired to run the magneto by a friction pulley, the same stand is used, but a spring is substituted for the thumb-screw, to hold the pulley against the flywheel. The armature of the magneto is made of laminated sheet-iron punchings. Copper commutator, carbon brushes, self-oiling bearings, etc., are among the good features of this sparker. It is said to generate a large current and may be run at 1,200 revolutions per minute.

Discovery of Cadmium in Colorado.

In view of the recent announcements concerning the new copper-cadmium secondary battery perfected by Thomas A. Edison, more than ordinary interest attaches to the discovery of an extensive deposit of cadmium-bearing ore at the Della S. mine, near Aspen, Colo. The rock is described as being of a bluish-white cast, and is quite rich in cadmium, silver and lead, the yield of the first-named being given as eight per cent. A large concentrating mill is now under construction at Aspen, under direction of D. R. C. Brown of New York, president of the Della S. company. Cadmium has been considered a comparatively rare metal, and it is asserted that a cheapening of its cost of production will give a substantial impetus to the commercial development of the new battery.

The Riverside Power company of Riverside, Cal., has been incorporated, with $250 000 capital, by C. W. Rogers, J. H. Barbour and I. D. Rogers.

Standardization of Electrical Apparatus.[1]

By H. F. Parshall.

The standardization of electrical apparatus, as to either speed, voltage, output or frequency, with a view to limiting the number of types and diminishing the cost of production, is and has been the constant study of manufacturers, and in England, perhaps, to a greater extent than in other countries. In a country situated like England, and subject to foreign competition, such efforts are disappointing in results, since, owing to the widely varying practice in different countries and the amount of competition, engineers experience no difficulty in getting numerous tenders for practically any size and type of apparatus fancied. From a manufacturer's point of view, a "standard" article is one that has a certain intrinsic value as regards output for a given cost as regards material and labor. In other words, an article is standard after it has been produced in such quantities that the ratio of cost of manufacture to output or capacity approximates to the average for a given class of apparatus. A piece of apparatus is termed "standard" when its efficiency has been demonstrated in practice and its cost per unit of output is satisfactory. It appears, therefore, that the only process of standardization which will prove useful relates to the conditions of output, such as rise of temperature, regulation, efficiency, etc. These conditions should be standardized and accurately defined, so that manufacturers are put upon a common basis. It is impossible for an engineer to balance off in value the absence to some extent of some one quality, against a predominance of some other quality, both of which have a direct bearing upon the cost of material and labor entering into an apparatus. With the conditions of output definitely standardized, a statement of output would insure a certain value in materials and a definite intrinsic value in a given apparatus. In what follows I shall attempt to outline generally the conditions of output, which should be defined to insure a given result as to efficiency and maintenance.

Thermal Limit of Output.

The thermal limit of output may be defined as the maximum temperature consistent with the durability of the insulation of the electrical circuits and the maintenance of the commutator or collector rings in best working condition. Practice in different countries varies considerably; thus, in the United States, in ordinary commercial practice, it is not unusual to specify that the increase of temperature by thermometer shall not exceed 35° Cent. When machines of exceptionally good qualities are required, it is not unusual to specify that no part of the generator shall attain, in actual working, a temperature of more than 25° Cent., this temperature being judged to be as high as is consistent with the most economical working, both as regards the maintenance of the insulation of the electrical circuits and mechanical properties of the commutator or collector rings. In Germany, some makers have two standards, namely, 45° Cent. in the hottest part to meet continental competition, and 35° Cent. to meet American competition. I am not aware that any definite standards exist in England. The deterioration of the insulation of the electrical circuits, depending, as it does, upon the maximum increase of temperature, and this being generally inaccessible to the thermometer, the rise of temperature in the electrical circuits should be determined by the increase of resistance. This should be referred to standard conditions of room temperature; a temperature of 25° Cent. and barometrical pressure of 750 millimeters have been suggested by the American Institute of Electrical Engineers, and may be fairly taken as a standard. It has also been suggested by the same body that the field and armature temperature by resistance for permanent working should not exceed 50° Cent. For the commutator, collector rings and brushes, a higher temperature has been thought permissible, namely, 55° Cent. Certainly none of these temperatures should be exceeded in practical working. In the case of machines working at approximate rated capacity, the above definition as the maximum increase of temperature has a definite practical significance.

In the case of apparatus working at widely varying loads, a further definition is necessary. This definition has reference to the time over which a certain cycle of operations is to be done and the average energy losses during this time.

In the case of transformers or machines having approximately constant magnetic flux, the output may be determined from the energy losses due to hysteresis and eddy currents, and the square root of the mean square of the currents during the time of operation.

In the case of transformers or motors working at constant speed, the total energy losses should be determined at this frequency.

In the case of traction motors, the energy loss corresponding to a given increase of temperature at the end of a given period of operation may be referred to the average speed during this time of operation.

The current capacity and output of a motor then become definitely fixed from the thermal constants and the energy losses for a given current intake and speed.

1. From Traction and Transmission, London.

From the above it will be seen that the power of an apparatus cannot be referred to the average current intake, since the average energy losses do not correspond to the average current intake; the magnetic losses are a function of the magnetization, which is disproportionate to the current, and the C^2R loss corresponds to the square root of the mean square of all the current values.

It has been frequently stated that, owing to the restricted space, the permissible increase of temperature of traction motors should be greater than that of other classes of machinery.

The increase of temperature for the same maintenance should be less, not greater. The method of testing traction motors by manufacturers is so purely arbitrary and so indefinitely related to the average energy loss that it cannot be taken as an indication of the temperature that is likely to occur in actual working.

Magnetic Limit of Output.

The magnetic limit of output is determined in commutating machines by sparking, and in alternators, synchronous motors, induction motors and transformers by regulation and maximum output. As regards commutating machines, it is usual to specify that such machines shall not spark, nor blacken nor roughen the commutator within the range of no load to 50 per cent. overload with brushes in a fixed position, and that 25 per cent. overload should be carried for two hours on the same conditions and with the same results. It is usually taken for granted with traction motors, although not generally specified, that a motor shall stand from two to three times its rated capacity without danger of flashing. In the case of rotary converters running without lag or lead in the supply circuit, and at constant angular velocity, it is usual to specify that there shall be no detrimental sparking at 50 per cent. overload, and no dangerous sparking with double load.

Inherent Regulation.

The inherent regulation is defined as the ratio of no-load to full-load voltage without change of excitation. The inherent regulation is of practical importance in generators used for lighting or purposes where hand regulation is found to be most convenient. This may vary from five per cent. to 20 per cent. in practice, but should be definitely set down in the specification, since it is a factor in determining the amount of material used in a given apparatus. In the case of alternators, it is also to be understood that the electromotive-force curve is a sine curve, and that the current is in phase with the electromotive force, otherwise a distinct stipulation should be made.

In the case of transformers, the inherent regulation should be considered in respect to the C^2R loss. In small transformers the limit to the C^2R loss and the amount of copper in the circuit is largely dependent upon the inherent regulation required, and not upon the thermal limit of output. In large transformers the thermal limit of output is the determining factor, so that the regulation is determined from the CR drop in the circuits, and not from the inductance. The inductance component in modern practice is so small as only to increase the total drop on non-inductive load by a fraction of one per cent.

Regulation by Compounding.

As in railway generators for regulating the voltage automatically, and rotary converters for displacement in phase or regulation of voltage. In railway generators the standard practice is to overcompound so as to increase the voltage to 10 per cent., from no load to full load, the increase of voltage being practically proportional to the current. The standard no-load voltage may be taken at 500, and the full-load voltage at 550.

In the case of rotary converters, it is usual practice to make the series coil furnish about 30 per cent. of the total field excitation, which, in the ordinary conditions of transmission as to reactance of the circuits, etc., may correspond to an increase of voltage from no load to full load from 500 to 525. Such an amount of compounding assumes that the angular velocity of the prime mover is so nearly constant that the phase displacement during a cycle is practically negligible, and that the impressed electromotive-force curve is of the same form as the counter electromotive-force curve. Failing these conditions, such an amount of compounding may cause surging and fluctuation of voltage, and should be the subject of special definition. With several rotaries running in parallel in the same network, it is advisable to specify the reactance drop in the primary mains.

Efficiency.

Commercially defined, the efficiency of an apparatus is the ratio of the cost of the energy intake to the energy output of the apparatus. This definition includes all the energy losses, together with the maintenance of the apparatus. In practice, the definition of the efficiency is restricted to the statement of the ratio of the energy intake to the energy output, maintenance being the subject of special arrangement. In general, the efficiency has to be considered for each size and type of apparatus. In smaller machines, numerous ranges in efficiency are consistent with proper working conditions, as to heating and regulation, whereas with larger machines the efficiency is largely determined by the magnetic and thermal conditions to be fulfilled. With apparatus working

under varying loads, it is usual to define the efficiency at different outputs, so that the percentage of fixed losses at average output may not be excessive. In the case of generators, it is usual to define the efficiency at half, three-quarters, full load and one and a quarter load. This same result could be quite as satisfactorily secured by allocating the different losses, that is, the core loss and C^2R losses, at some given load.

Losses other than C^2R should invariably be determined at the rated capacity of the machine, since such losses increase with the load to some extent in practically every class of machinery.

All efficiencies should be determined at the normal working temperature of an apparatus, that is, if the atmosphere is taken at 25°, and the normal working temperature at 50° Cent. increase, the efficiency should be determined at 75° Cent.

In the case of alternators, the efficiency should be determined with a sine electromotive-force curve, and with non-inductive load. In the case of transformers, the same remarks apply in regard to the electromotive-force curve and non-inductive load, and the losses should be allocated as between C^2R and core loss.

For a transformer subject to heavy overloading, it is frequently of importance to specify the current density in the circuits, since it is possible to comply with a given thermal specification at full load, while the current density may be dangerously high at the maximum overload.

Transformers to be used in connection with rotary converters should be subject to the same conditions as to overload rating as the rotary converters. This point is of material importance, since with the usual specification for transformers it has been frequently found that rotaries of a given kilowatt capacity would operate much more satisfactorily at overload with transformers having corresponding overload capacity.

In the case of induction motors, the efficiency at different loads should be defined, together with the energy factor, since the energy factor determines the C^2R losses in the transmission lines and generator. The determination of efficiency can frequently be made most conveniently, where two similar machines are available, by the Hopkinson method.

In the case of rotary converters or static transformers, there exists no difficulty in determining the efficiency by the use of wattmeters.

In the case, however, of large generators, it is frequently necessary to determine the core loss and the C^2R loss separately, and it sometimes occurs that the efficiency has to be determined by indirect means, such as superimposing a given C^2R loss and measuring the increase of temperature for the radiation of this amount of energy, and again measuring the increase of temperature.

Under full loads such methods have frequently given very accurate results when carefully carried out.

In the case of traction motors, the efficiency should be particularly determined with reference to the average working power. On account of the great range of loads, it is usual to specify the efficiency through the gears (in case gears are used) at a quarter, half, three-quarters and full-rated load. The fixed losses become of special importance at average load, hence a stipulation as to core loss at this average load is desirable.

Insulation.

The workmanship and mechanical handling of insulating material is such an important element in determining the final result that an exact specification as to the kind of insulation or the thickness thereof may not insure certain results.

In the case of the magnets for all classes of machinery, on account of induction discharges to which field magnets may be subjected, it is usual to use a greater thickness of insulation than in the case of armatures. Up to 500 volts it may be taken as standard practice to insulate both the fields and the armature of stationary motors and machines not subject to extra-hard usage for double the working voltage.

For street-car motors and machines subject to like working conditions, it is usual to insulate the field and armature to withstand in the manufacturer's works five times the working voltage.

In the case of extra-high-voltage generators, i. e., from 3,000 volts upward, and transformers, the usual practical test is double the working voltage, or, at the works of the makers, from three to five times, as may be stipulated. The thickness of the insulation on the magnet coils usually varies from one-sixteenth inch to three-sixteenths inch, according to the size of the machine and voltage for excitation. In armatures an approximate rule is that the insulation for a 500-volt armature be approximately .05 inch in thickness, increasing approximately as the square root of the voltage.

500-volt armatures	.05 insulation.
1 000-volt armatures	.071 insulation.
2,000-volt armatures	.1 insulation.
4,000-volt armatures	.142 insulation.
10 000-volt armatures	.225 insulation.

The value of insulation should be determined from the puncturing voltage, and not from the insulation resistance. Insulation tests should be made with the machines clean and dry, with sine electromotive-force curve and at the normal working temperature. The duration of tests should be defined, and in the ordinary case should not exceed five seconds, since insulation subject to extra high pressure deteriorates with the length of time it is subjected to such pressure.

In the case of transformers, the thickness of insulation stipulated above will ordinarily be found to be satisfactory, and the method of tests will apply. The voltage for the test should have reference to the primary or maximum potential between the high-pressure coil and the core of the transformer.

Conclusion.

The above is an outline of electrical standardization which might be incorporated in practice. Some of the principles set down admit of a greater amount of discussion, one of the most important of which is the proper determining of the power of a traction motor. I have set down as a principle here that the power of a motor should have reference to the average energy losses in the motor, the time the motor is working and the thermal constants of the motor as to the radiation of heat. Other engineers have set down that the capacity of the motor should be determined from the average value of the current during the time the motor is working, whereas manufacturers generally determine the heating capacity of the motor from a one or two hours' test for a maximum heating of 55° Cent. to 75° Cent. above the air; this method is uncertain in its results. A method employed by some manufacturers is to determine the power of a motor in respect to the maximum load to be exerted by the motor in actual working and the time that this maximum load is on the motor during the whole period of working. Such a test is useful in demonstrating the capacity of the motor for maximum work, but does not indicate what the average performance of the motor in working will be, heating considered.

A very elaborate report as to a plan of standardization has been prepared and adopted by the American Institute of Electrical Engineers. This scheme of standardization has been generally accepted in the United States by engineering firms, engineers and manufacturing companies. The definitions as to heating, efficiency, etc., have been accepted by the leading technical journals and institutions for electrical education, so that the confusion which existed heretofore as to the meaning of terms, method of tests, etc., has been largely overcome. Such a code of standardization is also being considered by a number of leading experts in Germany. The standardization proposed, however, is not in general agreement with the American standards, in that it is suggested that less stringent regulations as to heating and sparking should be permissible in practice—that is, a greater increase of temperature should be permitted, and a certain shifting of the brushes should be allowed in commutating machines to avoid sparking for a change of load. What is really wanted is an international code of standardization, so that the standards of one country shall not be below those of another. There is no uncertainty as to the meaning of the best, and there is little difficulty in defining what constitutes a satisfactory result. A code of standardization based on other than the best commercial results would be of but little use to either the engineer or the manufacturer, and is likely to react detrimentally on the art generally.

It seems to be generally admitted now that standardization beyond the scope of the report above referred to is neither necessary nor desirable, since electrical engineering is developing to such an extent that the standardization of specific apparatus rather than by the qualities of the apparatus is commercially unnecessary. The different values set down in the report mentioned are the maximum values, and it is recognized by the leading consulting engineers and manufacturing firms that as regards maintenance, much lower values as to heating might be advantageous. In the beginning of the paper I pointed out that standardization, from a manufacturer's point of view, simply means a sufficient demand to bring the cost of an apparatus, complying with standard conditions, to a consistent value. The term "standard article," as applied some years ago, can hardly be said to apply now, since the number of standard articles has increased in proportion to the supply. Some large manufacturers have 50 or 60 different types of railway motors, and as many more of generators and railway controllers. In fact, one company informs me that it makes no less than 200 standard types of railway controllers, and that such a variety of types is commercially justified by the conditions obtaining in practice in different parts of the world, which would sufficiently demonstrate that in a country like England, subject to competition with all foreign countries, standardization outside of the lines above discussed would not be commercially possible. Standardization within these lines, however, would, I think, be advantageous, since for an apparatus of given voltage, frequency and output the essential features determining the intrinsic value would be the same, and a different apparatus would not have to be built to satisfy the varying fancies of those called upon to prepare electrical specifications. Further, in the case of disagreement, the process of arbitration would be greatly simplified.

The United States court has ordered the sale of the New Albany (Ind.) street-railway system and Judge Baker has appointed F. D. Conner of New Albany to dispose of it. The decree provides that a bid under $50,000 will not be considered. The property has been in the hands of a receiver for some time.

American Street Railway Association.

For the annual meeting of the American Street Railway association, to be held in Madison Square Garden, New York, on October 9th, 10th and 11th, preparations are well under way. Among the companies which have already agreed to exhibit are the General Electric company, Westinghouse Electric and Manufacturing company, Gold Heating company, John A. Roebling's Sons company, J. G. Brill company, St. Louis Car company and National Conduit and Cable company.

President Vreeland of the Metropolitan Street Railway company of New York has been elected chairman of the general committee. The other members of this committee are Clinton L. Rossiter, David Young, Colonel N. H. Heft, Edward A. Maher, D. B. Hasbrouck, A. M. Young, J. R. Beetem, E. P. Bryan, Alfred Skitt, James H. McGraw, General Eugene Griffin, B. H. Warren, Harry Sanderson, Frank J. Sprague, Henry L. Shippy and John L. Heins.

The exhibit committee has for its chairman Milton G. Starrett, chief engineer for the Metropolitan Street Railway company, to whom all communications in regard to allotment of space should be addressed. The other members of this committee are Oren Root, Jr., C. D. Meneely, Eugene Chamberlain, Calvert Townley, Charles M. Jarvis, J. R. Lovejoy, Captain L. Candee, E. E. Gold, Peter M. King, Frank MacGovern, J. R. Elliott, A. N. Berry, R. L. MacDuffie, L. G. Read, Thomas Millen, Colonel A. C. Woodworth and John T. McRoy. Other committees have been named as follows:

Entertainment committee—Clinton L. Rossiter, chairman; H. D. Cooke, Ralph H. Beach, Edward E. Higgins, W. Boardman Read, Major H. C. Evans, F. H. Taylor, E. A. Merrill, Thomas G. Wood, James C. Barr, E. H. Wells, H. M. Littell, D. M. Brady, Charles F. Brooker, C. B. Fairchild, Jr., Colonel H. G. Prout.

Transportation committee—J. H. McGraw, chairman; W. W. Wheatley, Milton G. Roach, W. E. Baker.

Reception committee—Colonel T. S. Williams, chairman; A. C. Tully, Charles E. Warren, E. H. Mullen, James M. Wakeman, Henry W. Blake, E. C. Long, L. B. Stillwell, Harold P. Brown, Giles S. Allison, Jacob Wendell, Jr., Charles W. Price, H. A. Robinson.

Press committee—St. Clair McKelway, chairman; Adolph S. Ochs, Colin Armstrong, Charles E. Miller, Herman Ridder, William Van Benthuysen, John Burke, H. B. Cosgrove, Henry L. Stoddard.

Transmitting Sound Under Water.

Experiments with the submarine signaling apparatus invented by the late Professor Elisha Gray and Arthur J. Mundy have proved successful. At the request of the British government, Captain Lewis Bayly, naval attache at the English legation in Washington, Colonel Anderson, chief of engineers and head of the lighthouse service of Canada, British Consul Blunt of Boston and Abner Kingman of Montreal have witnessed some experiments in Massachusetts Bay. A lighter containing the bell and electrical apparatus was stationed off Winthrop Head, and a steamer, with the receiving apparatus, was stationed half a mile away. The receiver—a hollow-metal tube on which are diaphragms of ferrotype metal—was lowered 15 feet in the water. A cable connected the receiver with a battery on the steamer. At that distance the bell on the lighter could be distinctly heard on board the steamer. Then the steamer was successively moved three, four and 10 miles distant from the lighter, and the bell could be heard at each point. It is expected that by the end of this year bells will be stationed off Nahant and Minot's Ledge, which are prominent danger points. To insure simultaneous ringing, the bells will be placed in the same circuit and connected with a dynamo on shore. Receiving instruments will be placed on the boats of several lines of steamers which will have charts, with the distances so accurately indicated that the pilot can determine his location by the difference in time between the sounds of the two bells. The Morse code may be used in connection with the invention, so that ships may communicate with each other.

New York-Philadelphia Electric Railway.

Control of the Trenton, Lawrenceville and Princeton Railroad company of Trenton, N. J., has been acquired by the A. L. Johnson trolley syndicate. The transaction includes the Princeton extension of the road, which goes to make up the connecting link of the trolley line between New York and Philadelphia. The old company formerly controlled by the estate of the late Isaiah Williamson was reorganized and the following-named officers were elected: President, A. L. Johnson of New York; secretary and treasurer, Wilbur F. Sadler of Trenton. The directory consists of Robert E. Wright, Trenton; F. S. Drake, Philadelphia, and W. C. Callahan, Trenton. It is expected that traffic will be opened oover the entire distance between Philadelphia and New York in a couple of months.

The Louisville and West Point Electric Railway company of Louisville, Ky., has been incorporated, with a capital of $5,000. W. J. Lewis is president,

CORRESPONDENCE.

New York Notes.

New York, April 20.—Work on the great downtown terminal loop of the rapid-transit subway was commenced on Monday morning. The start was made in City Hall Park. The sub-contracting concern in charge of the loop is the Degnon-McLean company. F. D. Fisher is the engineer who supervises its work there and along the Elm street sections of the subway. The loop runs out from the main line at Chambers and Center streets, goes under the old Hall of Records, then around the City Hall, and along Mail street to Park Row, and thence back to Chambers street.

There seems to be some question as to whether the bill of the Rapid Transit Commission now before the state Legislature at Albany is to become a law. As the session ends next Tuesday, the time is short. It was reported yesterday that the bill would be amended and passed. The amendment will strike out all of Section 35, which has been greatly criticised as giving to Contractor McDonald the right to transfer his contract, by permitting him to assign to a corporation to be organized his right to operate the tunnel under the lease held by him.

On Monday Thomas A. Edison entertained Mr. G. Marconi and a party of New Yorkers and personally took them through the phonograph works, machine shops and laboratory in West Orange. With Mr. Marconi were John Bottomley, a nephew of Sir William Thompson (Lord Kelvin); H. A. Hemphill of the Norfolk and Western railroad; David Young, second vice-president of the North Jersey Street Railway company; Frank Brewer, president of the Orange Mountain Traction company, and a number of others. It was said that the visit was purely social and had nothing to do with the experiments of either of the inventors. Before the visit to Edison the party viewed a piece of Marconi's apparatus, which had been set up on the Deutschland, anchored at her pier in Hoboken.

The compressed-air cars operated by the Metropolitan Street Railway company on its cross-town lines have been removed and replaced by animal-power cars.

It is reliably reported that negotiations have been carried on for some time by the Brooklyn Rapid Transit company, with interests connected with another company, which is said to be seeking control of the Brooklyn property. The Brooklyn company's officials are reticent as to what these interests are. Jacob L. Greatsinger, the new president of the Brooklyn Rapid Transit company, has returned from his trip to Detroit, and it is expected that he will shortly introduce a number of improvements in the operation of the road.

The reported plan to effect a unification of the copper properties of the country was given strength this week by the announcement of Kidder, Peabody & Co. of Boston that they had been requested to arrange a consolidation of the Boston and Montana Copper and Silver Mining company and the Butte and Boston Mining company with the Amalgamated Copper company.

The aggregate of the tentative valuations of the special franchises of corporations operating in New York city, as fixed by the State Board of Tax Commissioners at Albany for the next tax year, is $217,930,932, which is a reduction of $1,612,419 from the aggregate of the final valuations fixed by the state board on those franchises one year ago, at which time the aggregate was $219,543,351. The board has reduced the assessment on the Brooklyn Rapid Transit system, the Manhattan elevated-railroad system, the Metropolitan railway system, the Third Avenue railroad system, the New York Central and Hudson River railroad system, and other corporations, and has increased it on the Consolidated Gas company, the Brooklyn Union Gas company, and several other minor companies.

Out of 15 competitors in the 100-mile endurance test of the Long Island Automobile Club, held today, nine completed the century in less than eight hours, five in less than seven hours and two in less than six hours. The weather conditions were very bad, which makes the showing more remarkable. All the competing vehicles were propelled by gasoline motive power, the steam and electric vehicles and six other gasoline vehicles not starting on account of the weather. The first two to cover the course were road wagons entered by the Automobile Company of America. Third to finish in the run was C. J. Field's De Dion-Bouton motorette; fourth, John D. Pratt's (gas mobile) white road wagon, driven by F. Walsh. Mr. Pratt and H. S. Chapin (Haynes-Apperson), with three guests, in a four-seated surrey, are believed to be the only winners of the blue-ribbon honors, having made no stop in making the century.

The plan of the Consolidated Gas company wholly to control the gas and electric-light and power interests in the Boroughs of Manhattan, the Bronx, Kings and Richmond is said to have been attained. It is announced that the adjournment of the New York Legislature will be the signal for making public the details of the plans.

M. L. G.

New England News.

Boston, April 19.—The Legislature has refused to take action regulating the price of electricity in Boston.

The mayor of Cambridge, Mass., has petitioned the General Court for legislation providing for the punishment of persons who interfere with fire-signal systems.

The Boston Elevated Railway company is straining every nerve to finish the Charlestown section of its elevated system before June 17th—Bunker Hill Day—when the processions and crowds in that section of the city always put a full stop to street-car traffic for several hours during the day.

During the April vacation, this week, a class of Massachusetts Technology seniors is accompanying Professor William L. Puffer on a trip of inspection to the works of the General Electric company at Schenectady, N. Y. The class will also visit some large power houses in New York and Brooklyn before its return.

The union linemen of Boston have asked the electric-light, telephone and telegraph companies for a working day of eight hours. The union initiated 102 members at a recent meeting.

The Massachusetts House of Representatives reconsidered its vote by which it accepted the report on the bill regulating the sale of electricity, submitted by the committee on manufactures. The committee report gave the petitioner leave to withdraw. After voting to reconsider the House laid the bill on the table, on the motion of Representative McNary, the petitioner. The bill provides that the sale of electricity shall be by meter, the unit of measure being the established electro-mechanical equivalent of the watt, obtained by multiplying the voltage by the amperage; the meters to be sealed and stamped by an inspector of gas meters. The bill also provides that no meter shall be used that may confuse or deceive the consumer as to the number of watts he has consumed or the price he shall pay per watt, and no charge is to be made unless electricity is actually furnished. Any electric company furnishing an unsealed and unstamped meter is to be liable to a fine of $5.

The Automobile Club of New England proposes to establish an automobile stable in the business section of this city, for the use of its members who come to town in their machines. The club's first run of the season was led by Knight Neftel, in a new electric racer, carrying 96 cells of battery. Eighteen carriages made the run of 40 miles. Mr. Neftel's carriage is designed for a speed of 60 miles an hour. It made the run without a replenishment of battery and kept the lead without effort, running through loose gravel as easily as though it were asphalt. A few days after the run, one of the wheels collapsed while the carriage was traveling at a rapid rate, and Mr. Neftel and Royal R. Sheldon were thrown out, receiving a few bruises. The carriage turned a complete sumersault and was badly damaged.

Representative McNary's bill, providing that Boston electric-lighting companies shall furnish electricity at a price not exceeding one-quarter of a cent per light of 16 candlepower per hour, was adversely reported upon by the committee on manufactures, and the Legislature sustained the committee report.

The legislative committee on metropolitan affairs held an executive session on April 17th, at which it discussed bills relative to a subway under Washington street in this city. The committee unanimously agreed that the time was ripe for such a project and that a bill along that line should be reported at this session of the Legislature. It was agreed that the city of Boston, and not the Boston Elevated Railway company, should build and own the subway. The members did not agree upon the proper length of time for a lease to the railway company, opinions covering a range from 20 to 50 years, and the prevailing sentiment favoring a long term, in order to lessen the rental. The rate of the rental would depend on the rate of interest the city would have to pay on the money raised for construction purposes. The committee was also divided on the question of removing the tracks from Washington street, but there was a strong feeling in favor of submitting that question to a popular vote. A subcommittee of seven will now draft a bill covering the subway matter.

At the Weymouth (Mass.) town meeting, on March 11th, a majority of the citizens voted against an appropriation for street lighting, and pursuant to a notice from the selectmen, the Weymouth Electric Light company discontinued its service on the following Monday. A special town meeting was subsequently held, in view of the inconvenience to the public, and $5,500 was appropriated, the meeting authorizing the committee to contract for the same number of lights as the electric-light company had previously furnished for $7,000. The company has agreed to furnish lights until the first of next March for the $5,500, but the company will not furnish town lights after that time, unless the town signs a contract for a term of years. The town is to pay $70 a year for each arc light and $17 a year for each incandescent light. The electric-light service was resumed to-day, the event being celebrated by firing of guns, firecrackers, etc. While the town was not using the electric lights scarcely a woman has been on the street alone after dark.

The Maine railroad commissioners have received the articles of incorporation of the Portland and Brunswick Street Railway company, which proposes to connect the Portland street railway with the Lewiston, Brunswick and Bath road. The Portland and Brunswick road will be 16 miles long. The company is capitalized at $80,000, and the directors are Amos F. Gerald, E. J. Lawrence, F. A. Nye and A. B. Page of Fairfield, Me., Cyrus W. Davis of Waterville, Me., and Henry M. Soule of Boston, Mass.

Plans and specifications for the first building of the new plant of the Cambridge (Mass.) Electric Light company, are under consideration by several contractors. The building is to be of brick, two stories high, and will measure 130 by 50 feet on the ground. It will be erected at the corner of Western avenue and Blackstone street and will contain four rooms on the ground floor, to be occupied by clerks, directors, and the meter department, and four unfinished rooms upstairs. The building will also contain a storeroom, 62 by 49 feet, including quarters for the men, shower baths, lavatories, etc. The plans for the station are not yet completed. A month ago the company's stock was selling at $150. During this week two shares were sold at $173.

Chairman Gaston of the board of directors of the Boston Elevated Railway company started the first or test fire in the boilers of the company's new elevated power station on Atlantic avenue, this week. Among those present were President W. A. Bancroft, Secretary Burnett and Chief Engineer Kimball of the company, and Chief Engineer H. A. Carson and Secretary B. L. Beal of the Boston Transit Commission. The test was very successful. General Bancroft conducted a small party of the officials in a special car on a tour of inspection of the elevated structure. The party traveled at the rate of 41 miles an hour on the Charlestown elevated line.

B.

From the Buckeye State.

Columbus, Ohio, April 20.—It has been announced that the Akron-Canton Electric Railway company, incorporated a week or so ago, has made a contract with the Northern Ohio Traction company to enter Akron over its line. In that case the Northern Ohio will not build the contemplated line to Canton, which means that there has possibly been a compromise in some other matters or that the Northern Ohio interests are probably thrown with the Akron-Canton company to some extent. It is possible that the Northern Ohio may build to Massillon, however.

Judge Allen Smalley of Upper Sandusky and others have been granted a franchise to build an electric road through Wyandotte County, from Kenton to Tiffin. They represent a company which is being promoted from Kenton.

The Millcreek Valley Electric Street Railway company has been granted a franchise to extend its lines into the heart of the city of Hamilton. The Southern Ohio Traction company has been negotiating with the local street-railway company at Hamilton to purchase the property, in order to meet competition from the other road between Cincinnati and Hamilton. The figures, it is said, stand at about $250,000.

Competition in central Ohio for good routes for electric lines is becoming rather warm. A week or two ago a company was incorporated to build a line from Columbus to Marion, by way of Delaware, and ultimately to connect with Toledo and Cleveland. This week the Defiance, Ottawa, Kenton and Columbus Interurban Railway company was incorporated, to build a line from Defiance to Columbus, by way of Ottawa and Kenton, and to extend north to the Michigan line. The capital stock was placed at $50,000, and the incorporators are Daniel J. Ryan, George H. Jones, Charles Kinney, Nelson E. Matthews, John M. Sheets and H. A. Fisher. Mr. Kinney has just retired from the office of secretary of state. Mr. Sheets is the present attorney-general. Mr. Fisher is the general manager of the Columbus, London and Springfield Railway company, and the other gentlemen are prominent in business affairs. An arrangement has been made to use the Columbus, Delaware and Northern tracks from Delaware to Columbus, when they are completed. This is the original company incorporated to build a line between these two cities several months since.

The Mahoning Valley Electric Railway company has increased the wages of conductors and motormen on the lines in the city of Youngstown from 17 to 18 cents an hour and on the country lines from 15 to 17 cents an hour.

The Cincinnati, Milford and Goshen Street Railway company has been granted a franchise to connect with the Cincinnati Traction company at Montauk, in Hamilton County. The company will build from that point to Loveland.

William Christy and M. J. Mendelbaum have been in Cincinnati negotiating with the Cincinnati Traction company for an entrance to the city over their lines. The result of the negotiations has not been given out, but the gentlemen assert that Southern Ohio Traction cars will be entering the city to Fountain Square within 30 days.

The Edwards Railroad Electric Light company has secured a site in Cumminsville, near Cincinnati, for a factory. The company manufactures electric headlights for locomotives.

The Little Miami Traction company of Xenia, Ohio, has been incorporated, with a capital stock of $1,000, to build a line from Xenia to Springfield. W. H. Marlatt, Alonzo M. Snyder, F. A. Henry, A. A. McCaslin and Harrison B. McGraw are the incorporators. The older company of that name gives its consent to use the name, signed by John P. Martin and Secretary Fitszimmons. It is stated that the line between Xenia and Springfield will be

built first, and from the latter place to Cincinnati later on. It will enter Cincinnati over the lines of the Cincinnati Traction company.

The Fort Wayne, Dayton and Cincinnati Traction company has been incorporated in South Dakota, to build a line from Fort Wayne to Cincinnati, and the capital stock is placed at $1,000,000. Dayton, Cincinnati, Fort Wayne and St. Paul capitalists are interested in the company.

Thomas N. Fordyce is at work on his canal equipment at Cincinnati. He hopes to have boats on that portion of the canal within the city of Cincinnati in operation within a few weeks.

The officers of the Buckeye Lake road have decided to build a power plant at Hebron. Smaller plants may be built at each end of the line; that is, at Columbus and Newark. Twenty miles of the road have now been graded.

The employes of the Cleveland, Elyria and Western Electric Railway company tendered the officers and directors a banquet at Elyria last Saturday evening.

It is stated that the Penhale-Davitt syndicate will build an electric line from Youngstown to Cleveland. With the other plans the syndicate has in view, this will give Cleveland connection with Sharon and Newcastle, Pa.

S. R. Smith has been chosen as general manager of the proposed line of the Cincinnati, Columbus and Southern Traction company.

Dr. Washington Gladden of Columbus took for his subject for his sermon last Sunday "Michael Faraday." He treated the life of the noted man in a very exhaustive manner.

The People's Hard Rubber company and the Diamond Rubber company, both of Akron, will manufacture rubber specialties for use by telephone companies and in the electrical business in general, in competition with the trust.

The Ross injunction against the Columbus Railway company has been dissolved by Judge Newby and the new ordinance has gone into effect. The company is now selling seven tickets for 25 cents, good for transfers. Owl cars are being run over several of the most important lines in the city also.

The case of the city of Middletown against the Southern Ohio Traction company has been dismissed by the Circuit Court. This is another case in which damages were sought because the water pipes were injured by electrolysis.

Stories still come in to the effect that the Everett syndicate will consolidate the interurban railways about Detroit. While the negotiations are not complete, it is said that the Rapid railway system, the Detroit, Rochester and Lake Orion, the Ann Arbor, Ypsilanti and Jackson, and the Detroit and Pontiac have already agreed to satisfactory terms. The Detroit and Northwestern may be purchased, if it does not see fit to become a part of the larger company.

From Toledo it is stated that the Detroit and Toledo shore line will be completed at once. From Detroit to Monroe it will be double-tracked and from there to Toledo a single track will be used. Charles Currie of Cleveland has been made manager of this road. It will pass through several important towns and will form a part of the Lake Shore line from Detroit to Buffalo. The Everetts are said to have secured an option on the Toledo and Monroe line, which will also be a portion of the large system.

O. M. C.

Information from Indiana.

Indianapolis, April 22.—The attempt to organize a union among the employes of the Indianapolis Electric Railway company has been abandoned. The sentiment of a majority of the men was against the union. President McGowan is bitterly opposed to a union of the men he employs. He says no benefits grow out of such an organization. On the other hand, it creates factional differences among employes, keeps them up late at night, interferes with their rest and interferes with their efficiency.

The promoters of an electric line between Indianapolis and Frankfort, as a part of the proposed system to connect Logansport and other northern cities and thence to Chicago, drove over the route during the week. Mr. O. P. Ensley, one of the chief promoters, said they received much encouragement, and the construction of the line would be begun this summer.

The Indiana electric lines are cutting into the business of the railroads considerably. The Greenfield line carries $500 worth of freight a week in and out of Indianapolis and local ticket sales are very heavy. Before the Union Traction electric line was built along the Michigan division of the Big Four the latter company's ticket sales amounted to nearly $5,000 a month at Alexandria. Now they do not amount to one-third of those figures.

After a year's contest in the courts, the City Council of Richmond decided recently to locate the power house of the municipal electric-light plant, to cost $143,000, in the river bottom, instead of the city park. The contractor refused to begin work unless the site be changed, fearing the appeal now in the Supreme Court might be adverse to the city.

The Union Traction company has secured the right-of-way for its extension from Marion to Converse. The average price paid was $80 an acre. One farmer refused to take more than $60 an acre, saying that was all the land was worth.

One of the large and new cars belonging to the Indianapolis Street Railway company and leased to the Union Traction company was wrecked near Anderson on the morning of the 18th. The car was running at full speed, and when approaching a sharp curve the air brake refused to work. The car climbed the rails and ran 100 feet on to the Big Four tracks and upset. Three passengers and the motorman were slightly injured.

The laboring element at Wabash is much wrought up over the importation of Italian laborers on the Wabash River Traction company's line, and trouble has narrowly been averted several times. The Italians, it is said, are paid $1.35 a day, while home laborers demand $1.50 a day.

The Kerlin Bros. of Toledo, who own a number of natural-gas plants in Indiana, have asked the council of Montpelier for a street-car franchise. The Kerlins propose to construct an electric line from Montpelier through Dundee, Blackford County, to Marion, where it will connect with the systems centering at that point. The line will traverse the oil region throughout its length, and promises much in freight traffic, as well as passengers. Brazil (Ind.) capitalists are also considering a project to build a line from Montpelier to this city.

The citizens of Bloomington and Martindale held a conference at the latter place on the 20th inst., and it is said the prospect of the electric line between the two cities was greatly augmented.

Work on the new $19,000 interurban power station has been begun at Fortville.

The city engineer of Indianapolis is now at work on specifications for a new public electric-lighting contract, and it is expected that the Board of Public Works will receive bids and let the contract within the next 60 days. The present contract with the Indianapolis Light and Power company does not expire for two years, but the board is anxious to let the contract in time for the successful bidder to build a new plant, if necessary. The action has created considerable curiosity, and charges of favoritism are made. It is said that the Home Heating and Lighting company, which is erecting a plant at Alabama and Sixteenth streets, is back of the early-letting scheme.

The presence of J. Levering Jones of Philadelphia in Indianapolis last week and the rumor that he had purchased heavily of the Union Traction company's stock revived the rumor that the owners of the Indianapolis Street Railway company intended to secure control of and merge the interurban lines into the local line and charge a straight five-cent fare. Mr. McGowan denies the story.

The interurban electric lines of Indiana are beginning to compete with the railroads in bidding for the transportation of mails, and the indications are that before the year ends all the lines from Indianapolis will have government contracts. The interurban companies are confining their plans to carrying mail between local points and are getting the contracts by bidding at a much smaller figure than the railroads have been charging.

F.

PERSONAL.

John B. O'Hara, editor and manager of Modern Machinery, Chicago, and for several years managing editor of the Western Electrician, is enjoying an extended rest at Atlantic City, N. J.

F. E. Drake, late director of machinery and electricity for the United States commission to the Paris Exposition, is engaged in electrical work in Berlin and will probably not return to the United States until autumn.

James Knibbs, superintendent of the fire-alarm system at Troy, N. Y., died at his home there on April 16th. Mr. Knibbs was known as the inventor of the "Knibbs run-around," an attachment to steam fire-engines.

Edgar W. Collins, who has been manager of the Postal Telegraph-cable company at Cleveland, Ohio, for the last two years, has been promoted to the position of district superintendent of the same interests, with headquarters at Cincinnati.

Cæsar Celso Moreno, a native of Italy, died recently in Washington at the age of 70. In 1872 Mr. Moreno organized the first Pacific cable company and obtained a charter from Congress. He spent some time on the project, which was, however, eventually abandoned.

At the recent meeting of the Rochester (N. Y.) Gas and Electric company Mr. George A. Redman, the well-known electrical superintendent of the company, was elected a director. Mr. Redman has a wide acquaintance among electrical men and is a familiar figure at the conventions of the National Electric Light association.

Richard McCulloch has been appointed assistant general manager of the Chicago City Railway company, of which his father, Robert McCulloch, is general manager. The younger Mr. McCulloch resigned his position as engineer of the National Railway lines of St. Louis some years ago to engage in electric-railway work in Europe, from which he has just returned.

The position of assistant general superintendent of the Postal Telegraph-cable company at Chicago recently made vacant by the appointment of E. J. Nally to be general superintendent, has been filled by the appointment of Charles M. Baker, formerly general superintendent of construction of the company. Mr. Baker entered the telegraph field over 30 years ago and has gradually worked his way up to his present position. He will take up the duties of his new position on May 1st.

Herrmann Schum, managing and technical director of the parent Otto Gas Engine company, died at Bonn, Germany, on April 3d, at the age of 60. Mr. Schum became interested in the Otto engine in 1876 and was one of the corps of engineers commissioned by Dr. Otto to work out the mechanical details and settle the standard design of the engine. He assisted in the organiation of Schleicher, Schum & Co. of Philadelphia in 1877, which firm later became the Otto Gas Engine Works.

Edwin B. Moore of Grand Rapids, Mich., has been appointed assistant commissioner of patents as the successor of Walter H. Chamberlain of Chicago, whose resignation will take effect on May 1st. Mr. Moore had the indorsement of Senators McMillan and Burrows. Mr. Moore is now a principal examiner in the Patent Office. He was born in Maine, but his legal residence is in Kent County, Mich. He has passed through the various grades in the examining corps to the rank of principal examiner.

Victor C. Alderson, acting president of Armour Institute of Technology, has been invited by the trustees of the proposed Carnegie School of Technology at Pittsburg to confer with them regarding the plans and scope of the new institution. Professor Alderson's successful career as a technical educator in Chicago makes him well fitted to render valuable assistance to the sponsors of the new enterprise, and he has already made one visit to Pittsburg to assist in the preparation of preliminary plans.

Richard P. Rothwell, editor and general manager of the Engineering and Mining Journal of New York and a mining engineer of note, died at his home in New York on April 18th, at the age of 64 years. He had studied at the Imperial School of Mines at Paris, France, and at the Mining Academy at Freiberg, Saxony. Mr. Rothwell was for nine years in the anthracite region of Pennsylvania, holding several responsible positions. In 1873 he went to New York and acquired an interest in the Engineering and Mining Journal, of which he was editor at the time of his death.

ELECTRIC LIGHTING.

An electric-light plant is to be installed at Gloster, Miss.

An electric-light plant is to be built at Jackson, Tenn., at a cost of $12,000.

Winchester, Tenn., will issue $30,000 in bonds, for the erection of an electric-light plant.

The lighting plant at Hubbard, Ohio, was destroyed recently by fire. The loss was about $7,500, and the town will probably be bonded for a new plant.

Bids for the lighting of the town of Suffolk, Va., will be opened on May 14th by W. N. McAnge, chairman of the lighting committee. The requirements are 50 incandescent lights and 30 arcs.

Suit has been brought against the city of Columbus, Ohio, by one of the taxpayers, to enjoin the levying of an assessment for the building of a municipal electric-light plant and to enjoin the collection of an assessment of $68,000, already levied. The plaintiff claims that the city cannot issue bonds in the sum of $300,000 for the building of an electric-light plant, for the reason that the same was not properly presented to the voters of Columbus and not properly carried. The suit is thought to be an attempt to prevent municipal control of the city lighting.

ELECTRIC RAILWAYS.

Extensive additions to cost about $125,000 will be made to the power house of the Louisville Railway company at Louisville, Ky.

A press dispatch from New Haven, Conn., announces that the New York and New Haven road will soon equip the Waterbury division of the New Haven system, which is the old Meriden, Waterbury and Cromwell line, with electricity. The contracts will provide for new power stations and all other requirements of modern electrical traction. The expense for machinery alone will be $300,000.

Mayor Tom L. Johnson of Cleveland has ordered the city law department to examine closely all existing street-railway franchises, and it has been discovered that although the franchise of the Little Consolidated company, according to the original ordinance, was to expire January 1, 1910, the official record in the city clerk's office reads January 26, 1900, and this Mayor Johnson holds to be correct. He declares that the company, of which Senator Hanna is president, to get a renewal of the franchise, must grant three-cent fares.

Right-of-way has been secured and franchises are being sought for the Chicago, St. Joseph and Southwestern Michigan Electric railroad. The road will run from Chicago to St. Joseph, and will pass through the towns of Hammond, Pullman, Kensington, Michigan City, New Buffalo, Sawyer, Bridgeman, Stevensville, Lincoln, Glen Lord, Hilltop, etc. The backers of the company are H. T. Clark and J. P. Barthoff of Cleveland and others. The road will cost $2,000,000, and it is guaranteed

in the contract that cars will run every 15 minutes between Chicago and St. Joseph.

The Toledo, Bowling Green and Southern Traction company will soon have its lines in full operation. A connecting link between Mortimer and Trombley, Ohio, is now building, and when this is completed it will make a through line between Findlay and Toledo. Arrangements have been completed between the new company and the Toledo and Bowling Green line, which will hereafter be operated by the former, which is mostly controlled by Cincinnati capitalists.

AUTOMOBILES.

It is announced that Emperor William will offer a prize for the Berlin-Paris automobile race on June 27th.

Two applicants for automobile operators' licenses recently examined in Chicago are said to be respectively the oldest and youngest ever granted licenses in the city. The latter is William D. Warner, 14 years old, and the former is Samuel Harris, 64 years of age, president of the firm of Samuel Harris & Co., machinists. Both were pronounced thoroughly competent in every particular to serve as operators.

The State Department has been prevailed upon by those who believe there should be a general restriction of the speed of motors in cities to procure from the American consuls abroad reports, showing the rules in force in foreign countries that have been constrained to apply rules. When these reports are received it is believed they will be of great assistance in helping Congress to make a law governing steam and electric road motors, where reckless use of them endangers life and limb.

The Indiana Supreme Court on April 18th, in reversing a judgment for damages recovered by Claude Bennett against Edward Bogue, held that a city or town has no power by ordinance to exclude from its streets automobiles, bicycles, motocycles, traction engines and other vehicles operated by something else than animal power, on the mere ground that steam or electricity or some new and unusual motive power is used to propel them. The fact that the vehicles interfere with drivers of animals, and that injury occurs by reason of fright to these animals, makes no difference.

PUBLICATIONS.

A recent bulletin of the Electric Storage Battery company of Philadelphia is devoted to the application of Chloride accumulators in mills and factories. Views are given of some typical battery installations.

Queen & Co. of Philadelphia have issued a new edition of their catalogue describing their electrical instruments for light and power stations. New instruments listed are the Queen I-V meter, a portable photometer and a wall-pattern galvanometer.

George W. Lord of Philadelphia, manufacturer and exporter of water-purifying chemicals, commonly known as Lord's boiler compounds, is distributing some useful pocket maps of the United States, Porto Rico and the Philippine Islands. These maps should prove handy and useful for reference. They are being used by Mr. Lord, with other printed matter, as a mailing series.

Palmer & Olson of 210 Center street, New York city, have issued an attractive folder illustrating and giving the "10 points of comfort" of their dynamos and motors. This firm embodies the best of material and skilled labor in the manufacture of its machinery, believing it is cheaper to add a small sum to the first cost, thereby saving in a comparatively short time perhaps 25 to 50 per cent. in repairs, which are a necessary sequence in a machine built by cheap material and labor.

Eugene Munsell & Co. of New York city, the extensive importers and dealers in mica and manufacturers of micanite, have recently issued a publication, in catalogue form, called "Mica Mining," which contains reproductions of a unique collection of photographs, illustrating the mines from which the firm obtains its supplies and the processes of mining and preparing mica for the market. Most of the illustrations show views of mines with the native miners in India, while the others are devoted to mines in Canada and North Carolina.

The Warren transformer is described and illustrated in a bulletin issued in the interest of the lighting department of the Warren Electric Manufacturing company of Sandusky, Ohio. The pamphlet shows in detail the construction of the apparatus, and gives tabulated data of design and performance, besides giving space to a discussion of the relation between copper and iron losses and their bearing upon efficiency. These transformers may be run dry or in oil, and the tubes through which the leads are run are sealed into the case with sulphur, to keep out moisture and prevent the oil from working out.

TRADE NEWS.

The B. & H. Storage Battery company of Chicago has been incorporated, with $2,500 capital, to manufacture storage batteries and electrical supplies. The incorporators are Fred W. Kraft, W. H. Paddock and L. Miller.

Sargent & Lundy, mechanical and electrical engineers of Chicago, will remove about May 1st from their present location in the Monadnock building to new quarters on the tenth and eleventh floors of the Isabella building, 46 East Van Buren street.

The new Monarch Electric and Wire company of Chicago, the incorporation of which was noticed in the Western Electrician last week, will take over the supply business of Samuel Mankowitz and will also manufacture insulated wire. The address of the company is 125-127 Clinton street.

The property of the Belden-Larwill Electric and Manufacturing company of Fort Wayne, Ind., will be sold at public auction on April 27th by order of the District Court of the United States. The property consists of two pieces of real estate in Fort Wayne, machinery, stock and material, tools and all other assets, except bills receivable. The machinery consists of lathes, drill presses, milling machines, shapers, pressers, etc. The Citizens' Trust company is the receiver.

The American Bridge company will make quite an elaborate building exhibit at the Pan-American Exposition, furnishing two buildings, each about 60 feet in width and 150 feet in length. One of the buildings will be of extremely plain construction, being designed for use as a manufacturing plant. The second, however, will be of ornamental design, such as would naturally be used for freight depots, street-car barns and that class of structures. The American Bridge company will also make an extensive exhibit of parts of large bridges.

The fire which visited the works of the B. F. Sturtevant company at Jamaica Plain, Mass., on Sunday, April 14th, proved to be far less disastrous than was first reported. Only the engine and electrical departments were injured. The power plant was started up with but a single day's delay, incident to renewing belts damaged by fire, and the entire blower, heater, forge, galvanized-iron and shipping departments, with the foundry, pattern shop, etc., were in full operation on that day and the shipments going forward as usual. No valuable office records were lost, the most serious damage occurring in the advertising department, where a large amount of printed matter was destroyed. Fortunately, however, an entirely new general catalogue was in press at the time and copies were issued on the 16th, in time to meet all demands for information. New offices were established on Monday morning in a nearby building, and by Monday noon the business was running as usual. With these facilities at the company's disposal, there is no likelihood of any delay in shipments, except such as may occur in the electrical and engine departments, and arrangements are already made for handling this work.

The American School of Correspondence of Boston, Mass., issues sets of instruction papers and books, covering thoroughly the practical details of stationary, electrical, mechanical, marine and locomotive engineering. These courses are prepared by trained instructors of the best standing and are well illustrated. By devoting the spare minutes of each working day to the successive lessons of such a course the student speedily advances until he has qualified himself for the diploma, which is given upon the satisfactory completion of the work. A system of direct, personal correspondence between teacher and pupil is continued throughout the course. Many thousands of wage-earners have availed themselves of the opportunity afforded by the American School, and there is reason to believe that a system that follows so closely the needs of the workingman will have a still more rapid development in the future. The American School of Correspondence now has among its pupils a considerable number in foreign countries; Great Britain, India, Africa and New Zealand are largely represented. More significant still of the scope and standing of the school is the fact that among its pupils are a large number of graduates of the foremost colleges in the United States, who are taking this means to add to their college training such lines of work as were not covered by their collegiate work.

BUSINESS.

W. B. Cowles & Co. of Cleveland, Ohio, are installing two 75-horsepower engines made by the Ball Engine company of Erie, Pa., in the new Power building in that city.

The Electric Appliance company of Chicago had a happy day last week when it received orders for immediate shipment for 350 Gutmann wattmeters. The company considers this not a bad day's record for one item.

W. N. Matthews & Bros. of St. Louis are calling attention to the Truitt regulating lamp and socket for which they are agents. With a 16-candlepower Truitt lamp it is claimed that the light can be reduced to eight candlepower or one candlepower. These lamps can be furnished in any voltage from 45 to 125 volts.

The American Bridge company will furnish to J. G. White & Co., New York, the structural steelwork for the power plant for the Kalgoorlie Electric Power company, Kalgoorlie, Australia. This plant consists of an engine house 43 feet by 159 feet, with a lean-to 17 feet by 40 feet, and a boiler house 41 feet by 132 feet in size.

The American Circular Loom company has leased its premises at 141 South Clinton street, Chicago, to the Aaron Electric company, and is now located at its new address in the Electrical building at the corner of West Jackson boulevard and Desplaines street, where Thomas G. Grier, the company's western manager, is in charge.

The Central Electric company of Chicago announces that it is compiling a new fan-motor catalogue for this season, in which it has listed Falcon, Diehl, General Electric, Tuerk, Westinghouse, Central, Empire and battery fan motors. This company has also a new complimentary order book which it is distributing to its customers.

The Manhattan Electrical Supply company calls attention to the fact that it is carrying a complete line of electrical supplies, in both its Chicago and New York establishments. The company's Chicago address is 186-188 Fifth avenue. The company will be pleased to furnish customers with a copy of its new catalogue, which is expected to be off the press by May 1st.

In government work the Lundell motors and generators manufactured by the Sprague Electric company of New York are used to a large extent. Recent orders include 17 motors of various sizes for the Norfolk navy yard, three 35-horsepower motors for the Mare Island navy yard, four motors for the Boston navy yard, and five motors, one generator and a two-kilowatt ventilating set for the Brooklyn navy yard. In addition to the government orders, the Sprague Electric company reports the following among its large sales: Steelton Light and Power company, one 125-kilowatt, belted-type generator; Columbia University, three 75-kilowatt, engine-type generators; C. S. Ashley, one 125-kilowatt generator; Pittsburg Reduction company, one 25-horsepower motor and one 166-horsepower motor; National Meter company, one 37½-kilowatt, engine-type generator; Chase Rolling Mill company, one 125-kilowatt, belted-type generator, and the Evansville Gas and Electric company, one 150-kilowatt generator.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 16, 1901.

672,015. Automatic Switch for Groups of Transformers. Alfred Schlatter, Budapest, Austria-Hungary. Application filed October 5, 1900.

A switch magnet has two coils effective in the same direction for exciting the magnet core, one of the coils being in the current branch of a large transformer and the other in that of a small one. Means are provided for increasing the drop in the current branch of the smaller transformer.

672,016. Automatic Apparatus for Measuring Liquids. William M. S. Selwyn, Philadelphia, Pa., assignor of one-half to Charles F. Van Horn and John I. McDuffee, Philadelphia, Pa. Application filed February 24, 1896.

A weighing tank or receptacle has valved inlet and outlet connections, with a motor for controlling the valves. Means responding to changes in the hydrostatic pressure in contradistinction to buoyancy of the contents of the tank operate the valve gear.

672,017. Electric Igniter for Gas Engines. Luther J. Sevison and Louis D. Cond. Constantine, Mich. Application filed June 29, 1900.

A condenser and a circuit-breaker comprise the stationary part, and a reciprocatory member moves longitudinally of the cylinder and makes a sliding contact during a portion of its stroke.

672,027. Coin-controlled Indicating Mechanism. George W. Adams, Stoughton, Mass. Application filed June 15, 1900.

A weighing machine includes a translucent face, dial, pointer, electric lamps, and a weighing mechanism connected with a platform. An electric circuit connects the lamps and a source of current with normally open terminals which are arranged to intercept a coin to close the circuit and thereby render visible the dial and pointer through the translucent face.

672,020. Electric Generator. George A. Burwell, Plattsburg, N. Y. Application filed January 17, 1901.

The armature shaft consists of two parts, one movable in relation to the other. The coupling connecting them comprises two coupling heads rigidly secured to the parts, the heads being movable only in parallel planes.

672,032. Arc-lamp Carbon. Herbert A. Couchman, Burton-on-Trent, England. Application filed March 7, 1900.

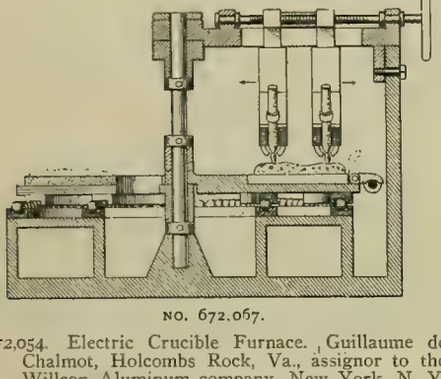
The core is composed of a refractory material and a fluxing material in the proportions of two parts of refractory material to one of fluxing material.

672,047. Electrode. Henry E. Waite, New York, N. Y. Application filed February 16, 1901.

The subject of this patent is a therapeutic electrode for the application of static electricity consisting of an electro-conductive body with a tubular portion having a capillary opening at its point.

672,048. Static Machine. Henry E. Waite, New York, N. Y. Application filed March 8, 1901.

Upon the revolving shaft of an influence machine carrying plates separated by insulating collars is an additional collar for clamping the plates together, and a coiled spring between the collar and the insulating collars.



NO. 672,067.

672,054. Electric Crucible Furnace. Guillaume de Chalmot, Holcombs Rock, Va., assignor to the Willson Aluminum company, New York, N. Y. Application filed September 5, 1899.

A shell forms a chamber within the furnace, and a crucible is suspended within the chamber, the latter being materially larger than the crucible to form a heat-insulating space around it. A carbon support for the crucible makes circuit connection therewith, the support being connected to one terminal of the circuit, and a carbon electrode makes contact with the lower part of the crucible and connects with the other terminal of the circuit and is movable so that it may be fed toward the crucible as it is consumed.

672,064. Telephone Metering System. Newman H. Holland, Brookline, Mass., assignor to the Automatic Telephone Meter company of New Jersey. Application filed November 27, 1899.

A timing mechanism is set in operation by a signal-sending device, and continues in operation a predetermined length of time after the initial impulse. A meter-controlling device is operated jointly by the timing device and the device which places the telephone instrument in condition for use.

672,067. Electric Furnace. Francis J. Patten, New York, N. Y. Application filed June 16, 1900.

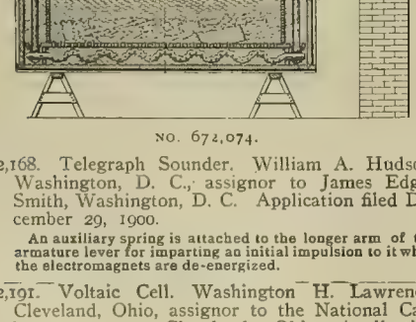
Two or more sector-shaped furnace hearths are revoluble about a common center in a horizontal plane, and two or more revoluble arms or carbon carriers above the hearths support two or more sets of carbons over each hearth, with means for deflecting the arcs downward from the ends of the carbons toward the furnace floors. (See cut.)

672,074. Apparatus for Electrical Laundrying. George D. Burton, Boston, Mass. Application filed June 27, 1898.

The articles to be treated are immersed in a tank containing a saponaceous solution. Electric conductors extend into and through the solution, with adjustable guards for the conductors. Perforated conductors are disposed near the bottom of the tank and perforated guards supported above the conductors. (See cut.)

672,122. Appliance for Telephone Switchboards. William W. Dean, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed December 8, 1899.

A call bell is included in a grounded branch from a limb of the line at a sub-station. A switch connects telephone apparatus at the sub-station in a bridge of the line. A key at the central office connects a grounded source of ringing current with the limb of the telephone line with which the signal bell at the sub-station is connected, the other limb of the line being grounded at the central office, whereby ringing current may return to ground at the central office when the subscriber operates his switch to close the bridge of the line through his telephone apparatus. Means are provided for locking the key to maintain the ringing current on the line, and also means controlled by the flow of current in the return path to ground at the central office for releasing the key.



NO. 672,074.

672,168. Telegraph Sounder. William A. Hudson, Washington, D. C., assignor to James Edgar Smith, Washington, D. C. Application filed December 29, 1900.

An auxiliary spring is attached to the longer arm of the armature lever for imparting an initial impulsion to it when the electromagnets are de-energized.

672,191. Voltaic Cell. Washington H. Lawrence, Cleveland, Ohio, assignor to the National Carbon company, Cleveland, Ohio. Application filed October 9, 1897.

A porous carbon cup has at its upper end an integral annular flange and an externally fluted cylindrical body extending therefrom, this body having an integral bottom and several longitudinal slits extending from near the bottom to the extreme lower edge, through the cylinder, between the flutings and parallel therewith.

672,195. Automatic Current Interrupter. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Gustave P. Gehring, Philadelphia, Pa. Application filed November 28, 1900.

An alined conductor shaft or rod is driven by the rotating shaft of a prime motor and has an end movement in addition to its rotary movement. A conductor rod is insulated and alined in the path of the conductor shaft. (See cut.)

672,219. Electric Battery. Arthur L. Stevens, New York, N. Y. Application filed May 28, 1900.

A battery cell or vessel adapted to receive battery plates is formed in one downwardly tapering piece having integral lateral ribs or projections adapted by direct contact with similarly ribbed cells and the battery box to prevent horizontal movement of all the cells of a battery. The cell also has means co-operating with a transverse key for mutually interlocking adjacent battery cells against independent vertical movement.

672,229. Apparatus for the Purification of Water or Other Hygienic Purposes. Jean M. A. Lacomme, Brooklyn, N. Y., assignor of one-half to Walter Lauder, Brooklyn, N. Y. Application filed July 13, 1900.

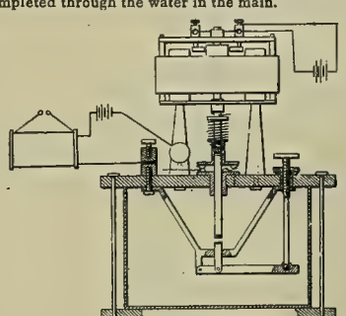
Electric conductors are arranged in a portable holder in position to act as electrodes, together with means to convey an induced current to the conductors. An electric lamp and a sparking device are also carried by the holder.

672,230. Apparatus for the Purification of Water. Jean M. A. Lacomme, Brooklyn, N. Y., assignor of one-half to Walter Lauder, Brooklyn, N. Y. Application filed October 24, 1900.

A rotating wheel has conducting rods projecting from its rim and spokes, the rods being electrically connected with each other and with a suitable source of electricity. An opposing stationary ring is also formed with projecting conducting rods connected with each other and to the source of electricity whereby the circuit through the rods will be completed through the water between them.

672,231. Device for the Purification of Water. Jean M. A. Lacomme, Brooklyn, N. Y., assignor of one-half to Walter Lauder, Brooklyn, N. Y. Application filed December 7, 1900.

A section of water main is made up of two or more pairs of electrodes, each electrode being insulated from the others. Induction coils are electrically connected with the electrodes and with separate sources of electricity, each pair of electrodes being electrically connected to one of the induction coils whereby cross currents of electricity will be completed through the water in the main.



NO. 672,195.

672,232. Construction of Armatures and Inductors for Dynamo-electric Machines or Motors. Oskar Lasche, Berlin, Germany. Application filed February 4, 1901.

The subject of this patent is a construction in which armatures and inductor rings are made up in sections coupled together by means of tension devices.

672,236. Electrical Resistance with Small Heating Capacity. Karl Ochs, Berlin, Germany, assignor to the Allgemeine Elektricitaets Gesellschaft, Berlin, Germany. Application filed September 16, 1899.

A coil of wire is adapted to be brought to a temperature approaching white heat by electric energy, and a heat-conducting insulating body of tubular form envelopes the coils of the conductor and is of such small mass as to be adapted to expand and contract under the heat generated, in harmony with the conductor.

672,243. Electrical Card-punching Apparatus for the Production of Jacquard Cards. Jan Szczepanik, Vienna, Austria-Hungary. Application filed February 16, 1899.

Contact levers bifurcated at their free end are loosely mounted upon a rod. Angular insulators, one between each two levers, have one of their arms loosely mounted on the rod, and rods pass respectively through the other arm and through the apices of the angles of the insulators, one of the rods lying in the bifurcation of the levers.

672,266. Electric Fire-alarm System. Fulton Gardner, Chicago, Ill. Application filed July 28, 1900.

A coil of wire is contained in the piping of a fire-extinguishing system connected with one side of a signal circuit and normally insulated from the opposite side and adapted when heated to close the signal circuit.

672,268. Electric Chain-link Welding Machine. Eugène F. Giraud, Doulaincourt, France. Application filed February 12, 1900.

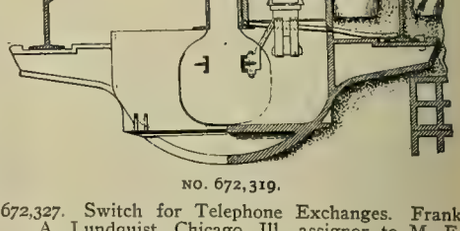
A carrier cylinder is provided over which the chain to be welded is passed. Electrodes are arranged to be movable to and from the link in position to be welded, the cylinder holding the chain so that the electrodes will when advanced rest on opposite sides of the joint. The electrodes are insulated from each other and adapted to be connected to the opposite sides of a circuit. Matrices movable against the welded link from opposite sides remove the bur caused by welding.

672,309. Process of Locating Metallic Minerals. Fred H. Brown, Los Angeles, Cal. Application filed September 19, 1900.

This patent covers a process of locating metallic or other conducting substances in the earth, which consists in successively causing direct extra electrical impulses to traverse successive different definite lengths of earth forming part of a circuit superimposed upon an electrically energized closed circuit, measuring the resistance thereof, then repeating the measurements, and finally comparing the resistances.

672,319. Insulator for Conduit Electric Railways. John M. Eadie, Alexander Stevens and Romeo P. Tomassek, New York, N. Y. Application filed August 2, 1900.

A line conductor extends along a conduit, and a hanger is adapted at one end to carry the line conductor. Insulating material is arranged to envelop and hold the opposite end of the hanger, and a bed block forms a support for the insulating material. A detachable overhanging cover or roof is placed over the insulating material, with means for securing the cover and holding the assembled parts in adjustment, free and clear of the walls of the conduit. (See cut.)



NO. 672,319.

672,327. Switch for Telephone Exchanges. Frank A. Lundquist, Chicago, Ill., assignor to M. E. Richardson, trustee, Sterling, Kan. Application filed January 22, 1900.

A pointer and a propelling mechanism therefor are provided with means for disengaging the one from the other. A device holds the pointer in its disengaged position, and a spring returns it to its normal position when so disengaged. Means are operated by the propelling mechanism for re-engaging the pointer with its propelling mechanism.

672,335. Trolley-pole Attachment. Willard P. Smith, Brooklyn, N. Y. Application filed February 20, 1901.

Guards are arranged at opposite sides of the trolley, each guard consisting of a single length of metal having a portion for extending upward along the trolley pole and mounted to swing on the trolley bolt. A brace connection is made between the outer end of a horizontal portion and the lower end of the first-named portion, and a roller is mounted on the horizontal portion.

672,338. Temperature-regulating Apparatus. John V. Stout, Easton, Pa. Application filed August 17, 1896.

A liquid column is arranged to exert its pressure upon a fluid-pressure motor to move the main valve in one direction. A second liquid column exerts its pressure to move the valve in the opposite direction. An auxiliary valve is adapted to vary the pressure in one of the columns when desired, the second liquid column serving to maintain a continuous pressure on one side of the motor and thereby prevent injury to the motor by the pressure on its opposite side.

672,368. Junction Box. George L. Holshuh, Brooklyn, N. Y. Application filed January 23, 1901.

A junction box for electric wiring has an opening in its lower wall and a tube extended downward from the upper wall of the box and adapted to surround a pipe. An offset forms a chamber at one side of the tube, and a dog is mounted to slide in the offset. A screw passes through the lower wall of the offset and engages with the dog to force it against the pipe.

672,387. Electrical Connector. Thomas J. McTighe, New York, N. Y. Application filed February 6, 1901.

A number of strands of wire have their adjacent ends welded into a homogeneous mass constituting a terminal.

672,388. Holder for Telephone Receivers. Cebert H. Newhall, Philadelphia, Pa. Application filed January 14, 1901.

An arm is provided at one end with a clip for attachment to a telephonic transmitter, and at the other with a socket. A clip adapted to be connected with a telephonic receiver is provided with a plug which is adapted to be removably seated in the socket, the plug and the bore of the socket being of angular form.

NO 672 419.

672,406. Combined Desk Telephone and Switch Stand for Interconnecting Telephone Lines. Hermann Herbstritt, San Francisco, Cal., assignor to the Automatic Interconnecting Telephone company, San Francisco, Cal. Application filed February 12, 1900. Renewed September 17, 1900.

The switch stand and telephone support comprise a slotted hollow pillar and a hollow base, a removable pillar block, stationary switch points thereon, and a slidable switch piece carrying a contact spring. Means are provided for moving the switch piece from the outside of the pillar, for locking the switch piece, and for releasing and returning it to position. The base block has binding posts mounted thereon, and wires individually connect the stationary contacts with the binding posts.

672,419. Means for Controlling Electric Motors. Frederic A. Johnson, Binghamton, N. Y., assignor to the Stow Manufacturing company, Binghamton, N. Y. Application filed January 15, 1901.

As a means of varying the reluctance of the magnetic circuit in an electric motor the field-magnet poles are provided with cylindrical cavities arranged substantially parallel to the armature shaft, with core pieces fitting the cavities and means for adjusting the core pieces in the cavities. (See cut.)

WESTERN ELECTRICIAN

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Electric Power in Cudahy Packing-house Plant at Kansas City.

The packing house of the Cudahy Packing company at Kansas City, Mo., is the newest as well as one of the most modern and complete of the packing houses in the country. No pains have been spared to make this plant strictly up-to-date in all respects, the buildings being designed particularly for electric transmission of power throughout. The entire plant consists of 22 brick buildings and occupies an area of about 10 acres. In all there is about 1,500,000 square feet of floor surface. Electricity is employed for light and power. The power house is centrally located with respect to the other buildings, and the system of transmission employed is direct current at 230 volts for both power and lighting. This system was decided upon after several years' trial of both alternating and direct-current systems at two other plants of this company in South Omaha and Sioux City.

There are about 40 motors scattered throughout the plant, aggregating about 700 horsepower. The motors range in size from one-fourth horsepower to 75 horsepower and are employed for a great variety of uses, everything requiring power in the entire packing plant being electrically driven.

In the oleo department, or what is known as Section 1 of the packing house, a three-horsepower motor is used to drive three oleo presses, while a 35-horsepower machine drives six tallow-cooking vessels, six lard-cooking vessels and three fat hashers. The killing house has some large motors for driving the machinery used in handling beef cattle and hogs. A 20-horsepower motor drives the friction hoists and cattle beds and a 15-horsepower machine runs two elevators, two cripple hoists and one hide hoist. The "Ferris wheel" used in hog slaughtering and the traveling table of the hog scraper are driven by a 15-horsepower motor, a hog-hair machine by one of 50 horsepower and a hog conveyor by a three-horsepower motor. The largest motor in the plant is located in this department. It is of 75-horsepower capacity and operates three Anderson blood driers and pickers and a bone mill.

On the cutting floor a beef conveyor is driven by a five-horsepower motor, a "back-fat" machine, a grindstone and rotary tables by a three-horsepower motor, and four band saws by two five-horsepower motors. Two hog conveyors in the hog-chill rooms are operated by a three-horsepower and a five-horsepower motor, respectively. In the lard refinery a 15-horsepower motor (Fig. 1) drives a set of lard rolls and an agitator and a three-horsepower one drives a lard agitator alone. Of the machinery in the sausage department five hashers, a spice mill and three mixers are driven by a 35-horsepower motor, a capping machine by a five-horsepower motor, four elevators by a 35-horsepower motor and a sewing machine by a one-fourth-horsepower motor. In the ice plant a 15-horsepower machine drives an ice crusher and one elevator.

In the main boiler room the coal crusher is operated by a 25-horsepower motor, while the two conveyors are handled by two 15-horsepower motors. Fig. 3 shows a 50-horsepower motor belted to a power pump for general water supply. This is located in the engine room, as well as the two 35-horsepower motors and one 25-horsepower motor shown in Fig. 4, which operate brine pumps. The extra motor shown in this picture was only temporarily installed. The machine shop has a 10-horsepower motor which drives the machine tools, etc., used in the company's repair work.

In Section 12 of the packing-house plant the glue house contains a three-horsepower motor for driving a glue slicer and a 50-horsepower motor connected to three 60-inch fans for an air blast used in drying glue. The box factory has a 10-horsepower motor driving circular saws and nailing, grooving and sand-papering machines. In the canning house a great variety of work is performed by the aid of four motors. A 25-horsepower machine drives a 60-inch ventilating fan, a 15-horsepower inverted motor (Fig. 2) operates two elevators, a 15-horsepower machine drives capping machines and can conveyors, while a 35-horsepower motor operates five vacuum pumps, a washing machine, three cooking machines and a cooling machine.

In a separate boiler house, which is used exclusively to furnish steam for the cooking and packing processes, is located a 10-horsepower motor driving a 60-inch ventilating blower. In the chill rooms two 60-inch exhaust fans used to exhaust the animal heat from the rooms are driven by a 25-horsepower motor. All the motors were built by the Crocker-Wheeler company and are provided with starting coils of the same company's manufacture.

There are about 3,000 incandescent lamps and 15 enclosed-arc lamps, all of 230 volts, used to light the buildings and grounds. Four feeder circuits for power and one for the lighting load are taken from the left-hand panel of the switchboard, shown in Fig. 7, on page 298. The other two panels are generator panels. The board is made of marbleized slate and is equipped with Weston instruments and I-T-E circuit-breakers.

Owing to the extreme dampness in and about the buildings of packing houses, it was found necessary to take the greatest precautions to prevent leaks in the wiring. All the inside as well as the outside wiring is supported on double-petticoat glass or porcelain insulators mounted on special iron hangers. All the cut-out cabinets are specially built to withstand moisture and great care was taken in the insulation. Each motor is furnished with a specially made fuse block, by means of which instruments may be connected by the simple removal of a plug. Frequent tests are made on each motor with a recording ammeter, and any trouble in machinery or shafting is thereby detected and eliminated.

In Fig. 5 is shown a view of the main boiler room, which is 137 feet long by 33 feet wide and 34 feet high, and contains 14 boilers arranged in two bat-

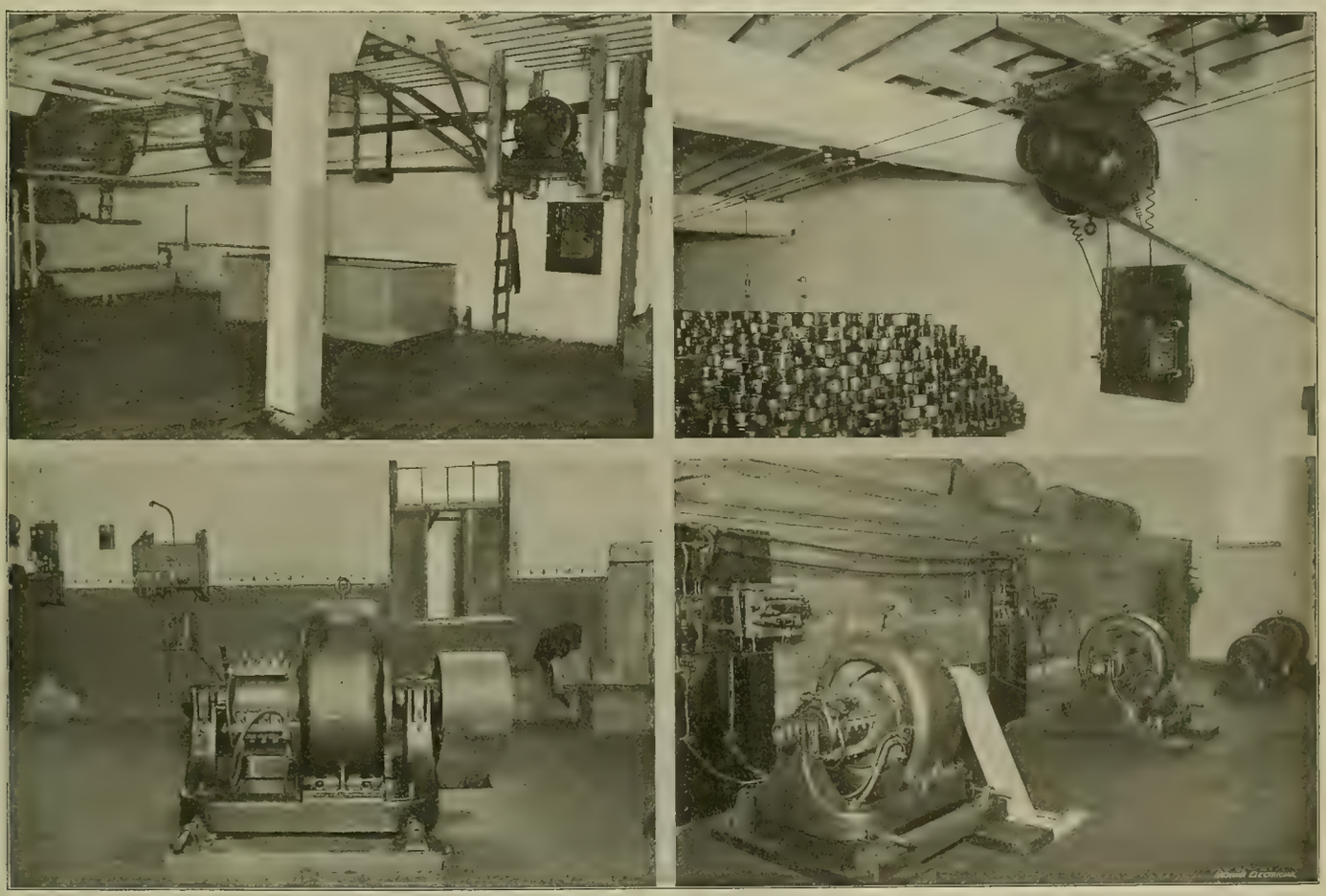


Fig. 1. 15-horsepower Motor Operating Lard Rolls.
Fig. 2. 15-horsepower Inverted Motor Operating Elevators in Canning Department.
Fig. 3. 50-horsepower Motor Belted to Pump in Engine Room.
Fig. 4. Group of Motors Driving Brine Pumps.

ELECTRIC POWER IN CUDAHY PACKING-HOUSE PLANT AT KANSAS CITY.

teries of seven boilers each. The boilers are of the fire tubular type and were built by the Murray Iron Works, Burlington, Iowa. They are 18 feet long by 72 inches in diameter and are rated at 150 horsepower each. The steam pressure used is 130 pounds per square inch. Two self-supporting lined steel stacks 125 feet high and six feet six inches inside diameter receive the products of combustion through steel flues lined with fire brick. The two stacks are placed one at each end of the boiler room and each is connected with one battery of boilers. Natural draft is used. Along the east wall of the boiler room and opposite the boilers there are installed six coal bunkers of 20 tons' capacity each, from which the coal is delivered in front of the boilers through 10-inch spouts after being automatically weighed. The coal is delivered

Fig. 5. Boiler Room.

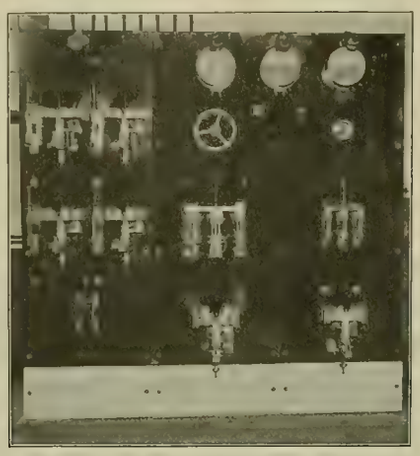


Fig. 7. Switchboard

ELECTRIC POWER IN CUDAHY PACKING-HOUSE PLANT AT KANSAS CITY.

from the cars outside the building to a crusher operated by a 25-horsepower motor, and thence is carried by means of a conveyor to the bunkers. Another conveyor is used to remove the ashes from the ash pits to the cars.

The boiler feed pumps are two in number and are of the Blake outside-packed-plunger, solid-cylinder type. The size of each is 16 by 9 by 18 inches. The steam and water piping is of the single system. The feed water is pumped into the boilers through a heater from an artificial reservoir located near by. A 12-inch steel steam header runs along the wall back of the boilers, steam being delivered from the boilers through a six-inch steam pipe. A six-inch steam pipe also runs from the header to each engine in the power plant. Each engine is equipped with a Sweet separator, which drains into a Crane trap. The exhaust passes through a feed-water heater and thence through a 10-inch standpipe into the open air.

The engine room, a partial view of which is given in Fig. 6, is 100 by 125 feet in size and 42 feet high, and contains all of the ice machinery and compressors, as well as the electric machinery. There are three Vilter horizontal 200-ton ice machines (two compound and one simple Corliss engine), one Keystone vertical 75-ton ice machine and one 16 by 36-inch Keystone vertical air compressor. The electric generators are of the Crocker-Wheeler engine type and are two in number, one of 350 kilowatts' and the other of 200 kilowatts' capacity. The 350-kilowatt machine is direct-connected to a Buckeye 24 by 33-inch simple automatic engine, running at a speed of 130 revolutions per minute, the 200-kilowatt unit being connected to a 20 by 21-inch Buckeye engine, which has a speed of 175 revolutions per minute. A view of this 200-kilowatt unit with the Keystone compressor in the background is shown in Fig. 6. The Siegrist automatic oiling system is used, the oil being pumped to tanks through a filter, whence it flows by gravity to the engine bearings.

A private telephone exchange of 42 stations connects all parts of the plant. The instruments are Bell instruments and the exchange is connected directly with the Kansas City Bell exchange.

Taken as a whole, the plant reflects great credit on Mr. James Phillips, master mechanic, and Mr. C. O. Fitch, electrical engineer, of the Cudahy Packing company, through whose efforts the plant was laid out and constructed.

Bryant and Perkins Companies Said to be Absorbed.

The Westinghouse Electric and Manufacturing company is said to have purchased the entire capital stock of the Perkins Electric Switch Manufacturing company of Hartford, Conn., and the Bryant Electric company of Bridgeport, Conn. The two companies may be managed by the Westinghouse company.

Opening of the Pan-American Exposition.

Buffalo, May 1.—This, the day set for formally opening the gates of the Pan-American Exposition, finds the exposition work, generally speaking, far in advance of any similar event on the opening hour. One of the main features of the exposition is to be its electrical illumination, and this, despite its extent, is ready to please the people. Some of the combinations of water and light effects are not yet ready, but will be within a few days. This is especially true of the basin neighborhood.

In the Electricity building to-day there is considerable evidence that the last few days have been days of wonderful progress. George F. Sever, superintendent of electrical exhibits, has done excellent work, and every exhibitor is well pleased with the manner in which he has treated him. In all, there will be nearly 100 exhibitors in the Electricity building, and out of all those who engaged space only one withdrew. Some of the exhibitors have not yet got their spaces in shape, and to some extent May will be a month of construction. However, there is no doubt that every exhibitor will do his best to have his exhibit in perfect order by the coming of the forces of the National Electric Light association. There will be much for the members of this association to see and admire, and it is intimated that some of the large exhibitors are still "enthusing" over the exposition and are ready to expend more money in making a showing that will be memorable.

It has been decided to keep the gates open on Sunday, the price of admission to be 25 cents for adults and children. The illumination will be a feature of Sunday evening. The Midway will be closed on Sunday.

The most elaborate illumination of the buildings and grounds of the exposition previous to the grand opening on May 1st took place last Saturday night, when all the buildings but the main government structure, and the grounds, were seen under the full flood of light.

It has all along been predicted that the night scene of the Pan-American would be the most gorgeous affair of the kind the world has ever witnessed, and so it proved to be. It is safe to say that no matter what the day beauty of the exposition is, no matter how pleasing the well-wrought color scheme is to the public eye, there will be an entrancing fascination about the grounds at night that will make everyone hesitate in pronouncing a verdict as to which is the more beautiful. Luther Stieringer and Henry Rustin have achieved really wonderful results in the construction of this feat of lighting. D.

Electrolytic Laboratory at the University of Pennsylvania.

Electrolytic work in chemistry has become so important in chemical research that from laboratories using simple primary batteries there have been developed large and expensive installations. As in many other lines, apparatus that was adequate only a few years ago has become antiquated, and with the development of electrical industries the apparatus available for research work has been greatly perfected. The University of Pennsylvania was one of the earliest to make this class of work a part of its regular course, and many of the successful methods in use are the results of the work done there under the direction of Dr. Edgar F. Smith, professor of chemistry. As in the past much of its apparatus has been so satisfactory that its methods were followed in other laboratories, writes A. William Schramm of the electrical engineering department of the university, it was thought that a description from an electrical point of view of the new laboratory and a comparison between that and its earlier laboratories might be interesting.

The electrical installation provided in 1894, and which has since been increased by the addition of a new equipment, consisted of 12 storage cells connected to a plug board, by which any number of cells could be connected in series or parallel, and connected to any one of three sets of terminals, conveniently placed on a working table. The storage cells were placed in a cupboard with the distributing board in front. The arrangement of the plug board with its connections is clearly indicated in Fig. 1 (page 299), where the lettered and numbered squares represent brass blocks mounted on a slab of hard rubber, and the dotted lines indicate the electrical connections on the back, thus providing for three students.

The brass blocks marked (P) are each connected to the positive terminal of a storage cell. These cells are marked in the figure by (A), (B), (C),

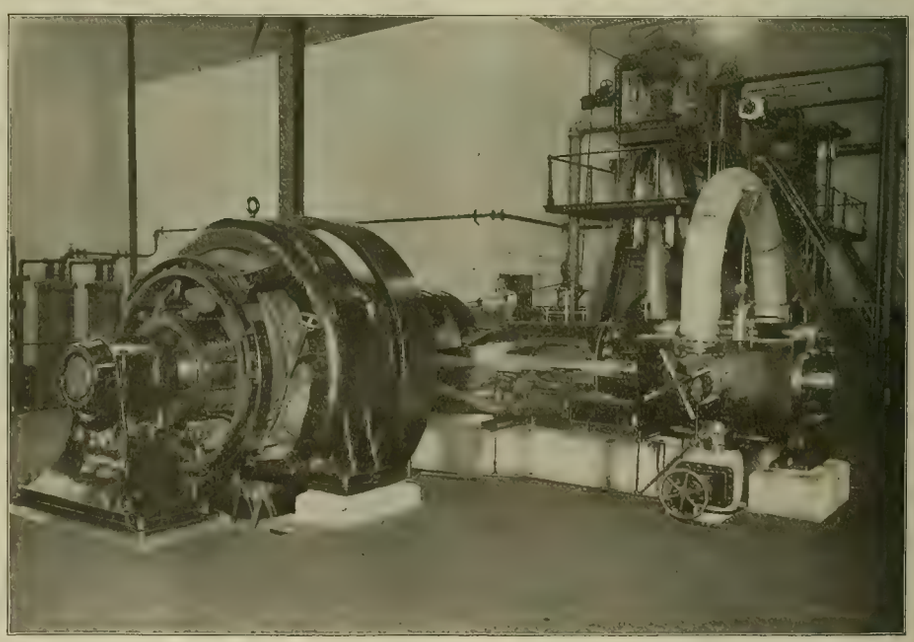


FIG. 6. ELECTRIC POWER IN CUDAHY PACKING-HOUSE PLANT AT KANSAS CITY.—PORTION OF THE ENGINE ROOM.

etc. The negative terminals are each connected to two blocks marked (N) as shown. The upper line of blocks, numbered (1), are all connected together, and in fact might be made of one strip except for economy of material. This row is connected to and forms part of the positive lead running to outlet No. 1 on the operating table. The negative lead for this same outlet is connected to the lower row of blocks marked (1). Thus: If the operator at outlet No. 1 wanted to use the two cells (A) and (K) in parallel it was only necessary for him to insert plugs between the upper row of (1) blocks and the (P) blocks of (A) and (K) respectively, and between the (N) blocks of (A) and (K) and lower row of No. 1's. Similarly, the upper row of blocks marked (2) is connected to the positive lead running to outlet No. 2, and the lower row of blocks marked

(2) are connected to the negative lead of the same outlet. And so with the blocks marked (3). It will be noticed that one of the two above-mentioned (N) blocks is located in the same row with the (P) blocks, and this (N) block of one cell is adjacent to a (P) block of its neighbor. This is for the purpose of connecting cells in series.

For instance, suppose that the operator at outlet No. 2 wanted to use cells (B), (C) and (D) in series, he would connect the (P) block of cell (B) to (2), the (P) block of (C) to the (N) of (B), and the (P) block of (D) to the (N) block of (C), finally connecting the (N) block of (D) to its adjacent (2) block.

In addition to the above, the operator at (3) could insert plugs so as to use the cells (E), (F), (G), (H), (I), (J) in a combination of all in parallel, three in parallel and two in series, two in parallel and three in series, or all in series, just as occasion might demand.

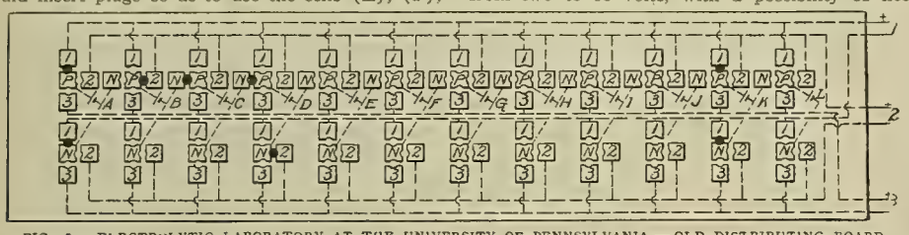


FIG. 1. ELECTROLYTIC LABORATORY AT THE UNIVERSITY OF PENNSYLVANIA.—OLD DISTRIBUTING BOARD.

For charging the cells, which was generally done at night, circuit No. 1 could be connected to the 110-volt lighting circuit by means of a small knife switch, conveniently located at the side of the operating table. Incandescent lamps placed in this charging circuit kept the current down to the desired value. The cells were then all connected in series and across the No. 1 leads. Making No. 1 leads the charging circuit also provided means for using the 110-volt current for electrolytic work where the solutions were of such high resistance that the 12 cells in series were insufficient to produce the desired results. Portable resistance frames were provided, consisting of wooden frames mounted on neat iron feet, having German-silver wire coils stretched between brass blocks on both sides. There were 16 pairs of coils of one resistance, and 10 pairs of one-tenth of that resistance, all joined in series between two binding posts, and so arranged that any number of coils of either denomination could be short-circuited by means of two plugs; thus the resistance could be altered by small steps. A third plug was provided to prevent the necessity for opening the circuit when altering the resistance. The measuring instruments were portable, Weston and Hartman-Braun.

This entire electrical equipment was fairly satisfactory and was duplicated later. It had many defects; for instance, it was possible to connect cells in parallel and series at the same time, and the student sometimes preferred to make connections haphazard rather than work out and understand the whole scheme. And even though he did understand it, the chances for making a wrong connection were too great because of the confusingly large number of blocks on the boards. The resistance frames had the fault that the German-silver wire soon became so corroded as to break. Replacing the coils by tinned-steel wire proved to be little or no improvement. The portable instruments, too, were in danger of being injured by solutions being spilled on them, and sometimes received rather rough handling, which soon decreased their usefulness.

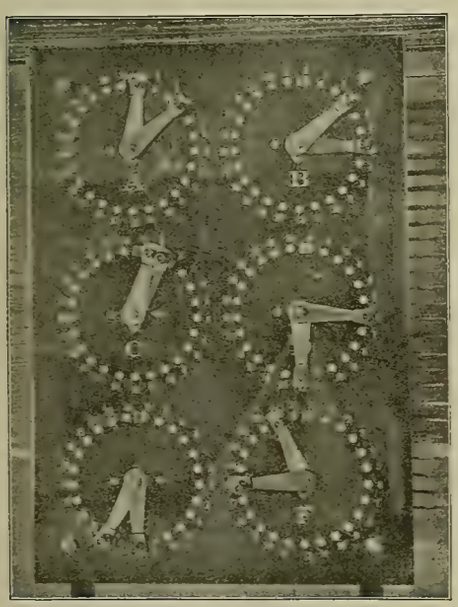


FIG. 2. ELECTROLYTIC LABORATORY AT THE UNIVERSITY OF PENNSYLVANIA.—DISTRIBUTING BOARD.

Finally it was decided to provide a laboratory and installation sufficient for 18 men, and to overcome as far as possible the defects of the previous arrangement. It will readily be seen that the matter of complication would be made infinitely worse if the number of outlets were increased to 18 and the number of cells to 50, so an entirely different arrangement of switchboard had to be devised. The only room available was one 15 feet by 26 feet, and it soon became evident that this room would not accommodate more than 16 men. This allows each student three feet by 20 inches' table space.

Twelve of these men will probably work at one time, each requiring from 1-100 to 10 amperes, and from two to 10 volts, with a possibility of needing up to 25 amperes and 50 volts. The remaining four men will work over the same ranges of current, but will probably need up to 100 volts. Storage cells were previously found to be required because of their constancy, and were therefore decided upon for this installation. Those used are 120 ampere-hours' capacity with a normal discharge rate of 15 amperes and a maximum rate of 30 amperes. Two groups of 24 cells each are located in compartments and supply their respective sides of the room. They are supported on racks of four shelves each, six cells per shelf. Each shelf was thoroughly paraffined and a half-inch layer of ground quartz placed around the jars.

The switchboards are three in number, two of them each controlling the six places on their respective sides of the room, and the third controlling the four places in the center. The face of one of these boards is shown in Fig. 2, the letters on the face referring to the working tables controlled.

The switchboard on the east side of the room consists of a slab of enameled slate 24 by 34 inches, one inch thick, and contains, for each of the six outlets to be controlled, one circle of 25 contact pieces, and has two spring levers, insulated from each other and moving about a common center, sweeping over them. The contact blocks are numbered consecutively from 0 to 24, and a stop is provided to prevent the levers from sweeping past the zero. Cell No. 1 is connected between blocks numbered 0 and 1 in each of the six circles, cell No. 2 between blocks numbered 1 and 2, and so on for the remainder of the 24 cells in that group, so that all blocks similarly numbered on the one board are connected together, and but a single wire leads from the six similarly numbered blocks to the junction between two cells. In this lead is provided the usual fuse. The circles are lettered (A), (B), (C), etc., consecutively, corresponding with the letters at the outlets to be controlled.

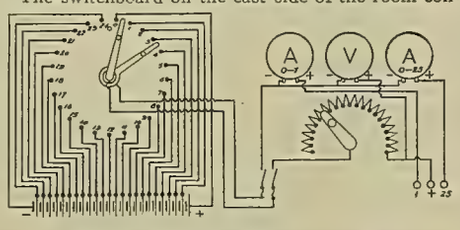


FIG. 3. ELECTROLYTIC LABORATORY AT THE UNIVERSITY OF PENNSYLVANIA.—CONNECTIONS TO WORKING TABLE.

Should the operator at the outlet (E), for instance, need two cells, he goes to this board, and finding that the cells from the twelfth cell on are not being used in any of the circles, he places one of his levers on contact block No. 12 and the other one on No. 14. There is thus very little chance of doing anything wrong, or for one man to interfere with another, because there is no necessity for him to use the same cells as another man, and he can see at a glance which cells are in use. Fig. 3 shows the electrical connections from one of these distributing boards to the cells and outlets on the working tables. The levers themselves are too narrow at their outer ends to reach across from one block to another, to prevent short-circuiting the cells, so they are provided with fiber extensions on each side to prevent their falling between the blocks, and also to prevent their making contact with each other. The switchboard on the west wall is exactly similar to the one just described, it containing the circles (G), (H), (I), (K), (L) and (M), while the third one, which controls the four outlets on the center table, is but 24 inches square, but has 26 contact blocks in each circle. They are numbered (0), (24), (25), (26), and so on to (48). Between the two blocks numbered (0) and (24) are connected the cells of the group on the east side of the room; between blocks (24) and (25) is connected cell No. 1 of the west side of the room, while cell No. 2 is connected between blocks numbered (25) and (26). This arrangement connects the two groups of cells in series, and permits the use of from one to 48 cells at the center table when necessity requires. It will, perhaps, have been noticed that there is no provision made for connecting cells in parallel, and this is not necessary, as the maximum discharge rate of the cells exceeds the greatest estimated current needed by one operator. All brass parts on the back of the board, as well as the bared ends of the wires, are thoroughly coated with P. & B. paint, while the brass parts on the front are heavily lacquered to prevent corrosion. The surface of the contact blocks can easily be cleaned with fine sandpaper.

The measuring instruments, after some deliberation, were chosen of the switchboard type. While this necessitated procuring at least one-third more instruments, yet the initial cost was considerably lower than if portable instruments had been provided, and experience with portable instruments leads me to believe that a greater accuracy will be attained with switchboard instruments of a good form, if not immediately, yet surely after the first six months of use.

Each outlet is provided with a fused switch, a voltmeter, two ammeters, a rheostat and a terminal board. They are connected as shown in Fig. 3. The positive lead after passing through the variable resistance runs directly to the positive binding post. The wire coming from the negative binding post runs to the low-reading ammeter and thence to the negative side of the switch, while the negative post marked (25) is connected to the same switch terminal, but through the ammeter of larger capacity. The anode of the electrolytic cell is therefore always connected to the middle binding post and the cathode either to the post (1) or (25), depending upon the strength of the current it is intended to pass through the cell. The voltmeter, being connected as shown, measures the potential differences at the terminals of the cell, except for the addition of the small fall of potential through the ammeters.

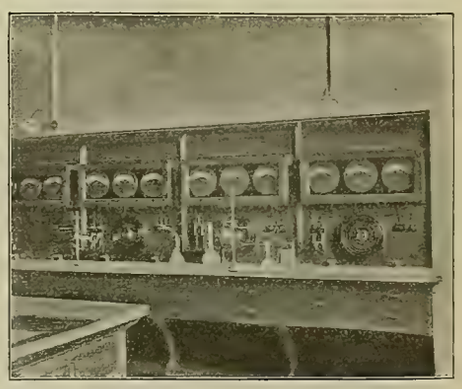


FIG. 4. ELECTROLYTIC LABORATORY AT THE UNIVERSITY OF PENNSYLVANIA.—WORKING TABLE.

The voltmeters on the side of the room have scales ranging from 0 to 50, and divided to one-half volt. Those on the center table range from 0 to 120. The ammeters ranging from 0 to 1 ampere are divided to 1-100 and those reading from 0 to 25 are divided to one-fifth ampere. The three instruments are mounted side by side on an oak backboard extending the whole length of the room, and are covered by an air-tight case with a glass front, as shown in Fig. 4. The cases have neither doors nor a back, but are simply screwed against a backboard with a heavy felt gasket, making the joint. The wires come out through hard-rubber tubes sealed at their outer ends by insulating tape. The rheostats are of the enameled type, chosen because of their being impervious to fumes. They have a total resistance of 172 ohms, divided into 51 steps in such a way that their resistances form a geometrical progression, the first step and the sum of all the steps being chosen in accordance with data of the resistances of the baths determined from the work done under the old system.

The wires, both those in the battery rooms and those in the laboratory proper, are covered with rubber, and those in the laboratory are further encased in oak molding, but this rather for appearance's sake than for protection. The whole installation, as well as the other fittings of the room, has a very neat and finished appearance, and is believed to be the most perfectly appointed laboratory of its kind in the world.

An "Electrical Party."

An "electrical party" was given on Saturday evening, April 13th, by Henry Blake, secretary and treasurer of the Jenkintown Light company, Jenkintown, Pa. The party was held in the power house of the company, the old boiler room being utilized as a combination banquet hall and ballroom. The room was pleasingly decorated, colored miniature incandescent lamps being a feature. The banquet was a good one, and there was dancing. The guests were invited to accompany Mr. Blake on a trip of inspection through the plant. Those who availed themselves of the opportunity saw a well-equipped power house.

Luminosity and Efficiency of the Nernst Lamp.

An anonymous correspondent of l'Industrie Electrique of Paris has sent that journal an interesting account of the action of the new Nernst incandescent lamp. The tests were made on a lamp marked 220 volts and 80 watts, the voltage during the test being varied between the limits of 180 and 220 volts. The lamp was mounted on an Edison base and enclosed in a globe of clear glass. The accompanying diagrams, Figs. 1, 2 and 3, represent the luminous

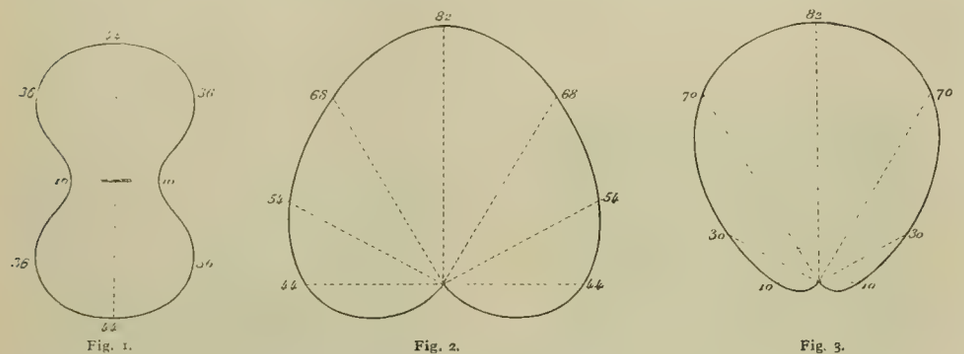


Fig. 1. Fig. 2. Fig. 3.

LUMINOSITY AND EFFICIENCY OF THE NERNST LAMP.

intensities of the lamp measured in different positions. Fig. 1 gives the luminous horizontal intensity on a level with the filament, Fig. 2 the vertical intensity in a plane perpendicular to the axis of the filament and passing through its center, while Fig. 3 shows the vertical intensity in the plane of the filament. The lamp was placed vertically, with the socket beneath. In the following table are given the results obtained with an expenditure of 90 watts:

	Luminous Intensity in Candlepower. Maximum.	Mean.
In the horizontal plane of the filament	44	50 (?)
In the vertical plane perpendicular to the filament	82	37
In the vertical plane of the filament	82	25
Mean spherical luminous intensity		30 candlepower.

The curves of Fig. 4, which are made from the data obtained in the tests while varying the voltage, show the rapid variations which all the elements entering into the operation of the lamp undergo as the voltage is raised. The tests showed that a diminution of five per cent. in the voltage produced

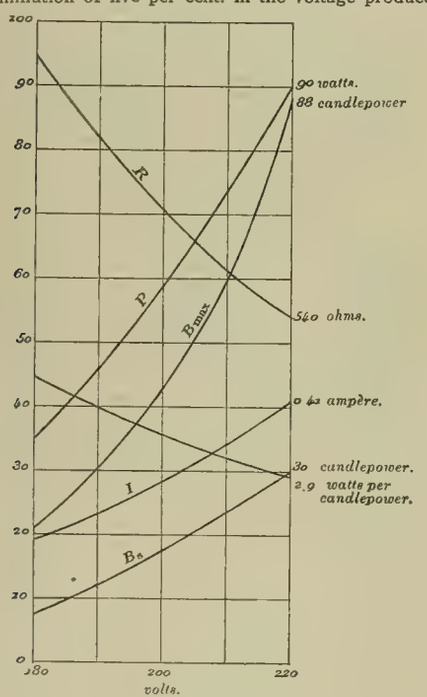


FIG. 4. LUMINOSITY AND EFFICIENCY OF THE NERNST LAMP.

a variation of 25 per cent. in the luminous intensity. The expenditure of about one watt per candlepower for the maximum luminous intensity was raised to 2.9 watts per candlepower for the mean spherical luminous intensity. Below 180 volts the light dies away very quickly. Referring to the diagram, the abscissæ represent the volts, (I) the current in amperes, (P) the power in watts, (R) the resistance in ohms, (Bmax) the maximum luminous intensity in the axial direction of the lamp in candlepower, and (Bs) the mean spherical luminous intensity in candlepower. The curve not marked indicates the specific consumption of power in watts per candlepower.

In all that concerns the brightness and quality of the light the new Nernst lamp is said to give complete satisfaction. The correspondent attributed the exaggeration of the luminous intensity in the direction of the axis of the lamp to the fact that the white-painted support over which the lamp is mounted forms a reflector, and that the bulb itself constitutes a sort of parabolic reflector of which the filament occupies practically the focus. In the horizontal direction the great variations in the brilliancy are perhaps due to the refractions in the irregularities of the glass, but are rather to be attributed to the shadows cast by the automatic igniter.

Commenting on these tests, Mr. E. Hospitalier, the editor of l'Industrie Electrique, says: "If these figures of our correspondent are exact—and it is probable that they are practical—they easily explain the hesitation, extremely creditable, moreover, of the promoters of the Nernst lamp to put it on the market. The promoters do not doubt that the Nernst lamp is bound to be one of the electric lights of the future, but the results which we have published make it evident that the lamp does not, so far, promise the industrial progress which has been achieved by the carbon incandescent lamps, if we take into account the complications introduced by the automatic igniter and the lack of stability of the elements entering into the operation."

Standardizing Street-railway Equipment.

The committee on standardizing of street-railway equipment appointed at the recent meeting of the executive committee of the American Street Railway association has begun active work with a view of presenting a comprehensive report on the subject at the annual meeting of the association in October next. T. E. Crossman has been appointed secretary to the committee, and he, in conjunction with the members of the committee, will visit some of the leading manufacturers of street-railway equipment to ascertain their views on the subject of standards.

The members of the committee are John R. Graham, Lynn and Boston Railroad company, Boston; N. H. Heft, Meriden Electric Railroad company, Meriden, Conn.; Willard J. Hield, Twin City Rapid Transit company, Minneapolis; Conway F. Holmes, Metropolitan Street Railway company, Kansas City; Frank G. Jones, Memphis Street Railway company, Memphis. The committeemen request that all who are interested in the subject will correspond with the secretary of the committee, whose address is 1829 Park Row building, New York, prior to May 20th, at which time a meeting of the committee will be held in Buffalo.

Electric Lighting at Nome, Alaska.

Nome, Alaska, has had electric lighting for some time. A recently erected plant is owned by the Alaska Commercial company, and is used for lighting the store, warehouses and dwellings of the company. When the Anvil Masonic Club gave its annual ball at the Standard Theater last winter Captain Carlson, general manager of the company at Nome, donated the power and material for the electrical decorations of the theater, among which the Masonic emblems were very conspicuous.

A large city-lighting plant is to be built this spring at Nome. H. H. Knox and others are promoting the plans. The entire plant is to be equipped by the North West Fixture company of Seattle, Wash., of which L. S. Kasson is president.

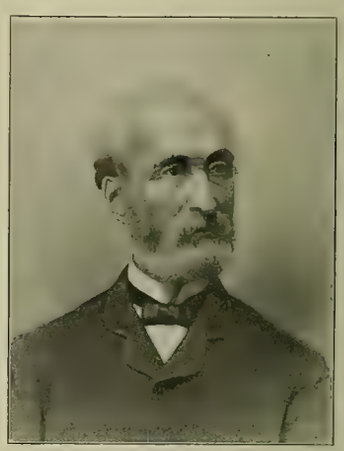
National Electric Light Association.

Announcement is made by C. O. Baker, Jr., master of transportation for the National Electric Light association, that the Trunk Line association, the New England Passenger association and the Canadian lines have granted a rate of a fare and a third on the certificate plan from all points in their territories to Niagara Falls and return for delegates and friends attending the twenty-fourth convention of the National association to be held on May 21st, 22d and 23d. The time limit of these tickets—three days before and three days after the meeting, not including Sundays—will enable members who desire to do so to attend the dedicatory ceremonies of the Pan-American Exposition at Buffalo, which will take place on Monday, May 20th.

OBITUARY.

James D. Reid.

James Douglas Reid, the "Grand Old Man" of the telegraph, died at his home in New York on Sunday, April 28th. He had been ill for many weeks. Mr. Reid was born in Edinburgh, Scotland, March 22, 1819, and in 1834 came to America, locating in Toronto, Canada. In 1837 he went to Rochester, N. Y., and entered the employment of Henry O'Reilly. In 1845, when Mr. O'Reilly completed his contract with the Morse patentees for the construction of western telegraph lines, he selected Mr. Reid as his first assistant. In August, 1845, Mr. Reid took charge of the initial telegraph line between Lancaster and Harrisburg, Pa. He soon afterward became acquainted with Samuel F. B. Morse. A strong mutual attachment followed, which led to Mr. Reid's appointment as superintendent of the Magnetic Telegraph company, extending from New York to Washington. In addition, he was made superintendent of the Atlantic and Ohio Telegraph company, under which name the first line from Philadelphia to Pittsburg was operated. The latter company was so successful from the start and paid such good dividends that Mr. Reid was appointed successively superintendent of the Lake Erie, Pittsburg and Louisville, the Ohio and Mississippi, and finally of the telegraph lines to New Orleans, and all known and for some time working together as the "National Lines." As far as data can be found, it seems conclusive that Mr. Reid was



JAMES D. REID.

the first duly appointed telegraph superintendent in either America or Europe.

In 1856 Mr. Reid was appointed superintendent of the New York, Albany and Buffalo Telegraph company, which, soon after, through negotiations of Mr. Reid, became a part of the Western Union telegraph system. In 1865 the United States Telegraph company was organized, with William Orton as president and James D. Reid as secretary, but only to be absorbed a year or two later by the Western Union Telegraph company, into whose service Mr. Reid again entered, and, at Mr. Orton's request, became editor of the Journal of the Telegraph. One of the first uses he made of his new position was to organize the Telegraphers' Mutual Benefit association—now a prosperous life-insurance association—for the benefit of telegraphers. Mr. Reid was the first president of this association.

It was in 1877 that Mr. Reid published his first edition of "The Telegraph in America," and the second edition made its appearance 10 years later. This book is a very complete history of the telegraph from its birth, and deals with the subject very thoroughly. On October 16, 1889, through the influence of Andrew Carnegie, who served under him for some time as a messenger boy, Mr. Reid was appointed, by President Harrison, consul at Dunfermline, Scotland, which office he retained until 1897. Mr. Reid had for years been a prominent figure at conventions and other places where persons interested in telegraphy have congregated. The statue of Professor Morse in Central Park, New York, was erected by the telegraph fraternity through the efforts of Mr. Reid. To quote the language of a well-known writer on telegraphic subjects: "Mr. Reid was the most beloved member of the telegraphic profession; his gentle and kind attributes endeared him to all, and as the 'Grand Old Man' of the telegraph his name will ever be associated with the telegraph itself."

Tragic Death of I. H. Farnham.

Mr. I. H. Farnham, chief electrician of the New England Telephone and Telegraph company, was

shot and instantly killed at Portland, Me., on April 24th, by George H. Brainerd, a foreman in the employment of the same company.

Extensive alterations are being made in the company's exchange at Portland, and Brainerd, with a crew of electricians, had been employed there for some weeks. Mr. Farnham had come from Boston to inspect the work, and Brainerd accompanied him during the inspection of the exchange. Just before two o'clock, Brainerd, without warning, and, so far as can be ascertained, without any provocation whatever, drew a revolver and shot Mr. Farnham in the forehead, killing him instantly. Before

I. H FARNHAM.

Brainerd was overpowered he had wounded three fellow-workmen, two of them fatally. No reason can be assigned for Brainerd's action, for he has been on the best of terms with all the employes of the company. He is a very nervous man and he evidently collapsed under the strain of his work. He had been employed by the New England company for 10 years and was 45 years old and married.

Isaiah Henry Farnham was one of the best-known men in New England electrical circles. He was born in Woolwich, Me., in 1853, and early in life showed a decided bent toward electricity, and especially toward experimental work. His first position in an electrical capacity was as a telegraph operator at Boothbay Harbor, Maine. He was made local manager of the Western Union Telegraph company at Portland in 1879, and in 1885 he became the electrical engineer of the New England Telephone and Telegraph company, with headquarters at Boston. He was one of the first electricians in the country to suggest the possible trouble to underground metallic structures, resultant from the grounded return of electric-railway systems.

Mr. Farnham had patented 20 or more electrical inventions. Among the first and most important of these was the device known as the "wax-ball protector," which is designed to afford protection to electrical apparatus. Mr. Farnham frequently appeared as expert in cases where professional knowledge was required, and he had been a participant in most of the old telephone conventions. He was a member of the American Institute of Electrical Engineers. His home was at Wellesley, Mass., where he lived with his wife and five children.

The loss of Mr. Farnham will be deeply felt by the officers of the New England company and by many other telephone and telegraph men.

Under date of April 26th the Boston correspondent of the Western Electrician writes: "George H. Brainerd was arraigned in the Portland (Maine) Municipal Court to-day, charged with the murder of Isaiah H. Farnham. His attorney entered a plea of not guilty, and waived examination. Brainerd was held for the grand jury without bail. He did not say a word in the courtroom and showed no trace of excitement. He will be taken to the Augusta Insane Asylum for an examination as to his sanity. Dr. Thayer of Portland examined him and declared that he was insane."

The New York Assembly has reported favorably the bill incorporating the Lower River Power and Water Supply company of Niagara Falls, N. Y., with a capital of $5,000,000, amended so as to confine its operations to Niagara County. This, it is said, will not prevent it selling power to transportation companies in that county for transmission to all the cities of the state. The incorporators are: Commodore P. Veeder, Tunis G. Bergen, William Williams, Charles E. Hotchkiss and De Witt Van D. Reiley of New York, and Patrick F. King, George W. Knox and James S. Simmons of Niagara Falls, N. Y. The company is to take its water out of the Niagara River below the Falls.

Electric Wiring in the Hawaiian Islands.

By R. G. Mayse.

On returning to America from the Philippine Islands and the Far East, I stopped over at Honolulu, and was surprised to observe the advancement which had been made in the telephone, telegraph and Signal Corps lines in the islands. I was here about two years or more ago and noted at the time that there was an abundance of opportunity for improvements in the conveying of messages from point to point in the islands. These possibilities have been recognized by the electricians and Signal Service men, and the result is that there are fairly good means in vogue for the transmitting of dispatches from one place to another.

I observed that many native electricians had been trained to handle the lines and instruments, and it may be interesting to readers to note some of the methods employed. I show in Fig. 1 a little sketch of the manner which is employed for twin wiring a joint. The tubes are armored and trunnioned. Caps (A), (A) are used and adjusted, as shown, while the line of wiring is at the level (B). Porcelain or metallic disks (C) are used for protecting purposes. However, I saw some of these unions broken at the joints, as at (D). In Fig. 2 is the way the native linemen put wires through partitions and woodwork, using tubing with protecting sleeve (F), the meeting section being at (E). I observed that some of the tube-wire carriers were broken, as at

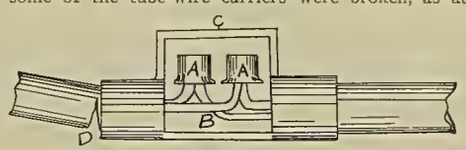


Fig 1

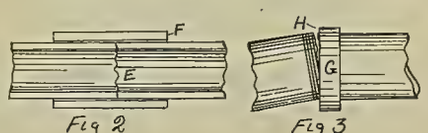


Fig 2 Fig 3

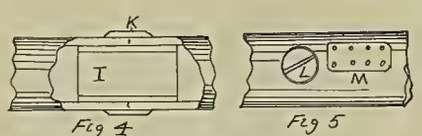


Fig 4 Fig 5

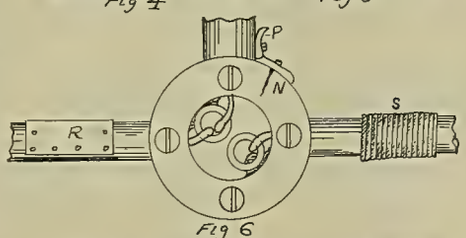


Fig 6

Fig 7

ELECTRIC WIRING IN THE HAWAIIAN ISLANDS.

(H), Fig. 3, the tube being fractured from the flange (G). In Fig. 4 is the way some of the machinists adjust a meeting of tubes. An inner sleeve (I) is brazed or soldered in, and an outer ring (K) is set on. I saw some of the tubes with patches like (M) on them (Fig. 5), to cover pinholes. Other holes of larger size were plugged with screws tapped and threaded in like (L).

In Fig. 6 we have a sketch of a combination porcelain thimble which I noted was in service in several places where wires required protection, and where the branches protruded on the plan presented. I saw that the base of the circular portion was broken at (N), and a strip of brass was put on to aid in holding the broken piece together. This strip is marked (P), and it is riveted with pins. On one of the branches a patch of sheet-metal covered a hole, while at the opposite branch piece some twine was wound over and over a fractured portion of the pipe.

I saw a number of pipe-conveying devices for wires in the condition shown in Fig. 7, in which a portion of the wall of the pipe is depressed, as at (U), touching the wires within and doing damage. This depression can be restored by heating and by exerting interior pressure with expanding devices well known to the trade.

I noticed that some of the tubes were keyed with heads, as at (T), while the head pieces or flanges of others were screwed on, as at (V), in which case some of them were wrenched to one side, like the sample.

Where spiral springs were used for sustaining the pressure on pin shafts, as in Fig. 8, many of these springs were broken, like (A), leaving the shaft (B), without the necessary force for closing itself. In repairing these springs, I noticed that in one case the machinist made the fit like that in Fig. 9. This caused the shoulders (E) and (D) to bind and also threw the spring spindle out of line at (C), all of which was finally restored to proper shape by overhauling and readjusting.

Fig. 10 shows how many of the disks get cracked. Screws are employed, which are bent over, and the disk is broken at (F). I also saw some leaders put in, as shown in Fig. 11. A wedge (G) was driven in, and this caused the thing to tip to one side. The manner of plugging places with wood pieces for nails for holding brackets for wires, etc., is shown in Fig. 12. The plug of wood is cemented in firmly in the plaster, and usually a fairly strong fit is assured, into which nails can be driven.

Fig. 13 shows another form of wire carrier which is popular here. There are little tubes fixed inside the main tube, and the wires are passed through these to any point desired. A common thimble for sinking into plaster with screws is shown in Fig. 14.

The electrical transmission lines now pretty thoroughly cover Honolulu and the outlying districts, and are of much usefulness to the commercial, manufacturing and military circles of the islands. There are American and foreign electrical machinists in the business here, but much of the work is done by native machinists. There is a dearth of proper supplies for the telephone and telegraph lines, and more supplies and general fittings should be sent here. There is always a shortage of wire, instruments, batteries and all furnishings. Poles and cross-arms are plentiful, as they can be cut from a hundred different places. There is an abundance of good native labor for working on the lines, and there are now natives who are familiar with sending and receiving messages over the wires, as they are quick to learn and take a great interest in the business.

There is a great need of a cable here connecting

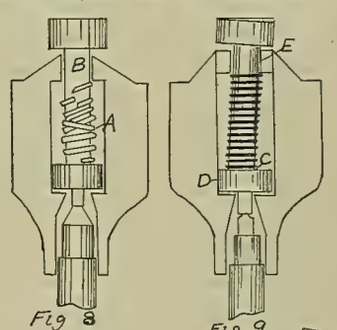


Fig 8 Fig 9

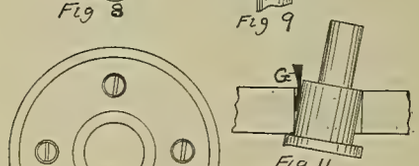


Fig 10 Fig 11

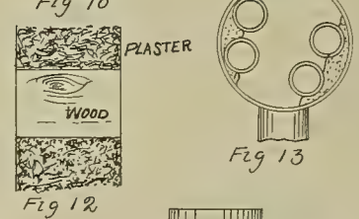


Fig 12 Fig 13

Fig 14

ELECTRIC WIRING IN THE HAWAIIAN ISLANDS.

with the United States. All of the army officials, business men and tourists refer to the need of a cable, and it is hoped that one will be put in soon. The Signal Corps men, with competent officers in charge, are doing as good work in the islands as their fellows are doing in the Philippines, where the service is more active.

The New Orleans City Railroad company, New Orleans, La., has secured a franchise to build a belt line in the suburbs, at an estimated cost of $12,000.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 20,000.

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CONVENTIONS AND EXPOSITIONS.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Independent Telephone association of the United States, Pan-American Exposition grounds. Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

On another page Mr. J. K. Pumpelly gives the history of some former experiments with storage batteries using cadmium and copper as electrodes in an alkaline-hydrate solution. Mr. Pumpelly is moved to a discussion of the matter because of the fact that the invention of a battery of this description has been attributed to Mr. Edison by certain publications, although Mr. Edison himself, so far as we are aware, has not given authority for such a statement. From Mr. Pumpelly's conclusions it seems likely that Mr. Edison's battery, if it is of the cadmium and copper type, must depart in some radical particular from the former efforts in this line, as described by Mr. Pumpelly. Indeed, this is almost certain to be the case if Mr. Edison's battery is a copper and cadmium cell at all, of which, up to the present time, we have no real assurance.

The electrical control of clocks from a standard or master clock may be facilitated by the invention of a New Haven man, who proposes to do away with clock dials altogether, substituting therefor moving figure wheels, showing through openings in an appropriate plane surface, to indicate time as a cyclometer does miles. Many advantages are enumerated for the new clock, which will at all times show the exact time, as 12:52, 6:19 and the like, without mental calculation of the position of the hands. The idea lends itself readily to electrical control.

Electrical regulation of clocks is now accomplished on a large scale, the Western Union Telegraph company having a department exclusively devoted to the purpose and controlling 1,500 clocks in New York city alone. However, the new invention discloses wider possibilities and seems worthy of attention.

May is the month of exposition opening and 1901 is the year of two important international exhibitions—those of Buffalo and Glasgow. The Pan-American Exposition at Buffalo is already open to visitors. From its close relation to the electrically transmitted power of Niagara Falls, from its spectacular electric-lighting features and from the electrical conventions held in conjunction with it, this exposition is of especial interest to electrical men. That at Glasgow is less well known on this side of the water, but is also an important collection, particularly in machinery. It is not open as yet, but will be by the middle of the month. Here American exhibits occupy a large space in the machinery hall, but after Great Britain Russia is the largest exhibitor. Power is supplied from steam boilers and engines, coal being burned as fuel. Four-fifths of the power generated is transformed into electricity, there being 12 engine-dynamo units having a combined output of 4,176 horsepower. Direct current and 250-volt and 500-volt circuits are used. The principal lighting is by enclosed arc lamps, run either 10 in series or five in series. An interesting exhibition is promised, but one without the electrical novelties and electrical decorations which are to be shown at Buffalo.

From a curious prospectus in script reproduction we learn that electric-power transmission on a large scale has at least reached the promoting stage in Russia. It appears that his majesty the emperor has ordered to be issued permission to the "titular councilor engineer-mechanic," Benjamin Dobrotvorsky, to establish a joint stock company called the St. Petersburg Company for Electric Transmission of the Power of Wateerfalls, according to the statute examined and confirmed by his imperial majesty in Peterhof on June 13, 1897. Further examination of the document reveals the fact that it is proposed to transmit electrically power from the rapids of the Volkhov, Narova and Vuoksa rivers to St. Petersburg to an amount up to 100,000 horsepower. Engineering details are not given in the prospectus, which is issued with the idea of enlisting American capital. It is stated, however, that, as might be expected, aerial conductors and high-pressure currents are to be used.

The following paragraph is interesting: "The income of the business has been calculated at 40 per cent., but in reality it will be nearly double. Besides, the prices for renting electric light have been lowered from 25 copecks, which is the price current, to 9.6 copecks; for electric motive power, from 18 copecks to 5¼ copecks per kilowatt per hour; for factories, instead of 4½ copecks, what costs horse hour, as for example at the Poutikoff works, to 3¼ copecks per kilowatt-hour." The English of this is rather misty in spots, but the promise of large profits and reduced prices to consumers of electric current is quite clear.

The total capitalization of the company may be 20,000,000 rubles, and the promoters say that "It is very important for the United States that her largest electric firms take part in this sure and advantageous enterprise." United States Consul-general Holloway at St. Petersburg is said to certify that the powers of the company have been confirmed by the Russian government. The names of some Chicago and New York gentlemen are given as having taken interest in the project. We do not know of any hydro-electric transmission plant in the United States or elsewhere that pays 80 per cent. profit, but, on the other hand, conditions are different in the czar's dominions, and it is barely possible that the prospects of the business are not so extravagantly overdrawn as one might suppose at first glance. At any rate, the project is an interesting one, although many items of information that should be given are lacking in the financial prospectus.

The question of the responsibility of electrical companies in the erection of guard wires over high-potential wires in a city street is an old one, but the Supreme Court of New Jersey, in the case of Rowe against the New York and New Jersey Telephone company and the Hudson County Electric company, has taken the rather unusual course of declaring that both companies—one using current of potential so low as to be harmless, and the other employing high-pressure wires—are to be held responsible. In this particular case a boy was killed by contact with a telephone wire which had been blown over the electric-light wires, the fatal current coming from the latter. Under these circumstances, the Supreme Court thinks that the omission of the companies to construct guards between their lines at the places where they crossed was a fact on which a finding of negligence in each could be supported. Assuming that such a guard may be required, the court goes on to consider particularly whether the duty of providing it may be imposed on both companies. It says that the obligations of the electric-light company in this case may readily be indicated. The telephone company's system was first erected, and was in operation when the electric-light company constructed its line. The latter company therefore took its privilege of using the street subject to the fact that the telephone wires were there crossing its route. In view of this fact, it placed its wires below, and introduced the high-pressure current, thus making dangerous the wires of the telephone company, which before had been harmless. Against the danger thus created by the electric-light company, the latter's duty plainly required it to guard by all reasonable means.

The obligation of the telephone company, the court says, was not so palpable, but still it thinks it might be deduced from settled principles. Every person using the highways is bound to exercise reasonable care to protect others from harm through his use. In case the use is continuous, the degree of care required will not be governed by the condition of the highway at the time the use began, but will change as that condition changes, and must keep pace with the circumstances as they occur. A corporation authorized by law to occupy the public streets with appliances for its business holds the privileges subject to such regulations as are reasonably necessary for the common use of the streets for all lawful purposes. When, therefore, the electric-light company, under legislative sanction, placed its structures in the street, a new state of things appeared, with reference to which the care demandable from the telephone company must be gauged. It at once became the duty of the telephone company, it is asserted, to adopt reasonable measures to protect travelers from danger attending its own use of the street as occupied by the electric-light company's system. From this it follows, the court says, that, if a guard such as is above mentioned be a reasonable means of preventing danger likely to arise from the breaking of the telephone company's wires, it was the duty of that company to provide the guard, or see that it was provided, and a failure to do so was negligence. Thus the court holds that the absence of such guards would sustain a finding that both companies had neglected their duties to travelers on the highway.

Some Notes on the Copper-cadmium Storage Battery.

By J. K. Pumpelly.

In a storage battery recently described as new and attributed to Mr. Thomas A. Edison one of the main features is the use of copper and cadmium as electrodes in an alkaline-hydrate solution, for the reason that cadmium is insoluble in an "alkaline lye."

The history of this particular type of battery dates back to 1887, when William Morrison and Louis Schmidt, the latter a well-known chemist, both of Des Moines, Iowa, after many experiments, first made application for patents for the use of cadmium and copper in an alkaline-hydrate solution as electrodes for a storage battery. The gentlemen named built several of these batteries, at great expense, and then abandoned their use on account of the excessive cost and the lack of efficiency. The expense of making these experiments and complete batteries was as follows: Two hundred pounds of finely divided copper at 54 cents a pound, 250 pounds of cadmium at $1.20 a pound, and about 150 pounds of cadmium sulphate at $1.80 a pound. These purchases were made from Malinckrodt of St. Louis and from a Des Moines wholesale drug concern—Hulburt, Hess & Co.—and in order to continue these experiments to a practical result, it was found necessary to buy 50 pounds more of cadmium, the price of which had risen to $2.40 a pound. The amount purchased at first seems to have cornered the market. And this is not strange if, even at this later date, the year 1900, five tons of cadmium was all that was made in the world.

The natural result of such prices was to convince business men that this type of battery was utterly impracticable. In addition, Mr. Morrison found that to charge the completed battery with any practicable current the counter electromotive force ran up nearly as high as in charging a lead battery, approximately 2.3 volts per cell, while on discharge, under a load of 10 or 15 amperes, the voltage dropped to approximately 0.5 volt, and then slowly to 0.3 volt, the average discharge being at about 0.4 volt.

Mr. Morrison's object in all these expensive experiments was to make a battery in which both electrodes would be insoluble in the alkaline electrolyte—an advantage which did not obtain with the zinc and copper couple; but this advantage of insolubility of electrodes was lost when compared with the work done by the soluble zinc on account of the higher voltage gained by the use of the zinc and by the comparatively much lower cost of that metal. A satisfactory grade of battery zinc could be bought in the market for 10 cents a pound, whereas the price of cadmium ranged from $1.40 to $1.10 a pound. The latter figure is quoted to-day by Merck & Co. of New York.

Now, according to the atomic weight of zinc, it requires 3 1/2 pounds of zinc to decompose one pound of water. This, at 10 cents a pound, would be, approximately, 31 cents, which is the retail price of battery zincs to-day. The atomic or combining weight of zinc is 65, and of cadmium, 112. Now, it can be readily calculated that it would require about two pounds of cadmium to do the work of one pound of zinc. With cadmium at $1.10, the lowest price quoted, with two pounds of cadmium to do the work of one of zinc, with 3 1/2 pounds of zinc to decompose one pound of water, and therefore with over six pounds of cadmium to do the same work, the relative costs would be $6.60 in the case of cadmium and 31 cents in the case of zinc. This shows great difference in price as well as the loss in efficiency of over 70 per cent.

The writer some years ago experimented on these lines, and met with the same objections that Mr. Morrison encountered.

Now, although the cadmium and copper may last for years without any loss, the low voltage in the output of the battery and the high expense of current necessary to charge it render it, as it stands in the recent printed descriptions, both inefficient and too expensive for automobile work. Undoubtedly, this type of battery could be made useful where small batteries and a small output are needed, as in telephone and telegraph distribution, where only a small current of high voltage is wanted, the cost of charging in such cases being almost negligible.

Annual Report of the General Electric Company.

The financial part of the annual report of the General Electric company for the year ended January 31, 1901, was summarized in the Western Electrician of April 20th. The complete report to the stockholders has since been issued, however, and from it the following facts of general interest are quoted.

Sales Department (Vice-president Griffin).

During the year over 150,000 separate supply orders were received, averaging over $60 each, and over 12,000,000 incandescent lamps were ordered.

We received orders for over 350,000 horsepower of alternating and direct-current generators, and more than 600,000 horsepower of electric motors and transformers for various uses.

Long-distance transmission plants have continued to increase in number and importance. One of the most interesting contracts of this character is one closed this year for the electrical equipment of a power station, the construction of a pole line nearly 100 miles long, and for supplying 4,000 horsepower of our motors, to operate mining machinery at the Kolar gold fields in the state of Mysore, India. This contract was awarded to us after an exhaustive investigation and a careful study, on the part of the engineers of the Mysore government, of the competitive tenders of the principal electrical firms of the world.

The consolidation of various small railway and lighting systems under one management has resulted in the concentration of electrical apparatus in large stations, equipped with alternating apparatus and supplying energy over a considerable area, the system employed being that of the revolving-field generator and rotary converter, mentioned in previous reports. The demonstrated economies of our early installations of this character have lead to a great extension of this kind of business. Among the important contracts is one for 30,000 horsepower in large generators for the initial equipment of the new power house of the Niagara Falls Power company at Niagara Falls.

During the past year we have established an office in London for the better conduct of our European business and such business from the British colonies and other parts of the world as naturally focuses in London.

Manufacturing (Vice-president Rice).

Our large and increasing business has required the expenditure, for extensions to existing buildings and the erection of new ones, and for additional machinery, of approximately $1,200,000, exclusive of the cost of patterns, special tools, furniture, etc.

At the Schenectady works the extensions to Building 23 of about 40,000 square feet to provide for the increased demand for switchboards, controllers and similar apparatus, and to the iron foundry, of about 40,000 square feet, both mentioned in my last report, were completed during the year.

A new porcelain shop, of 46,000 square feet, and buildings for the manufacture of special insulating materials, aggregating 30,000 square feet, have also been completed.

To provide adequately for the increased power required for testing and manufacturing purposes, and for the necessary heating of the extensions to plant, our power house has been extended and additional boilers and engines, aggregating 6,000 horsepower, have been installed.

We are now erecting a pattern shop of 52,000 square feet, and adding about 70,000 square feet to our machine-shop facilities.

At the Lynn works, extensions amounting to 70,000 square feet have been made to various departments.

At the Harrison works a fireproof storage building, of 68,000 square feet, is nearly completed.

Engineering (Vice-president Rice).

Engineering work during the past year has been directed toward increasing the efficiency and reducing the cost of our standard apparatus and the designing of new machinery or modifications in standard machinery to meet special cases.

The demand for generators of large size, from 3,000 to 5,000 horsepower, has increased, and the average size of electric motors and generators has materially increased.

The 5,000-horsepower generators for the new power house at Niagara Falls have been designed, and their construction is well under way. This installation, which is expected to be a model of efficiency and simplicity, also includes a switchboard of special design for the control of 30,000 horsepower.

In many instances it is found to be cheaper to convert the energy of coal into electricity at the mines and transmit it over a wire to the point of consumption than to transport the coal itself. Successful installations of this character have been made by us during the past year. It is expected that such installations will become more numerous and important as the distance to which electricity may be economically transmitted is increased.

The number of industrial plants in which electric motors are used for the operation of machinery, such as plate-glass, harvesting, cotton, woolen, cement machinery, etc., has largely increased. Some of the larger mills have installed electric motors to an aggregate capacity of more than 5,000 horsepower. Users of electric motors are rapidly learning to appreciate the value of electricity, not alone on account of the saving in power following its use, but principally because of the convenience, flexibility and ready control of the electric system, which invariably economizes labor and increases production.

The original and important work done by several of our engineers in the development of a simple and highly effective train control for electric traction is a matter of great satisfaction.

Much of our best engineering skill has been devoted to the difficult problem of providing a simple and safe method of controlling and switching large amounts of electrical energy at high voltage. The result has been signally successful and has been followed by large orders for switchboard installations involving the use of our improved appliances, among which orders may be mentioned one of 50,000-horsepower capacity and one of 30,000 horsepower, for two of the most important electrical enterprises in this country.

Stocks Owned by General Electric Company.

Corporate Name.	Address.	Par Value.
Australian General Electric company	Schenectady, N. Y.	$ 50,000
Augusta Railway and Electric company	Augusta, Ga.	240,000
Buffalo General Electric company	Buffalo, N. Y.	131,500
British Thomson-Houston company, Limited	London, Eng.	158,750
Cie. d'Electricite Thomson-Houston de la Mediterranee.	Paris, France.	113.175
Compagnie Francaise, etc., Thomson-Houston	Paris, France	50,000
Chattanooga Light and Power company	Chattanooga, Tenn	150,000
Cincinnati Edison Electric company	Cincinnati, Ohio	266,600
Consolidated Electric Light company	Birmingham, Ala.	314,500
Cleveland Electric Illuminating company (Com.)	Cleveland, Ohio	187,000
Chicago Edison company	Chicago, Ill	190,300
Columbus Edison company (Pref.)	Columbus, Ohio	20,100
Columbus Edison company (Com.)	Columbus, Ohio	30,200
Edison Light company of Grand Rapids	Grand Rapids, Mich.	24,000
Edison Electric company (Pref.)	New Orleans, La.	1,763,800
Edison Electric company (Com.)	New Orleans, La.	1,365,000
Jackson Light and Power company	Jackson, Mich.	25,000
Mexican General Electric company	Schenectady, N. Y.	50,000
New Omaha Thomson-Houston Electric Light company.	Omaha, Neb.	288,750
Northern Railway and Improvement company	New Whatcom, Wash.	53,100
Otis Elevator company (Pref.)	Yonkers, N. Y.	60,000
Otis Elevator company (Com.)	Yonkers, N Y.	60,000
Paterson and Passaic Gas and Electric company	Paterson, N. J.	30,000
Pueblo Traction and Electric company	Pueblo, Colo	50,000
Public Works company	Bangor, Me.	146,104
Seattle Electric company (Pref.)	Seattle, Wash.	50,000
Seattle Electric company (Com.)	Seattle, Wash.	92,000
Schenectady Realty company.	Schenectady, N. Y.	100,000
South Jersey Gas, Electric and Traction company	Trenton, N. J.	31,200
Sacramento Electric, Gas and Railway company	Sacramento, Cal.	38,000
Seneca Edison company	Seneca Falls, N. Y.	37,700
Schenectady Railway company	Schenectady, N. Y.	300,000
South African General Electric company	Schenectady, N. Y.	50,000
South American General Electric Supply company	Schenectady, N. Y.	25,000
Tacoma Railway and Power company	Tacoma, Wash.	751,400
Union Elektricitaets-Gesellschaft	Berlin, Germany	31,654
Union Electric company (Pref.)	Dubuque, Ia.	122,500
Union Electric company (Com.)	Dubuque, Ia.	122,500
United Electric Securities company (Com.)	Boston, Mass.	500,000
United Gas and Electric company	Dover, N. H.	62,500
Utica Belt Line Street Railroad company (Pref.)	Utica, N. Y.	50,000
Total		$8,182,333

Total book value.....$3,269,832.84
Average per cent. of book value of above-named stocks to par, 39.96.

Bonds Owned by General Electric Company.

Corporate Name.	Address.	Par Value.
Anniston Electric and Gas company	Anniston, Ala.	$ 96,000
Asheville Street Railroad company	Asheville, N. C.	27,000
Asheville and Biltmore Street Railway and Transportation company	Asheville, N. C.	35,000
Ashland Light, Power and Street Railway company	Ashland, Wis.	110,000
Brush Electric company	Cleveland, Ohio	165 000
Columbus Railroad company.	Columbus, Ga.	43,000
Charleston Consolidated Railway, Gas and Electric company	Charleston, S. C.	70,000
Citizens' Electric Light and Power company (Rec'rs Ctfs.)	Houston, Tex.	60,000
Edison Electric company	Los Angeles, Cal.	36,000
Geneva Power and Light company	Geneva, N. Y.	49,000
Jackson Light and Power company	Jackson, Mich.	32,000
Little Rock Edison Electric Light and Power company.	Little Rock, Ark.	21,000
Little Rock Traction and Electric company (2d Mortg.)	Little Rock, Ark.	77,000
Madison Electric Railway company	Madison, Wis.	22,000
Montana Power Transmission company	Butte, Mont.	38,000
Northern Railway and Improvement company	New Whatcom, Wash.	45,000
Public Works company	Bangor, Me.	222,715
Rutland City Electric company	Rutland, Vt.	98,000
Sacramento Electric, Gas and Railway company	Sacramento, Cal.	207,000
Schenectady Railway company	Schenectady, N. Y.	256,000
Seneca Edison company	Seneca Falls, N. Y.	30,000
Tacoma Railway and Power company	Tacoma, Wash.	423,000
United Gas and Electric company	Dover, N. H.	20,000
Winona Railway and Light company	Winona, Minn.	36,000
Total		$2,218,715

Total book value..... $1 569,418.89
Average per cent. of book value of above-named bonds to par, 70.73.

Miscellaneous.

The annual meeting of the stockholders of the General Electric company will be held at the company's office, Schenectady, N. Y., on Tuesday, May 14, 1901, at noon.

Mr. Hinsdill Parson, the head of the law department at Schenectady, has recently been elected fourth vice-president of the company.

DEVELOPMENT OF THE TELEPHONE FIELD.

The Coming of Mr. Sabin.

Brief announcement was made last week of impending changes in the Chicago Telephone company and the Central Union Telephone company, by which John I. Sabin, the well-known telephone man of San Francisco, will accept the presidency of both companies. Mr. Sabin will come to Chicago about May 15th, to take up his new work. He has already accepted the presidency of the Chicago company, and it is expected that at the meeting of the directors of the Central Union company on May 16th a similar change will be authorized.

Mr. Sabin was in Chicago for a few hours on April 24th, but he would say but little concerning his future plans. It is surmised, however, that he will put into effect the graded-rate or measured-service system, which has been and is now in use by his company on the coast. One of the improvements which Mr. Sabin has brought into use on the coast and which has also been tried in Michigan is reduced rates for short conversations over long-distance lines. He found that one or two minutes' conversation is often sufficient for the transaction of business, and he arranged a rate schedule for short

JOHN I. SABIN.

conversations, instead of charging the same rate for anything under five minutes.

The coming of the new president is looked forward to with great interest by the telephone subscribers in Chicago, as Mr. Sabin's fine record on the Pacific coast is well known. In San Francisco, on December 31, 1895, there were 6,372 subscribers and on December 31, 1900, there were 21,324, an increase of 14,952 subscribers, or about 340 per cent., in five years. The greatest increase was in 1900, being 4,507 subscribers. In the Pacific States Telephone and Telegraph company, as a whole, the increase was from 20,053 subscribers on December 31, 1895, to 85,744 on December 31, 1900, an increase of 65,691 subscribers, or 425 per cent., in five years. The most comprehensive explanation for this phenomenal growth is that given by one who said: "The reason for the success of the Pacific States Telephone and Telegraph company is its president." To know the policy and personality of President John I. Sabin is to know the secret of the company's success.

Mr. Sabin first went to California in 1866 with the Collins expedition to establish European telegraphic connection by land lines to Alaska. That project being abandoned, he selected San Francisco for his home and entered the Western Union service. He was appointed manager of the supply department and afterward from that position he was promoted to that of superintendent of the American District Telegraph company. Mr. Sabin organized two or three telegraph companies in the West. One was in the state of Washington, one in Oregon and one in California, and he formed the Pacific States Telephone and Telegraph company by merging the three companies. He has been the president and manager of the Pacific States Telephone and Telegraph company since its organization, and will retain both offices, though he will reside in Chicago.

A great many telephone patents have been granted to Mr. Sabin, among which the most prominent are those relating to the Sabin-Hampton express system. This system has been in use in San Francisco and other western cities controlled by the Pacific States company since 1893, and it has given satisfaction.

The net income of the Mexican Telephone company for the year ended February 28, 1901, was $76,779. The net income of the preceding year was $59,991, but as the expense for new construction was greater, the balance was less—$18,082 for the year ended last February, compared with $25,658 of the year before.

Telephone News from the Northwest.

The Western Telephone company will construct a line between Garretson and Dell Rapids, S. D.

The Woonsocket Telephone company has been granted a franchise for a local exchange at Woonsocket, S. D.

The Minnesota Rural Telephone company has been formed at Wyanette, near Princeton, Minn., with $25,000 capital stock. It will build a line from Princeton to Wyanette.

The Wisconsin Telephone company has just completed a copper-metallic circuit connecting Appleton and other points in the Fox River Valley with Eau Claire.

E. Allen secured a franchise at Jamestown, N. D., for a local exchange. M. H. Jewell's request for a franchise was refused.

The People's Independent Telephone company has been granted a franchise for a local exchange at Winthrop, Minn.

The sheriff at St. Paul has been appealed to by the Northwestern Telephone Exchange company to corner an individual who makes a practice of loading nickel-in-the-slot instruments with beer checks, slugs and any other metal which comes handy.

The Northern Electric Telephone company informs the people of Brown's Valley, Minn., that the company will build for a distance of 12 miles into the country if given a guarantee of 12 subscribers at $2 each a month.

The Trempealeau and Buffalo County Telephone company has been formed, and will at once construct a line between Independence and Gilmanton, Wis.

The local exchange at Milbank, S. D., has had its 50-drop switchboard replaced by one of 100 drops.

The city of Duluth, Minn., has appealed to the Supreme Court in the case against the Duluth Telephone company, involving the right of the company to continue in business after the expiration of its franchise. The company won its case in the lower court.

A local exchange will be installed and in operation in Webster, S. D., about May 20th.

The Fergus Telephone company of Fergus Falls, Minn., is about to establish a local exchange at Pelican Rapids, Minn.

The heads of city departments in St. Paul will keep a careful watch henceforth on the use of their telephones for long-distance service. A careful record will be made of all out-of-town connections. In the past it has been customary to allow many persons an indiscriminate use of the telephones, but the suit of the telephone company for service has made a change in this respect.

The Rocky Mountain Bell Telephone company will build a line from Whitehall to Bozeman, 80 miles, and from Laurel to Red Lodge and Bridger. A heavy copper wire is to be strung from Butte to Dillon, 85 miles.

The Home Telephone company of Oskaloosa, Iowa, has been sold to the Oskaloosa Home Telephone company, which is said to be backed by $500,000 capital. Senator H. H. Evans of Aurora, Ill., is president.

The Williamsburg Telephone company of Williamsburg, Iowa, has been incorporated, with $10,000 capital stock.

The Story City Telephone company of Story City, Iowa, has filed articles of incorporation.

N. S. and M. H. Harter have been granted a franchise for a local exchange at Kingsley, Iowa.

The system of the Central Telephone company, which has headquarters in Des Moines, Iowa, has been sold to Indiana men for $19,000. It is understood that from $20,000 to $25,000 will be expended at once in improvements. The company has 175 miles of copper metallic-circuit toll lines.

R. Spire and Fred McCall will connect Sheridan and Tama, Iowa, by telephone this spring.

The Trans-Mississippi Telephone and Telegraph company has been incorporated, with head offices at Des Moines, Iowa. The capital stock is $100,000. The company will build a long-distance-line system across the state to connect the 200 Independent companies of Iowa. The first line will be from Council Bluffs to Iowa City.

The Hay Springs Telephone company of Hay Springs, Neb., has been formed, to build a line to Mooneow, 20 miles south. The line is expected to be completed by June 1st.

The Afton Mutual Telephone company of Afton, Iowa, will install a local exchange at once. R.

Ohio Telephone Notes.

The telephone lines in the state have for the most part been repaired and put in good condition since the storm of a few days ago abated. For some time it was almost impossible to secure communication with either Pittsburg or New York, by telegraph or telephone, but the lines have now all been put in order. High waters have also done some damage, especially along the Ohio River and along some of the smaller streams of the state. Everything will soon be in order in these places, however, as the water is receding. Portsmouth seemed to be in the greatest danger, although Huntington, W. Va., was also cut off from the outer world for a time.

The Weston and Grand Rapids Telephone company of Weston, Ohio, will build a line west from the town for the use of farmers. This company has been in operation a year and has proved such a success, locally, that it is deemed advisable to extend the service.

The building recently purchased by the Mansfield Telephone company in Mansfield is being remodeled to suit the needs of the company. It will be known as the Telephone building. This company is now at work on the underground-cable system and the cables are being laid as rapidly as possible.

There is said to be trouble in Preble County among the telephone companies over the toll charges. They have had a mutual arrangement for a year past, and the matter grew out of the accounts.

There is a movement on foot to establish a telephone service in the villages in Hamilton County along the line of the Southern Ohio Traction company. S. A. Butterfield and J. R. Bevis of Bevis, Ohio, have charge of the right-of-way, but it cannot be learned at this time what system is to be used.

It is reported that the Central Union Telephone company is arranging to introduce a free county service in Pickaway County for the Circleville patrons of the exchange.

The United States Telephone company has applied for a franchise for a toll station in Springfield. Under the conditions of the application, it seems that an exchange will not be built there at this time. The company is building a line west through that city.

The Ohio Telephone and Telegraph company has been granted a franchise to operate a toll station in Gallipolis. Local papers say that it looks very much like a franchise to operate another exchange in the town. There was quite a little opposition to the passage of the ordinance, as the people do not want three exchanges, but it went through.

The Warren and Youngstown men who some time ago purchased the Independent telephone plant in Seattle, Wash., have arranged to form a company with a capital stock of $500,000, to purchase the Portland (Ore.) system. This syndicate is acquiring some extensive properties throughout the country. Besides the Seattle plant, it also owns one at Birmingham, Ala.

The Spencerville Telephone company of Spencerville, Allen County, has been incorporated. The capital stock is placed at $20,000 and the incorporators are Albert C. Buss, Harry M. Ashton, S. L. Ashton, Ira B. Post and Philip Zimmerman.

The Henry County Telephone company of Napoleon Ohio, has been incorporated by M. Donnelly, Ed. L. Barber, James S. Brailey, S. M. Heller and F. D. Prentis. The capital stock is $50,000. The company will build a plant at Napoleon and toll lines to Ridgeville, Liberty Center and Holgate, with branches to other points. O. M. C.

TELEPHONE MEN.

C. S. Winston, late of the Western Electric company's telephone-engineering department, has accepted a position with the Kellogg Switchboard and Supply company.

F. H. Whitaker, formerly of Topeka, Kan., has taken the position of superintendent of the People's Home Telephone company of Birmingham, Ala. The former superintendent, Frank Pazack, has gone to Seattle, Wash., to supervise the construction of a new Independent exchange.

Speaking of Frederick P. Fish, president-elect of the American Telephone and Telegraph company, a Boston correspondent writes: "It is understood that his income from his professional duties amounts to about $75,000 per annum and that his salary as president of the American Telephone company will be about $100,000 per annum."

M. V. Shriver, superintendent of construction of the Columbiana County Telephone company, Salem, Ohio, has resigned his position to accept a place with the Baltimore and Pittsburg Telephone company, and will have his headquarters at Downington, Pa. He has been with the former company for a year and is considered an expert in the matter of construction.

E. L. Wilson, an inspector of instruments in the stock department of the American Telephone and Telegraph company at Boston, was taken insane on April 26th and was locked up in the city prison pending an examination by experts. He is about 40 years of age. His attack causes much comment, through its so closely following the insane act of George H. Brainerd, in shooting four men last week at Portland, Me.

F. L. Springer, the telephone and switchboard inventor, whose home was in Fortville, Ind., died at St. Vincent's Hospital in Indianapolis on April 22d. He failed to rally from the effects of an operation. He made many inventions, the majority of them having reference to telephones and switchboards, and he was rapidly coming into prominence among telephone people. Recently he had been employed by the New Telephone company of Indianapolis as its chief designer.

The Charlottesville Rural Telephone company of Hancock County, Ind. (capital stock, $2,000), was incorporated last week. The company will operate rural telephone lines, with headquarters at Charlottesville.

Telephone Development in Indiana.

"Telephones and telephone service are spreading over Indiana as rapidly as workmen can erect the plants," said S. P. Sheerin of the New Long Distance company of Indianapolis to a Western Electrician correspondent. "Within the last six years telephones in Indiana have increased from 12,000 to 65,000. The development of the Independent companies and their friendly co-operation have been the most remarkable in modern history, and this development and the investment of large sums of money have been accomplished in spite of strong opposition and legal complications. The barbed-wire farm service has given way to substantial lines, and good service among the farmers is about as common as in the cities. Our line is now connected with nearly 30,000 telephones, and by reason of contracts with other Independent companies we are connected with upward of 50,000 telephones." Mr. Sheerin says the future is full of promise, and henceforth the battle will be an even contest.

A Tart Circular.

Under date of April 23, 1901, the Rochester Telephone company issued the following circular letter to its subscribers: "Our attention has been called to the fact that the Bell Telephone company of Buffalo is distributing to our subscribers, through messengers, copies of their new supplement. In many cases our subscribers have been requested, as we are informed, to place this supplement in the directory of the Rochester Telephone company. Whether this distribution of Bell supplements is intended to annoy us, or to confuse our service, or to create some false impression in the minds of our subscribers, or is simply an evidence of general imbecility, we do not know. The place for this supplement is in the Bell directory, if you have one; if not, in the waste-basket."

Mr. Transmitter Addresses Mr. High Potential.

The employes of the Iowa Telephone company at Sioux City, Iowa, have organized a club called the Potential Club for the study of electrical science and telephony. The officers have electrical terms to designate their respective offices. The president is called High Potential, the vice-president, Low Potential, the secretary, Repeater, and the treasurer, Accumulator. The speaker for the evening is called a transmitter and all ordinary members are receivers. The aim is to study all important subjects pertaining to advanced telephony and other important electrical matters.

Party-line Rates in New England.

The New England Telephone and Telegraph company has granted a rate of $18 a year for residence telephones on 10-party lines in Greenfield, Easthampton, Ware, Amherst, Athol, Orange, Lee, Lenox and Great Barrington, Mass., and Brattleboro, Bellows Falls and Bennington, Vt. Telephones on six-party business lines have been granted unlimited local service for $25, the rate hitherto charged for 500 calls a year.

MANUFACTURERS AND DEALERS.

The Monarch Telephone Manufacturing company, Chicago, has been incorporated, with $10,000 capital stock. The incorporators are John E. Norling, Ernest E. Yaxley and Ward B. Sawyer.

The International Telephone Manufacturing company, Chicago, has been incorporated, with an authorized capital stock of $100,000. William E. McCormick, J. F. Dunlap and George H. Dunlap are the incorporators.

The latest bulletin of the Farr Telephone and Construction company of Chicago shows a number of different types of switchboards, telephone sets, receivers, transmitters, magneto bells and many telephone appliances.

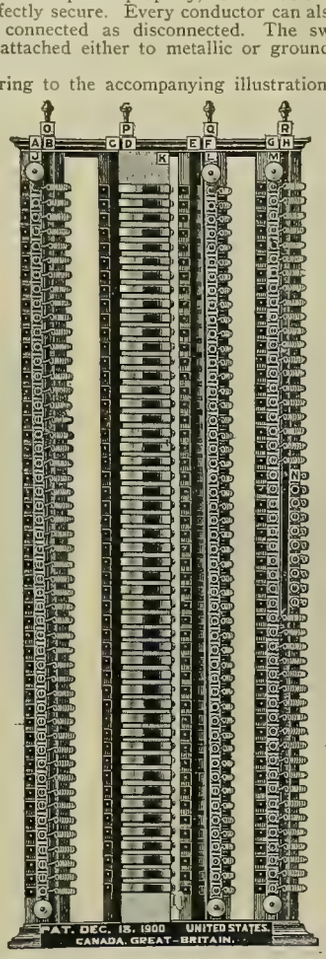
The Peerless Electric Telephone company of Rio, Wis., has published a catalogue describing its telephones and switchboard apparatus. Special mention is made of series and bridging telephones, desk sets, test sets, magneto bells, receivers, transmitters, etc.

The Central Electric company of Chicago is distributing a folder on National telephone cables, which contains many points of interest to users of this material. For this cable the company claims the following advantages over other cables: The paper used in the insulation is purer, heavier and one-eighth inch wider than that used in other cables. This makes the cable larger in diameter, thereby necessitating the use of more lead in the casing. The result of this is that the cable is not so apt to break when bent. It is also the cause of the cable weighing more per foot than other cables. A single thickness of paper used in these National cables is said to offer a resistance of 500 megohms a mile.

Scott Emergency Disconnecting Switch.

A patent has recently been granted to C. W. Scott of Lynchburg, Va., for what he thinks is one of the most practical devices for disconnecting telephone switchboards instantly in case of emergencies or at the approach of storms that has ever been devised. The electric switch, as it is called, secures a certain and safe contact and makes all property safe from high-pressure currents. With the device it is said that 1,000 subscribers can be easily disconnected within 10 seconds and every conductor grounded, making the telephone property, as well as the building, perfectly secure. Every conductor can also be as quickly connected as disconnected. The switch is readily attached either to metallic or grounded circuits.

Referring to the accompanying illustration of the



SCOTT EMERGENCY DISCONNECTING SWITCH

switch, the following description is of interest: The bar (J) is in channel (A) and all the conductors of that section are in normal working condition. The bar (K) shows another section with every conductor cut out, but not grounded, simply by releasing it from channel (C). Bar (L) shows it taken from its normal working condition from channel (E) and placed in channel (F), which not only cuts out every subscriber of that section, but grounds them as well, which prevents any flooding back of the current. Bar (M) is shown in its normal channel (G), save that 10 of the conductors, beginning at (N), are shown cut out and grounded. The rods (O), (P), (Q), (R) are heavy copper rods leading to the ground from a perfect contact in the channels (B), (D), (F) and (H), and by shifting the bars from the channels (A), (C), (E) and (G) to the channels (B), (D), (F) and (H), a contact is made with these copper grounds, (O), (P), (Q) and (R), rendering positively safe every conductor so changed.

EXTENSIONS AND IMPROVEMENTS.

The Wood County Telephone company has purchased, through its manager, C. M. Dougherty, from the Kellogg Switchboard and Supply company of Chicago, a 400-drop switchboard for its Grand Rapids (Wis.) exchange. This board will be used for central energy before long by changing drops for targets.

W. H. Harvey and A. E. Graham have just secured a charter to build a telephone line from Memphis, via Holly Springs and Oxford, to Grenada, Miss. The capital stock of the enterprise is $25,000. Mr. Harvey is the owner of an exchange at Oxford, Miss., and also has charge of the electric-light plant. The telephone line has already been completed between Oxford and Holly Springs.

The Cumberland Telegraph and Telephone company has just secured a franchise at Holly Springs, Miss., and will put in at that town a first-class telephone exchange. Mr. E. L. Mosby has been operating a small exchange at that place for several years. It was quite an important grant to the Cumberland company, as it required a location for a long-distance office at this place, Holly Springs being at the crossing of the Illinois Central and the Kansas City, Memphis and Birmingham railways.

Some Facts About the Van Choate Electric Company.

Boston, April 27.—Stephen H. Tyng, auditor in the case of W. L. Clark against the Van Choate Electric company, has filed his report in the office of the clerk of the United States Circuit Court. That court appointed Mr. Tyng to pass upon claims presented by creditors of the company. His report states that when the company was organized its only assets consisted of rights and property turned over by Van Choate in return for 599,900 shares of the stock, but that the actual, tangible property was so inconsequential in amount and value as to be scarcely worth consideration. Mr. Tyng considers it simply preposterous that any sane person would pay $6,000,000 for it. He adds: "I do not deem it necessary to present more fully evidence that Van Choate and his coadjutors were perfectly conscious of the fact that, considering what the corporation actually received, it was vastly overcapitalized. I find that none of the inventions has ever yet been demonstrated to be a practical commercial success, and I am unable to find that they really had any pecuniary value, whatever. I do not find that the company was in a solvent condition at any time after beginning business. I find that the stock was worth nothing unless upon the ruling of the court the legal claims are insufficient to exhaust the present assets of the company, and in that event that the stock is worth such percentage of its par value as said residuum bears to the entire amount of stock issued." In regard to the company's efforts to sell stock to the public, the auditor says: "The community was flooded with seductive literature, replete with grossly extravagant reports which, in some instances, if not directly mendacious, were certainly so in their suggestiveness.

"The company offered the presidency to Erastus P. Carpenter of Foxboro, and he filled the position from July 14, 1894, to October 22, 1895. Van Choate and Carpenter entered into an agreement by which the latter was to purchase 2,500 shares of the company's stock and was to use his influence in favor of the company. This agreement was also signed by C. Henry Kimball and Warren L. Knox. There is no evidence on the company's records that Carpenter ever attended a meeting of the directors or stockholders, but rather evidence that he did not attend. He proved a great disappointment to the promoters. His claim for services as president, etc., is over $17,000." The auditor thinks that the court will hold the Carpenter agreement as against public policy, fraudulent, illegal and void, but if it is not so held, and Carpenter is entitled to anything, Mr. Tyng thinks the amount allowed should not exceed $12,715.04.

Kimball claims over $100,000, and the auditor says: "I regard the presentation of this claim by Kimball as a mixture of unblushing impudence and reckless mendacity. I believe, if he has any claim, it is against Van Choate personally, and not against the company. Van Choate's claim is for $113,950, of which $100,000 is for breach of contract. Van Choate realized more from the sales of the stock he received than his inventions were worth. He had ample time to test the value of the inventions, and his failure is the result either of inability or extravagant, wasteful and unbusinesslike methods." The court will give a hearing on the report at some future day. B.

Electrical Development in California.

An address on "The Industrial Development of California" was recently delivered before an assembly of engineering students at the University of Illinois by Dr. F. A. C. Perrine, formerly professor of electrical engineering at Leland Stanford Junior University. Dr. Perrine explained the present economic, social and industrial progress of California arising from the electrical development and utilization of the waterpowers abounding in the mountain ranges of the state. Since coal from Australia, China and other Pacific fields cost $12 a ton, delivered at the seaboard in ballast, it has heretofore been impossible to develop mines and manufactories, electric lighting, electric railways and other industries dependent upon cheap power. Electric transmission is now in successful operation at many places throughout the state, and energy is secured at distances upward of 150 miles, as in the case of the Standard Electric company supplying Stockton and Oakland. Dr. Perrine has been for the last three years consulting engineer for this company. The speaker dwelt at length upon the unprecedented engineering difficulties encountered in the electrical development of California waterpowers. He recited many examples of practical work that would have been considered impossible by eastern engineers, in the storage of water to last over the long dry seasons of about 150 days; in the development of power by impulse wheels, using the high heads of upward of 1,400 feet, and in the construction, maintenance and protection of high-potential transmissions, as the 60,000-volt line.

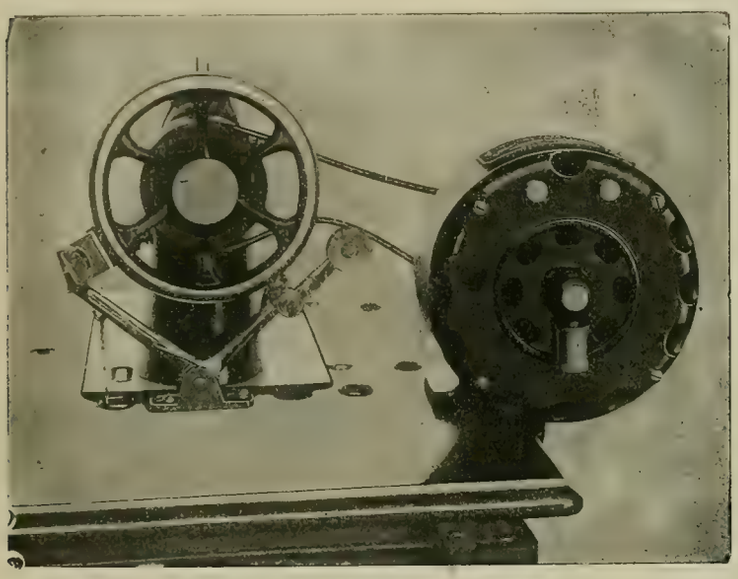
There is a rumor in Johnstown, Pa., that Tom L. Johnson is preparing to dispose of his interest in the Johnstown Passenger Railway company. It is said by stockholders in the local street railway that Mr. Johnson controls a majority of the stock in that enterprise and also holds practically all of the $800,000 in bonds. He and his immediate friends are said to hold 6,200 shares of the stock.

General Electric Sewing-machine Motor.

Compactness and simplicity of construction are prominent features of the sewing-machine motors manufactured by the General Electric company. The ease with which they may be installed renders them particularly adaptable for attaching to machines for domestic use. The motors are similar to fan motors, but have a frame casting with a clamping foot instead of the ordinary pedestal base. The illustration shows the motor with its attachments. The complete outfit consists of the motor, a bell crank or rocker with idle pulley and brake, clamp hooks and chain. Most of the standard sewing machines can be fitted with the motor.

The motor can be connected to a lamp socket or wall receptacle by means of a flexible cord and plug. A small snap switch, which should be placed on the under side of the sewing-machine table near the front edge, will enable the operator to start or stop the motor without leaving the machine. The motor is clamped to the back of the machine table, so that the pulley is in line with the pulley on the sewing-machine hand wheel. These pulleys are connected by a small leather belt of circular cross-section, the length of which is such that the machine will not take power from the motor unless the belt is tightened by pressure of the idle pulley on the rocker arm. The L-shaped rocker is hinged to a bracket which may be fastened by screws to the top of the machine table, beneath the hand wheel, and in line with it. A chain hooked to the brake arm of the rocker passes through the forward belt hole in the machine table, and is hooked to a clamp on the treadle. A coil spring attached to the rocker and bracket throws the brake against the rim of the hand wheel when pressure is removed from the heel of the treadle.

The machine is started by applying to the heel of the treadle a slight pressure, which, by means of the chain and the brake arm, removes the brake from the hand wheel, and, at the same time, forces the idle pulley against the belt, thus tightening it so that the motion of the motor pulley is transmitted to the pulley on the hand wheel. The machine is stopped by merely removing the pressure from the heel of the treadle. It will be seen that the speed of the sewing machine can be regulated at will by pressure on the treadle—that is, the speed increases with the pressure. These sewing-machine motors are wound for 115 volts, direct current, and for 52 or 104 volts, and 60 or 125 cycles, alternating current.



GENERAL ELECTRIC SEWING-MACHINE MOTOR.

Unique Electric-lighting Advertising Specialty.

Recently there was exhibited in an office in the Knickerbocker Theater building in New York an electric advertising appurtenance which without doubt will be welcomed by merchants and others throughout the United States who have spent a great deal of money in electric-light window and sign displays. This device was described in detail in the Western Electrician of November 24, 1900, but, owing to the fact that it will shortly be placed on the market in this country, a general explanation of its application is opportune.

Generally speaking, the device consists of a so-called "board" or especially prepared surface, as is shown in Fig. 1, into which incandescent lamps, as illustrated in Fig. 2, may be stuck in and lighted in any location on the board that may be desired.

A merchant desiring to make up an electric sign, and who is equipped with one of these boards and a number of specially prepared lamps, has only to mark out letters on the board and stick in the lamps, like pins, as it were, along the lines of the letters, with the result shown in Fig. 1.

The peculiar feature of the board is that the lamps may be shifted about at will, so that it becomes a very easy matter to make changes in the electric signs every night, or even twice a night, were it desired.

In addition to this novel electric-lighting board or surface, there was also shown at the exhibition at the Knickerbocker Theater building a flexible cable, built on the same plan as the board, and into which lamps may be stuck, precisely as upon the board, wherever it is desired.

The value of this cable becomes evident when one realizes the immense amount of festooning that is nowadays demanded at private parties, in show-window work, etc. All one has to do with this cable is to drape it into any desired shape or position, and then stick in the lamps, which immediately light.

The various methods of using this novel invention were explained by the advertising manager, Clarence F. Chatfield, of Ehrich Bros.' dry-goods store, who personally superintended the introduction of this device to the public, in company with Manager of Works William G. Haywood, who had been sent from England to secure the approval of the underwriters in the United States. It may be added that Mr. Haywood has succeeded in his mission. A company is now being organized in New York among prominent capitalists for the exploiture of this electric-lighting board and the cable.

Fig. 1.

Fig. 2.

UNIQUE ELECTRIC-LIGHTING ADVERTISING SPECIALTY.

Electric Railways in Canada.

From returns received from the 35 electric railways of Canada, the Dominion statistician makes up the following statement: At the end of December, 1900, the number of miles of electric railway in Canada increased to 681 miles, or 49 miles over the number in the year previous. These railways carried 118,129,862 passengers in 1900, an increase of 14,097,203. This is equal to carrying the total population of the country 21 times. The car mileage run was 30,924,355 miles, an increase of 1,277,508 miles over last year. The mileage run and the passengers carried show that for each mile run the electrics carried 3.8 passengers, against 3.5 in 1899. The amount of paid-up capital invested in electrics on December 31, 1900, was $20,633,000, and the bonded debt was $12,619,422. The number of cars in active service in 1900 was 1,642, an increase of 98 over the previous year. The employes numbered 4,493, showing an increase of 164 over 1899. The total receipts for the year were $5,422,540, and the expenses were $3,268,001. Since 1897 the number of passengers carried by the electric railways increased from 83,811,000 to 118,130,000, an increase of about 41 per cent.

Electrolytic Reduction of Copper.

A London dispatch of recent date refers vaguely to a new electrolytic process for the reduction of copper "by which the bars, sheets and tubes can be manufactured from the crude material almost at the pit's mouth. This will mean a saving of at least $100 a ton on the finished material. The new process uses the same amount of electrical energy per ton of metal as the old, but is worked at a rate [?] 10 times greater, and in making bar copper for subsequent melting a rate 20 times greater is said to have been successfully used." David Cook, an electrical engineer of London, is reported to have said that "where 100 tons of copper are electrolytically refined daily in 1,400 vats, covering something like 65 acres of ground, only 100 vats would be required by the new process." Again, quoting from the newspaper report under a London date line, "Messrs. Stanger and Blount, government analysts, have been making tests of the new process in their laboratory at Westminster. The results of their test were given to-day [April 27th]. These show that copper can be deposited as a coherent sheet at a current density 10 times greater than that employed in the ordinary process. The copper so deposited is almost chemically pure and in consequence of this purity its electrical conductivity approaches the theoretical limit." These fragmentary accounts are rather conflicting. It is said, however, that Senator Clark of Montana has secured an option on the American rights for the use of the new process.

BOOK TABLE.

ELECTRIC LIGHTING. Vol. II. By Francis B. Crocker, E. M., Ph. D. New York: D. Van Nostrand company. 1901. Pp., vi., 505, 6 by 9 inches, with 391 diagrams and illustrations. Price, $3.

The second volume of Professor Crocker's well-known work is devoted to the consideration of all of those parts of an electric-lighting system which are not included in the generating station, such as feeders, mains, lamps, switches, cut-outs, meters and pressure-transforming devices of all kinds. The former volume was concerned chiefly with the power-generating apparatus, and the two, forming a complete treatise covering all commercial systems of distribution, are intended as textbooks for schools of engineering and as reference works for practicing engineers. The information contained in the present volume is extremely concise, well arranged and broad in scope, and while necessarily written for readers possessing some technical knowledge of the subject, it is condensed and disposed with a constant view to the practical application of the principles of design and construction of electrical distributing systems.

Care has been taken by the author to provide a logical arrangement of the subject-matter, the first chapter being devoted to a consideration of the properties of electrical conductors. The next five treat of the various systems used primarily for direct-current distribution for different classes of service, and include brief references to the devices employed as auxiliaries, such, for instance, as boosters, secondary batteries and compensators. Considerable attention is given to the several methods of pressure regulation now in use, and this necessitates a statement of the principles involved in the calculation of feeders, their arrangement, and the design of networks. The three and five-wire systems are treated thoroughly and in detail in the early portion of the book, so that in the part devoted to alternating-current distribution only a brief reference to them is necessary. Both analytical and graphical methods are presented for the design of feeder circuits, the graphical methods for determination of drop in feeders being given considerable prominence and affording opportunities of making an appreciable saving of time in extensive calculations. An entire chapter is devoted to distribution by means of a network of conductors.

With Chapter 7 is begun a study of the principles and phenomena of alternating currents. After illustrating the methods of determining capacity and self-induction in circuits of different configurations the resultant phenomena, such as phase displacement, mutual induction, resonance and "skin effect," are taken up, and their causes and results discussed. Graphical determinations and the use of vectors are developed in a manner easily followed. In the next chapter the methods previously illustrated are utilized in the consideration of the properties of polyphase currents, while Chapter 9, one of the longest in the book, deals exclusively with transformers. The author has brought out the salient features of transformer design by careful description and a number of excellent illustrations, and formulas are given for calculation of copper and iron losses and efficiencies, together with data on the influence on full load and all-day efficiency exerted by copper and iron losses of various relative proportions. These descriptions of alternating-current principles and apparatus are followed by chapters on alternating-current distributing systems and the calculation of circuits by graphical and analytical processes.

The latter half of the work treats of overhead and underground conductors, pole-line and conduit construction and interior wiring. Carefully prepared chapters on arc and incandescent lamps are also included, and the volume closes with a discussion of

the methods of charging for power in common use and descriptions and illustrations of the commercial meters at present on the market. Two appendixes are added, one comprising the complete National Electrical Code of the National Board of Fire Underwriters, and the other the report of the standardization committee of the American Institute of Electrical Engineers.

Valuable data on transformer design and properties of transmission lines are to be found, compiled and tabulated, in the work, and the two volumes should find a place in every technical library, whether public or private.

Paragon Sewing-machine Transmitter.

The accompanying views illustrate an apparatus which is believed to represent a high development in the operation of sewing machines by means of electric motors. The device is known as a sewing-machine transmitter. It operates by means of a friction wheel bearing on the hand wheel of the sewing machine at right angles to it. The general appearance of the apparatus is shown in Fig. 1, while Figs. 2 and 3 are detailed sketches of the

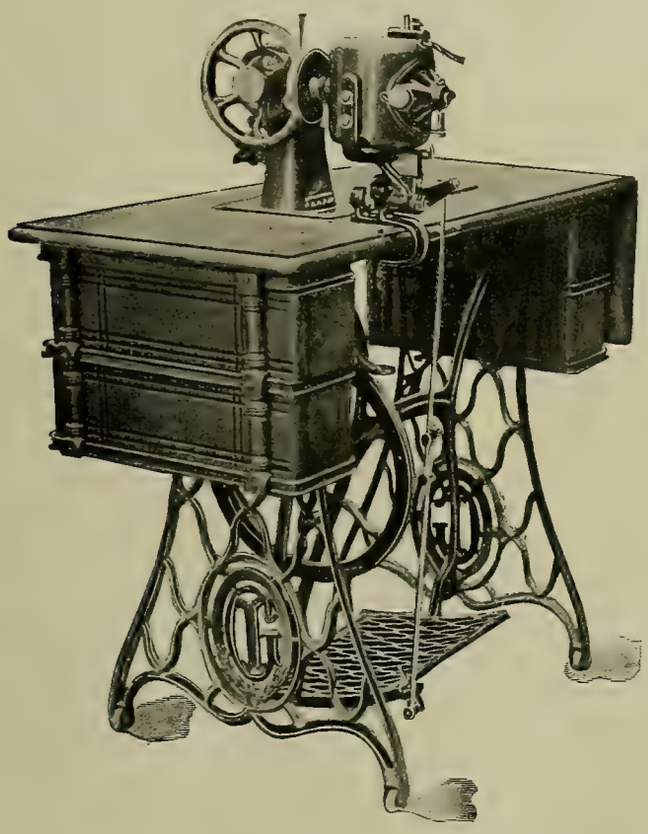


Fig. 1.

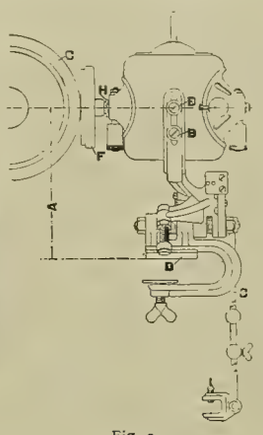


Fig. 2.

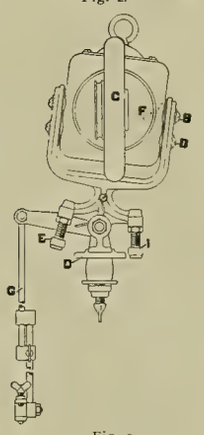


Fig. 3.

PARAGON SEWING-MACHINE TRANSMITTER.

motor. In these drawings the friction wheel is represented by (F), and the hand wheel of the machine by (C); the apparatus clamps on the table of the sewing machine by means of the slide (D). The variability in speed is obtained by rocking the motor back and forth on an axis, the limits of movement being regulated by the screws (E) and (I). As the motor is rocked the friction wheel moves so that the point of contact with the hand wheel is carried from the center toward the periphery, thus increasing the speed of the machine, while the speed of the motor remains constant. This rocking of the motor is accomplished by means of a connecting rod fastened to the treadle. A slight movement of the treadle by the foot is all that is required to rock the motor and thus vary the speed of the machine.

The Paragon equipment has the advantage of having no belting or rheostat. It can be applied to any machine without mutilation. The motor does not run continuously, but only with the operation of the sewing machine. It takes power only in proportion to the amount of work being done and the speed or number of stitches per minute. The variable speed is under perfect control of the operator, gives any speed from two stitches per minute to 2,000, and makes it possible to "pick up" the needle the fraction of an inch when desired. An immediate start at full speed can be had when desired. With the Paragon transmitter, the machine head is driven positively at all times and the variable speed obtained by means of a variable leverage, so that any degree of work, no matter how heavy, may be accomplished by allowing the machine head to operate at a sufficiently low speed. These transmitters are made in two sizes, for household or factory work, respectively, and for both alternating and direct current. They are manufactured by the Paragon Fan and Motor company of New York city.

Sharp Practice in Washington.

A number of the employes of the Washington (D. C.) Traction and Electric company are charged with conspiracy to defraud the company by substituting used tickets, which were supposed to have been destroyed, for the new tickets issued to the street-railway conductors daily, and appropriating to their own benefit the fares received when this substitution was made. A trustworthy clerk takes each day the hundreds of tickets collected and punched by the conductors and carries them to the boiler room at the power station at Fourteenth and East Capitol streets. He dumps them on top of the burning coals, and it has been his practice to stand for a moment or two to see that the tickets were on fire before leaving. These used tickets are tied up in bundles of 100, with a rubber band around each, and a fireman discovered that several minutes after they had been thrown into the furnace a bundle could be pulled out and a portion of the tickets would be practically uninjured, except for the punch mark, which is supposed to be made at the time the ticket is collected for fare. The fireman saw an opportunity to make money dishonestly out of this, and for months, it is asserted, he has been rescuing tickets and selling them to conductors at one cent each. The conductors turned them in at a profit of four cents.

Cheaper Current Predicted.

"Holland," the widely read New York correspondent of the Philadelphia Press, makes this prediction: "Before the end of the year it is probable that some remarkable discoveries and inventions will have been made public. One that is of the utmost consequence has been recently perfected, but for certain business reasons the inventors do not care that publicity shall be made. The great masters of commercial electricity, however, know of it. George Westinghouse knows all about it, and conservative as he is, he ventures to predict that it is to be of revolutionary importance. It seems to have solved a problem whose solution the great scientists in the past have said would revolutionize the production of power. At the electrical exhibition at Columbia University the opinion was freely expressed by the scientists that within the course of two or three years the electrical current will have come into universal use for heating houses. The chief object of the inventors and scientists has recently been the cheapening of the production of the current, and it is believed that this is about to be secured, and in such manner that houses may be heated at far less cost and with much greater economy and safety than the modern furnace or steam heat, or any of the apparatus used for warming houses, make possible."

The Ohio River and Youngstown Railway company, Warren, Ohio, has been incorporated for $10,000. The company is authorized to build an electric railway through Mahoning and Columbiana counties.

CORRESPONDENCE.

New York Notes.

New York, April 27.—The engineers of the construction company have practically decided the question whether there is to be one or several power houses for the rapid-transit subway. There will be one main power house, which will be larger than either the Metropolitan or Manhattan plants, with several sub-stations for the distribution of electrical energy. Mr. J. Van Vleck has been appointed mechanical engineer of the Rapid Transit Subway Construction company, and he is to cooperate with the electrical engineer for the commissioners, L. B. Stillwell, in the construction of the power plant. A site for the power house has not yet been selected.

With the view of giving electric-railway companies the same rights of condemnation as steam railways and to promote competition a bill has been introduced in the New York Legislature to put electric railways under regulations similar to those placed upon steam railroads with which they are compelled to compete.

At the two-hundred-and-fourteenth meeting of the New York Electrical society, last Thursday, the following-named new members were elected: W. E. Gavit, Robert B. Corbett, J. C. Lynch, Ralph Straschnow, William H. Eckert, Willard M. Miner, W. Stanley Eckert, H. P. Marshall, Willard B. Kendall, C. E. Fairbanks, Dr. Ralph Julian Sachers, Edwin L. Ross and J. C. Weart of New York, Edgar H. Stevens, Elizabeth, N. J., and C. E. Brown, Brooklyn, N. Y.

The Consolidated Railway, Electric Lighting and Equipment company, a concern with $16,000,000 capitalization, has lately been merged with the Consolidated Railway, Lighting and Refrigerating company, which has a capital stock of $22,000,000. Some of the shareholders object to the consolidation and have formed a protective committee.

The net earnings of the Brooklyn Rapid Transit company for March showed a decrease of $36,758, as compared with the corresponding month of last year. A net increase of $426,077 is shown from July 1st.

Fifteen automobiles made a road run from Fifth avenue and Fifty-eighth street to Jericho, on Long Island, to-day. Three went to Oyster Bay, a distance of 53 miles for the round trip. M. L. G.

New England News.

Boston, April 27.—Attorney-general Knowlton, of this state, has given the opinion that legislation authorizing street-railway companies to use their tracks in the public highway as common carriers of goods, wares and merchandise would be constitutional.

On May 7th and 8th the United States Civil Service examiners will meet in this city to examine applicants for appointment as inspector of electrical engineering.

Heavy rains and the breaking of a reservoir dam at Middlefield, Mass., caused the flooding of the electric-light station at Chester, Mass., on the night of April 21st.

The owners of the Soule mills in New Bedford, Mass., are considering the adoption of electricity as a motive power for the machinery. No other mill in New Bedford has tried electric power.

Willard P. Gerrish, of Harvard College Observatory, calls attention to the want of a time signal in Boston. The dome of the Massachusetts State House is nightly lighted by two circlets of electric lights, which can be seen for a distance of at least 10 miles. Mr. Gerrish proposes to connect the circuit of the upper circlet with the Harvard Observatory, where the current will be turned off at 8:59 p. m., to be restored at exactly nine o'clock, by a switch controlled by the observatory clock.

Colonel William A. Gile of Worcester, Mass., is organizing the National Electric Clock company, with a capital of $300,000, and with offices at 505 Colonial building, this city, and factory at Bangor, Me. The plant and patents are owned by General Joseph S. Smith of Bangor. The clock is run by an electric battery and does not require winding. The battery has to be replenished only once a year.

The New York, New Haven and Hartford Railroad company has bought the Worcester and Webster and the Webster and Dudley street railways. The two street railways will form the Worcester end of a system paralleling the Norwich and Worcester division of the New York, New Haven and Hartford system. The street-railway system will be extended to Hartford and New Haven, Conn., but it will not at present bear the name of the railroad company, although the company will operate it.

In the House of Representatives, on April 23d, the committee on manufactures and mercantile affairs reported a bill restricting combinations of electric-light companies. The bill provides that no such combination shall be allowed without the approval of the Gas and Electric Light Commission, that electric-light companies cannot issue trust certificates nor place their management in the hands of trustees. If control of a corporation be placed in the hands of trustees, the attorney-general may obtain its dissolution and the appointment of a receiver.

On April 24th the committee on manufactures and mercantile affairs reported a bill authorizing the purchase of the Boston Electric Light company's property by the Edison Electric Illuminating

company of Boston. Mr. Wardwell, who represented the Edison company, told the committee that if this bill was defeated the company would immediately ask the commissioners for new capital amounting to $1,000,000.

The Massachusetts Board of Trade has indorsed the bills restricting combinations of electric-light companies and permitting the purchase of the Boston company by the Edison company.

The Ames Engine company has been awarded the contract for the engine of the new municipal electric plant in Lowell, Mass. The General Electric company received the contract for the electrical apparatus. B.

Southern Developments.

Charlotte, N. C., April 27.—The mayor of Atlanta, Ga., has approved the ordinance granting the Atlanta Railway and Power company a franchise to operate an electric-lighting plant in that city for a term of 21 years. The officers of the company were given a short time within which to accept or decline the franchise. If the company accepts, a bond of $40,000 will be required as a guarantee of the erection and putting into operation of its electric-lighting plant. Competition in electric lighting in Atlanta is now said to seem assured.

At a meeting held in Pensacola, Fla., for the purpose of taking action on the proposed bill for Pensacola and to provide for issuing improvement bonds, a motion was carried to memorialize the Legislature for authority to issue $1,000,000 bonds. Buying the electric-light plant is one step contemplated.

The Board of Aldermen of Charlotte, N. C., will, in May, grant a franchise to F. F. Van Deventer and others, who propose an $800,000 development of Matts Falls, 30 miles distant from Charlotte. L.

From the Buckeye State.

Columbus, Ohio, April 27.—An interview with an Ohio man who succeeded in keeping his name out of print will be interesting from the fact that he seems to have great hope of the future of the electric-railway business in the central states. The Cincinnati Enquirer quotes him as follows: "Leaving out all routes talked about or prospected, and taking up those actually under contract and construction, which are absolutely sure of completion within 12 months—most of them by January, 1902—in the states of Ohio, Indiana and Michigan, there will be 700 miles of new electric-railway lines. Detroit now leads all cities in this territory—even Cleveland—in the extent of her suburban-railway lines, 276 miles in actual operation and 183 miles under construction. For a city of 225,000 population and shut off by river on one side of her, this is a great showing. A line is now under way between Cleveland, Columbus and Cincinnati, which will be completed in 1902, and which will be equipped with sleepers, parlor and buffet cars. With long sidings and double tracks, I see no reason why through trains making stops at important points should not make an average speed of 35 miles an hour, with freedom from smoke and cinders. It has been satisfactorily demonstrated that a speed of 50 miles an hour can be attained for short distances with safety."

The Crawford county commissioners have granted a franchise to a company to build a line from Marion to Bucyrus.

The commissioners of Richland County have granted a franchise to F. D. Carpenter and L. M. Coe to build an electric line from Mansfield to Crestline, where it will connect with some of the proposed lines to Cleveland.

R. S. Rosenstock has been granted a franchise for an electric line through Union County. He is the chief engineer of the Toledo, Findlay and Southern, and it is supposed that this move has something to do with the extension of that line south from Findlay.

In some places it was necessary last week for the street cars in Cincinnati to run through water in order to carry passengers to and from their homes. The Cincinnati Traction company has a peculiar high car which is used for this purpose in case of a flood. The motors are placed high up, so that the water will not interfere.

A syndicate of Cleveland capitalists, headed by George T. Bishop, is negotiating with the street-railway companies of Dallas, Texas, for the purchase and consolidation of the various systems in that city. The syndicate, which is known as the Northern Texas Traction company, is now building a line between Dallas and Fort Worth, and already has acquired the lines in the latter city, at a cost of $500,000. The interurban line will be about 30 miles long. Mr. Bishop is president of the company, and John Sherwin, of the Park National Bank at Cleveland, is secretary.

The Columbus, Delaware and Northern Traction company has increased its capital stock to $1,000,000, and the following-named officers have been chosen: President, James M. Loren; vice-president, J. S. Harshman of Springfield; secretary and treasurer, J. G. Webb of Springfield; general manager, H. A. Fisher of Columbus. It thus passes under the control of the owners of the Columbus, London and Springfield road, which in a manner insures its being built. The same people last week incorporated a road to be built from Columbus to the Michigan line, by way of Defiance and Ottawa, and this likely will form a portion of that road.

The Miami and Erie Canal Transportation company has increased its capital stock from $10,000 to $3,000,000, for the purpose of providing funds for building the canalboat line.

It seems that the Northern Ohio Traction company will carry out its original plan of building a road from Akron to Canton, notwithstanding the arrangements that have been made with the Akron-Canton road to allow the latter to enter Akron over its line. There was no agreement in regard to the building of another competitive road, and from all that can be learned, the matter stands just as it did before the traffic arrangements were made. The Northern Ohio people are unwilling to oppose other companies, but prefer to go on with their own plans.

As indicated by an item in last week's issue of the Western Electrician, the Little Miami Traction company, reincorporated, has passed into the control of the Cleveland electric-railway men, although John P. Martin, the energetic projector, will be connected with them in the enterprise. The change was made simply to insure the financing of the company. The officers are as follows: President, John P. Martin, Xenia; vice-president, F. T. Pomeroy, Cleveland; secretary, H. C. Lang, with M. J. Mendelbaum & Co., Cleveland; treasurer, J. R. Nutt, Akron. W. H. Lamprecht, Charles Orr and L. J. Wolf of Cleveland, E. W. Christy of Akron and J. M. Hutton of Cincinnati, with the officers, constitute the board of directors. The capital stock of the company will be $500,000, and the first section of the road between Xenia and Springfield will be built at once. That between Springfield and Cincinnati, by way of Lebanon, will be built later on.

The Iron Trade Review of Cleveland says that contracts and inquiries for rails for electric roads alone for the last week will aggregate 35,000 tons and that fully 650 miles of electric road are now under construction by the companies made up of the Cleveland syndicates alone.

General Manager Charles Currie of the Detroit and Toledo Shore Line railway held a conference with E. W. Moore at Cleveland this week, and it was decided to begin the construction of that road at once, mostly over private right-of-way. The distance is 60 miles, and it is planned to make a magnificent roadbed, with the intention of covering the entire distance in one hour and 10 minutes, or at the rate of 50 miles an hour. Through trains will be run, as well as local cars, and they will depart at intervals of one hour. It is the intention to carry freight as well as passengers, and there will likely be a lively contest between this road and the steam lines. The fare will be placed at about half what has been charged by the steam lines.

The Canton, Massillon and Akron Railway company, Akron, with a capital stock of $1,000,000, has been incorporated by E. H. Moorley, Fred A. Henry, I. R. Nutt, Will Christy, A. M. Snyder, H. B. McGrew and L. E. Beilstein. The company has authority to build an electric line from Akron to Jackson, Stark County, with branches to Canton and Massillon.

An electric line will be built from the center of the city of Youngstown to Steelton, where the plants of the National Steel company are located. It may eventually be extended on to Warren and Niles, where it will make connection with Cleveland.

O. M. C.

Information from Indiana.

Indianapolis, April 29.—A new municipal electric-light plant has been installed at Cambridge City. The original cost was $14,000.

Frank Clark, chief electrical engineer of the Big Four railway, is installing electric-light plants for the company at Wabash, Brightwood and other cities. All of the roundhouses, offices and station buildings at the points named are to be lighted by electricity.

Mass meetings are being held at Frankfort, and committees composed of business men are trying to induce President McCulloch of the Union Traction company to extend the company's system to Frankfort.

The Indiana Appellate Court held that where a street-railway company ran a gaily decorated trolley car, containing a party of young persons who were blowing horns and making a loud noise, so as to frighten a horse, occasioning it to wheel across the track in front of the car and thus to receive injury, the company is liable.

The Richmond street-railway plant has been transferred to James Murdock of Lafayette and his associates, who have been for the last year contemplating the building of an electric line from Richmond to Cambridge City, and from that point to Greenfield. The Union Trust company of St. Louis owned the Richmond plant, and it is said received over $100,000 for it. The franchise over the National road as far as Cambridge City has been procured, and will be transferred to the purchasers of the local plant.

The construction of interurban electric lines in Indiana has taken a new turn, and private rights-of-way are now being sought. Companies organized to construct lines over the public highways have found it difficult to get their projects financed. Moneyed men say there is a greater risk of accidents and damage suits; that the speed necessary cannot well be maintained if a public highway is used, and that the cost of maintaining a road in a highway is greater than where constructed in a private right-of-way. So the Indianapolis and Logansport Traction company has closed a contract with John Blair McAfee of Philadelphia, Pa., for the construction of its proposed road, contingent on a private right-of-way being obtained. Mr. Blair will have a force of surveyors at work on the line this week. The contract specifies that the road shall be completed within 18 months from the first of May. The people are in favor of the road, and no great difficulty will be experienced in securing a right-of-way.

A company, headed by C. F. Smith, was incorporated last week and will begin the construction of an electric road between Indianapolis and Martinsville within the next 60 days over a private right-of-way that is now being obtained. Franchises have been granted to two other companies for lines between these points over the public highways, but the new company's project has nothing to do with them.

The Indianapolis Automobile and Touring Club has been organized, by electing H. T. Hearsey, president, and C. Koehring, secretary. There are now over 35 automobile and motor-carriage owners in Indianapolis, and several successful runs have been made. F.

Northwestern Notations.

Minneapolis, April 27.—The Boone Suburban Railway company has been incorporated, with $15,000 capital stock, at Boone, Iowa.

The Fargo Gas and Electric company of Fargo, N. D., has passed into the control of William Maitland. As soon as possible the electric-light plant will be put in first-class shape.

The Grand Island Gas Company will add an electric-light system to its plant in Grand Island, Neb. Work will be started at once.

The Street Railway company of Des Moines, Iowa, is having plans prepared for an addition to its power house to double the floor space. A large amount of new machinery is soon to be installed. The work will cost $70,000.

The Des Moines Street Railway company will start work on the new car line to the new army post near Des Moines very soon.

The Waterloo and Cedar Falls Rapid Transit company contemplates building a 12-mile extension of the line from Waterloo to Denver, Iowa. Surveys have been started. The cost of the line is estimated at $150,000 to $175,000.

The villages of Winneconne and Butte des Morts, Wis., are anxious to secure electric-railway connection with outside points. Efforts are being made to interest the Winnebago Traction company of Oshkosh in an extension to take in these towns.

The Electric Light company of Viroqua, Wis., will put in a new boiler at its power station and will make other improvements.

The Missouri River Power company of Helena, Mont., finds a demand for all the power developed at its power plant, and will construct an additional plant across the river, at a cost of $1,000,000, to secure more power. The company is transmitting power to Butte, 50 miles distant, and has a demand for 10,000 horsepower more than it can supply. A new line will be strung to Butte.

It is probable that the street-car line in Green Bay, Wis., will be extended to Bay beach this summer, at a cost of $10,000.

Park River, N. D., will probably vote on a proposition to issue bonds for the establishment of an electric-lighting and waterworks system.

Stone & Webster of Boston recently bought in the outstanding bonds and receivers' certificates in Seattle, Wash., of the Seattle City Railway company, operating the Yesler way cable and the Jackson street electric lines. At the sale the firm will doubtless buy in the roads and add them to the other lines represented by the Seattle Electric company.

It is expected that the Electric Street Railway company of Winnipeg, Man., will expend $300,000 the coming season in improvements to its system. A car shed and shops are to be erected at Main and Assiniboine streets. The building will be 135 by 400 feet in size and will have room for 100 cars. It will cost $80,000. The lines through the city are to be improved.

The Council of Wausau, Wis., has granted a franchise to the Wisconsin River Electric Railway company for a line which is to run to Merrill, Wis., within a year.

The waterpower dam at Mellen, Wis., which furnishes power for the electric-light plant, was washed out, completely shutting down the lighting plant. It will take several months to rebuild the dam and get it in shape to furnish power for the lighting plant.

The new Wisconsin Traction, Heat and Power company has arranged to lease the Atlas mill site and power at Appleton, Wis., for 99 years. There is $2,500 horsepower available there. The new company will absorb the Electric Light and Power company of Appleton and the Fox River Valley Electric Railway company, and will carry out the plans of the latter with reference to a line to Kaukauna from Appleton. If the council of Kaukauna will grant a franchise, the road will be built through the town. Otherwise its rails will reach the city limits.

A movement is under way at Moline, Ill., to secure the extension of a car line from East Moline to Moline.

B. E. Linehan and William S. Molo have sold their half interest in the Union Electric company

of Dubuque, Iowa, to the General Electric company of New York for $350,000. It includes all the street-car lines and lighting plants in the city.

The council of Charles City, Iowa, has granted a franchise for the electric railway which is to run to Greene, Iowa.

The council of Windom, Minn., contemplates changing the system of installing lights for private parties. At present, the village puts in the lights, charging $2, which is paid in advance, and then that amount of light is allowed the consumer. Under the new system, the consumer is to be charged for the wiring, which will then be his own.

The St. Paul City Railway company has filed an answer to the collection of delinquent taxes for 1900. The company made a return of $1,060,060, which was accepted by the County Board of Equalization. The state board promptly raised the amount to $2,100,000. The company tendered taxes on the basis of the original assessment, which were refused. It now asks an injunction to restrain the county officials from proceeding to collect the taxes, and asks that the increased assessment be declared void.

The Fox River Valley Gas and Electric company has taken possession of the plant of the Appleton Gas Light company and of the Neenah and Menasha Gas and Electric company. The company will proceed to erect a power plant to furnish power for the local and interurban street-car lines and the Neenah and Kaukauna lines.

The Street Railway company of Duluth, Minn., will put in a loop at Lester Park, in order to handle the large double-truck cars.

The Citizens' Electric Light company has been formed at Jamestown, N. D., with $35,000 capital stock. L. B. Hanna of Fargo is president.

John Porter of Eldora, Iowa, is interested in a projected trolley line from Eldora to Des Moines, Iowa, by way of Zearing, Nevada and Cambridge.

The Electric Light company of Iowa City, Iowa, will soon install a day service for furnishing power.

Beloit, Wis., has granted a franchise to the Interurban Electric Railway company. The city of Janesville made a proposition to the Interurban Electric Railway company to grant a franchise and give a bonus of $5,000, if the company would build through that city and establish its power house there.

J. M. Saemann and P. Brickbauer are applicants for a franchise for an electric-railway line from Sheboygan, Wis., to Waldo, Plymouth and Elkhart Lake.

An electric-lighting and power plant is projected for Charter Oak, Iowa.

The council of Duluth, Minn., has contracted with the Commercial Light and Power company for street lighting for five years, at $55 per light per annum. This is $15 less than the present price.

The Fox River Valley Electric Railway company has renewed its request to the city of Kaukauna, Wis., for a franchise. The company has been refused a franchise twice, but it is understood that the present council is favorable to the project.

The Chandler-Dunbar Water Power company and the Edison Sault Electric company of Sault Ste. Marie, Mich., have arranged to enlarge the electric plant extensively. Work is to be started soon. The waterpower is at St. Mary's Falls, where 60,000 horsepower could be developed.

The German State Bank has secured control of the light and water plant at LeMars, Iowa, and will operate it in the future. H. H. Bush has managed the plant, as lessee, for a number of years past.

The street-railway company of Superior, Wis., is making arrangements for improving the East End line.

William Guenther and A. D. Johnson of Appleton, Wis., have secured the waterpower at Kilbourn, Wis. It is understood that a company will be formed for the transmission of electric power to Portage, Baraboo and Madison. The power is said to be the best in the state.

The General Electric company of Minneapolis has just completed the task of moving its electric-power plant, of 1,500 horsepower, into new quarters on Fifth street. The machinery was moved without interrupting the service. It required the services of 48 men. R.

PERSONAL.

Mr. Stephen L. Coles, who has been managing editor of the Electrical Review for the last 12 years, has associated himself with Mr. M. J. Shaughnessy of New York city in the business of preparing and publishing technical and trade literature and advertising.

It is reported that the engagement of Mr. Marconi and Miss Josephine Bowen Holman of Indianapolis is about to be announced. Miss Holman is the daughter of the late Judge J. A. Holman of the Indiana Supreme Court, and a cousin of the late Congressman W. S. Holman. It is said that the couple first met on board the steamship St. Paul in November, 1899, on the way to Europe. Miss Holman became interested in Mr. Marconi's wireless-telegraph experiments, and the two met afterward in Paris.

Mr. Clarence W. Whitney, associate editor of the Western Electrician, was united in marriage to Miss Margaret D. Mason of Ann Arbor, Mich., formerly of Muskegon, by the Rev. Henry Tatlock, at St. Andrew's Episcopal Church of Ann Arbor, at 8 p. m., on April 30th. The best man was Mr. Charles A. La Fever of Battle Creek, Mich., and the maid of honor was Miss Mary E. Bunker of Muskegon. An informal reception at the home of the bride's mother, Mrs. Jerome W. Mason, followed the ceremony at the church. Both Mr. and Mrs. Whitney are graduates of the University of Michigan and active in college-fraternity circles, the bride being the grand president of the Alpha Phi fraternity and the groom grand annotator of the Sigma Chi fraternity. Mr. Whitney's associates on the Western Electrician join with many other friends in Chicago and Michigan in extending all good wishes.

ELECTRIC LIGHTING.

The York Power and Light company of York, Neb., has increased its capital stock to $24,000.

The People's Electric company of Jermyn, Pa., has been incorporated, with $5,000 capital stock.

C. T. Bowen, an eastern capitalist, contemplates putting an electric-lighting plant in at Kendrick, Idaho.

The city of Allegheny, Pa., has issued $100,000 in bonds to provide for the installation of a lighting system.

The Southern Electric Light and Power company is erecting an electric-light plant at Rosebud, Texas.

Citizens of Lewes, Del., at a special election, voted to bond the town in order to establish an electric-light plant.

The Delaware City Light and Water company, Delaware City, Del., has been incorporated, with $12,500 capital stock.

J. H. McMahan is at the head of a party of local capitalists who will soon erect a new electric-lighting plant at Alma, Kan.

Bids will be received up to May 15th by W. N. McAnge at Suffolk, Va., for the erection of an electric-lighting plant there.

The Boise-Payette River Electric Power company has been organized at Boise, Idaho, by H. E. Neal, J. Spofford, J. C. Stout and E. Yanish.

The city of Independence, Mo., will hold an election on April 30th to vote on the question of issuing $30,000 in bonds to build an electric-light plant.

The Red Bluff Light and Power company of San Francisco, Cal., has been incorporated, with $75,000 capital, by W. L. Priest, E. I. Johnson and J. E. Ennis.

The Dodge Manufacturing company of Mishawaka, Ind., will soon let a contract for the installation of an extensive electric-light plant for its establishment.

The Ventura Water, Light and Power company of Los Angeles, Cal., has been incorporated, with a capital of $500,000, by J. H. Adams, T. W. Phillips and T. W. Brotherton.

The entire plant of the Egg Harbor Electric Light company, Egg Harbor, N. J., was destroyed by fire on April 23d. The loss was about $8,000. A new plant will soon be built.

The Pennsylvania Light, Heat and Power company of Allegheny, Pa., has been granted permission by the building inspector of Allegheny to erect a power house, to cost $15,000.

The Decatur (Ill.) Gas and Electric company will begin at once to make extensive improvements in both the gas and electric plants. About $15,000 will be expended in improvements.

The Grand Island (Neb.) Gas company will install an electric-lighting plant, in connection with its gas plant, this summer. H. G. Leavitt is president, and E. J. Whitson, electrician, of the company.

The city of Rock Hill, S. C., will hold an election to decide the issuance of $95,000 of bonds for purchasing the electric-light plant and waterworks of the Rock Hill Water, Light and Power company.

The Bloomfield Light, Power and Heat company of Bloomfield, Ind., has been incorporated, with an authorized capital stock of $10,000. The incorporators are E. H. Dugger, J. E. Meredith and W. B. Maddock.

The Cairo (Ill.) Daily Telegram is working up a plan of municipal ownership of electric light and power for that city, and would be pleased to hear from electric contractors and others who may be interested.

A new electric-light company has been incorporated at Niles, Ohio, with $20,000 capital stock, by W. A. Taylor, T. H. Wilson, R. Weiss and others. The company will take over the Niles Electric company's plant.

Bids will be received until May 9th for furnishing labor and material for a street-lighting plant at St. Joseph, Mich. The equipment will include a 125-light arc generator, with 120 arc lamps and material for about 11 miles of line, also a 100-horsepower gasoline engine. Blank forms and specifications may be obtained of the Board of Public Works, St. Joseph, Mich.

The East Jersey Light and Power company, Elizabeth, N. J., has been incorporated, with an authorized capital stock of $250,000. A. M. Reed, B. Franklin de Frece and G. Holmes are the incorporators.

The Water and Light company of Santa Fe, N. M., will begin at once to make extensive improvements in its system. The sum of $50,000 will be expended in extending the light wires, increasing the power of the plant, etc.

H. A. Taylor, assistant secretary of the Treasury Department, will open bids on May 16th for the installation of an electric-light and power plant, including engines, generators and switchboards, at the Postoffice building at Philadelphia.

The city of Tampa, Fla., is considering bids for lighting the city. It has received from the Tampa Electric company an offer for arc lights for all-night service at $120 a year each, on a five-year contract, and from the Tampa Gas company an offer of 313 or more gaslights, to be operated on the moonlight schedule, at $27 each, on a five-year contract.

The Wayne County Electric company, Lyons, N. Y., has been formed, with $100,000 capital stock, by the consolidation of the Lyons Electric Light and Power company with the Lux Electric Light, Heat and Power company of Clyde. The principal office will be at Lyons. The directors of the company are C. A. Lux, J. W. Putnam and J. W. Van Etten.

Conduit and wiring systems are to be installed for the postoffice buildings at Streator, Ill., and Annapolis, Md. Proposals for the installations will be received and opened at the office of James Knox Taylor, supervising architect, Treasury Department, Washington, for the former on May 15th and for the latter on May 20th. Specifications may be obtained at the same office.

The Citizens' Electric Light and Power company of Jamestown, N. D., has been incorporated, with $35,000 capital stock, by L. B. Hannah, G. Lutz, O. L. Churchill, T. Pettigrew and others. The company contemplates the purchase of the Jamestown Electric Light company's plant and will completely remodel and rebuild the same at an estimated cost of about $15,000.

The Interstate Power company of The Dalles, Ore., has been incorporated, to construct and operate an electric-light plant at the mouth of the Des Chutes River, for the purpose of generating and conducting electric power to points in Wasco and Sherman counties in Oregon, and Klickitat County, Wash., and to institute an electric-light system at The Dalles and other points. The Dalles will be the principal office of the company, and the incorporators are E. Kurtz, W. M. Moody, H. L. Kuck and others.

ELECTRIC RAILWAYS.

The Oklahoma Street Railway, Light, Power and Improvement company, Oklahoma City, Okla., has been incorporated.

Hon. J. D. Woods and others have decided to construct an electric railway from Sherman to Fairview, Texas, a distance of 10 miles.

The Beloit (Wis.) council has granted a 50-year franchise through the city to the Beloit, Delavan Lake and Janesville electric railway.

The construction of an electric railway between Mansfield, Ohio, and Crestline, Ohio, is being promoted by F. D. Carpenter and L. M. Coe.

The Boone Suburban Railway company of Boone, Iowa, has been incorporated, with $15,000 capital stock, by L. W. Reynolds and J. Reynolds.

The Columbus Light and Power company, Columbus, Miss., is considering the construction of a street-railway line in that city. H. J. Malochee of New Orleans is interested in the project.

The Reading, Fleetwood and Kutztown Railroad company of Reading, Pa., has been incorporated, with an authorized capital of $130,000. J. W. Shepp of Philadelphia is president of the company.

O. P. Eusley, A. M. Glossbrenner, H. A. Mansfield and F. W. Roberts of Indianapolis, Ind., are promoting an electric line as a part of the proposed system between Indianapolis and Logansport.

The Delaware General Electric company has mortgaged its property to the Knickerbocker Trust company of New York for $1,000,000, to provide funds for the construction of the Kent County trolley line.

The Louisville Railway company, Louisville, Ky., will make extensive improvements, including the enlargement of its power house, by the installation of a combined new engine and generator, to cost $125,000.

The Paulsboro Traction company, Paulsboro, N. J., has been incorporated, with an authorized capital stock of $1,000,000. The incorporators are Benjamin C. Paul, George C. Laws and George S. Tallman.

The Gainesville and Dahlonega Electric Railway company, Gainesville, Ga., has been organized by H. H. Dean, Z. T. Castleberry, D. E. Evans and

others, for the purpose of erecting a street railway from Gainesville to Dahlonega.

An electric line is to be built from Columbus, Ohio, to Mechanicsburg, Ohio. The Columbus, London and Springfield railway is securing the rights-of-way for a branch line from Summerford to Mechanicsburg. H. A. Fisher is manager.

The Leavenworth and Kansas City Railway company has asked the county commissioners of Lawrence County, S. D., for a 10-year right-of-way through that county for an electric railway, the construction of which will cost about $1,400,000.

The car barn of the Birmingham Street Railway, Light and Power company at Twenty-second street and Avenue F, Birmingham, Ala., was burned on April 17th, together with 25 cars. The total loss, which is largely covered by insurance, is estimated at $135,000.

The Lackawanna and Wyoming Valley Rapid Transit company, Scranton, Pa., has been incorporated by United States Senator M. S. Quay, W. Connell, C. C. Mattes and F. F. Penman. It is said that about $5,000,000 will be spent in erecting electric street railways.

The Youngstown-Sharon Railway company of Sharon, Pa., is securing the right-of-way for a street railway, to be built from Sharon to Greenville. The line will be 14 miles long and will connect at Sharpsville with the Valley railway, which is owned by the Penhale-Devitt syndicate.

The principal property of the North American company, the Milwaukee Electric Railway and Light company, reports for the year ended December 31, 1900, as follows: Gross earnings for 1900, $2,204,536; operating expenses, $1,129,787; net, $1,074,749; taxes, $87,451; balance, $987,298.

A concession has been granted to a Belgian company by the Spanish government to construct a double-track electric railway between the ports of Luz and Las Palmas in the island of Grand Canary, Canary Islands. The road will run along the seashore front and will be from four to five miles long.

It is expected that Colorado Springs, Denver and Pueblo will be joined by a trolley line, to cost $2,500,000. It will be built by Chicago, Detroit and Cleveland capitalists. C. W. Taylor, who represents the syndicate, has petitioned for a right-of-way over country roads. The main power house will be built at Colorado Springs.

The Troy, Rensselaer and Pittsfield Railroad company, Troy, N. Y., has been incorporated, with an authorized capital stock of $350,000, to operate a high-speed electric road, to be 35 miles long and to terminate in the cities of Troy and Rensselaer and at the boundary line between Massachusetts and New York, in the town of New Lebanon.

A recent consular report gives some details concerning the conversion of the street railways of Nottingham, England, to electric roads. The power house will contain 12 700-horsepower Willans-Siemens generating units. Fifty-seven double-decked cars have been contracted for, each equipped with two 25-horsepower motors, and capable of running eight miles an hour. The cars will cost about $3,000 each.

The Illinois street-railway bill, editorially summarized in the Western Electrician of December 29th last, which has been in the hands of the state Legislature of Illinois for some weeks, is reported as being practically dead, as it has been placed in the hands of a committee of the lower house, the members of which are believed to be against the passage of the bill. The measure provides for the ultimate municipal ownership of the street railways in Chicago.

The Homestake company of Lead, S. D., through T. J. Grier, the superintendent, has applied to the county commissioners for a franchise to build and operate an electric road through Lawrence County. The company intends to build its line to Sundance, Wyo., where it controls 7,500 acres of coal lands. It is the intention to establish a power plant for furnishing electric power for all of the machinery in Lawrence County, operate an electric standard-gauge road and open up the rich coal land.

The Metropolitan Street Railway company of Kansas City, Mo., has recently purchased the East Side electric railway in that city, popularly known as the Heim line. This gives the Metropolitan company a complete monopoly of the street railways in Kansas City. The company has purchased 14 acres of land in the eastern part of the city, upon which it proposes to erect new car shops to cost $150,000. It is reported also that the company will soon commence work upon a new power house to cost $1,000,000.

The electric railway connecting the port of Santa Cruz with the town of La Laguna in the Canary Islands was opened to the public on March 15th. It is an overhead-trolley system and is equipped with both passenger and freight cars. The latter are used principally for fruit, which is the main export from these islands. The line is 5.6 miles long. The concession for this line was granted at Madrid and includes the whole of the road between Santa Cruz and Orotava, a distance of 27 miles. A regular service of automobiles will run from the present terminus to the town of Orotava until the railway is completed. It is a Belgian company and has a capital of 1,600,000 francs ($308,800).

One of the difficulties in connection with the street-car service in Havana, says Mr. William M. Doull, the secretary-treasurer of the Cuban electric railway, of which Mr. A. F. Gault of Montreal is president, is the fact that they have no five-cent pieces to use. This has been overcome, but not satisfactorily. They have the peseta, which is equal to 15 cents, and for this piece of money three tickets are secured. Mr. Doull was in Havana when the first section of the street railway was opened for traffic, and he states that the success, in the way of traffic, was even better than was ever anticipated.

William Weinrich, Jr., of the United States Coast and Geodetic Survey, says that he has traversed the city of New Orleans from end to end, in all directions, and visited the outskirts, but found nowhere a spot to determine the declination, the dip and the intensity of the magnetic force. "New Orleans is truly well provided with electric railroads," he says. "The reputation the city bears of having the most complete trolley system in the world is well deserved. I can testify that the electric lines prevented me from fixing the line of magnetic variations —something I have never been prevented in determining in any other city of the country. The only suggestion I can make to the department in Washington is to establish a station on the government reserves along the lower river at one of the forts."

PUBLICATIONS.

A booklet illustrating Pemco, Peru, Creole, Stoddard and K. W. fuse rosettes has been issued by the Peru Electric Manufacturing company of Peru, Ind.

The Keystone Electrical Instrument company of Philadelphia has recently issued a creditable catalogue devoted to its electrical measuring instruments.

"A Few Installations" made by the Ball Engine company of Erie, Pa., are shown in a recent booklet, which contains some very clear illustrations of Ball engine plants in different parts of the country, including the company's exhibit at the Paris Exposition.

The Star Dynamo Works of Jefferson City, Mo., has recently issued a circular describing and illustrating the direct-current bipolar and multipolar dynamos and motors which the firm has been building for a number of years. In addition to manufacturing these machines the Star Works make a specialty of furnishing complete incandescent-lighting plants.

A neat 32-page booklet, issued by the Fort Wayne Electric Works of Fort Wayne, Ind., describes the company's direct-acting, shunt-feed, focusing and non-focusing series arc lamps. Besides illustrations of several different types of complete lamps, views are given of the essential parts of the lamp mechanism. A complete price-list of all the parts of the lamps is also given.

"The Gravity Dam, and Essays on the Fallacies, Problems and Philosophy of Dam Construction" is the title of an 80-page booklet, compiled by E. R. Beardsley, mechanical and hydraulic engineer. The book is issued by the Beardsley Gravity Dam and Construction company of Elkhart, Ind., which is prepared to construct any kind of hydraulic work, electric-light plants, docks, piers, etc. Besides explaining the merits of the gravity dam, the book contains a number of views of various types of dams, both old and new.

SOCIETIES AND SCHOOLS.

A. V. Abbott, chief engineer of the Chicago Telephone company, is scheduled to present a paper on "Experiments with High-frequency Electrical Oscillations" (illustrated with apparatus) before the Western Society of Engineers in Chicago on May 8th.

The joint annual meeting of the Old Time Telegraphers' association and the United States Military Telegraph Corps will be held at Montreal, Que., on September 11th, 12th and 13th. The convention headquarters for both associations will be at the Windsor Hotel.

The University of Vermont, Burlington, Vt., has issued a catalogue devoted to its four years' course in chemistry. An account of the object and scope of the course, a description of the courses, etc., are accompanied by some very good illustrations of the laboratories and different departments.

The American Institute of Mining Engineers will hold its eighty-first meeting at the City of Mexico, early in November, 1901. Theodore Dwight, assistant treasurer of the association, has undertaken to organize a party of a limited number of members and guests to go to Mexico by special train, starting about November 1st and returning about December 1st.

Kalamazoo College of Kalamazoo, Mich., an affiliated school of the University of Chicago, is to have a new science hall, to cost $50,000. The plans for the building have just been completed by Patton, Fisher & Miller of Chicago, and the contracts for the construction work will soon be let. Besides lecture and recitation rooms and a biological laboratory, there will be located in the building chemical and electrical laboratories and a general physical laboratory.

Since the announcement of the recent donation to Armour Institute of Technology, noticed in a recent issue of the Western Electrician, assurances have been given that whatever new buildings are required will be taken care of outside of the endowment fund of $1,000,000, which is to be reserved to provide an additional income. Following this announcement plans are being considered for two new buildings near the present structure, one to contain the shops and laboratories and the other to be devoted solely to engineering uses.

The annual catalogue of Purdue University, Lafayette, Ind., for the college year 1900-1901, has just been issued. It contains the usual amount of statistics and information relating to the university, its courses and methods of study, lists of faculty and students, etc. The total attendance for this year is 1,043. Accompanying the catalogue is a pamphlet giving several selected views of Purdue University, showing some of the principal buildings, campus scenes and portions of the different laboratories and shops.

The annual meeting of the Association of Railway Telegraph Superintendents will be held at Statler's Pan-American Hotel, Buffalo, N. Y., on June 19th, 20th and 21st, instead of in Boston, as originally announced. Indications point to a very successful meeting and a large attendance. One of the subjects likely to come up for discussion at the convention is simultaneous telegraphy and telephony. It is expected that a large display of exhibits will be made. P. W. Drew, superintendent of telegraph of the Wisconsin Central Railroad company, Milwaukee, Wis., is secretary and treasurer of the association.

ELECTRICAL SECURITIES.

The General Electric company has declared a regular semi-annual dividend of $3.50, payable August 1st to stock of record June 15th.

The Edison Electric Illuminating company of Boston has declared a quarterly dividend of 2½ per cent., payable May 1st to stock of record April 23d.

The stock of the Chicago Edison company developed considerable strength in the Chicago stock market last week. The shares advanced from 162 to 167 in one day on small sales. The Chicago Record-Herald, commenting on the advance, said: "The stock is in strong position on account of the expedition of a merging of the company with the Peoples' Gas Light and Coke company."

SPACE TELEGRAPHY.

A system of space telegraphy has been established on the coast of Corsica for a distance of 124 miles, masts 120 feet in height being employed.

A Berlin report announces that Emperor William is to make a personal investigation of Professor Slaby's system, the latter having been greatly improved recently.

Nikola Tesla has placed contracts with the Westinghouse Electric and Manufacturing company at Pittsburg for the construction of some of the apparatus with which he expects, it is said, to transmit messages across the Atlantic Ocean. He expects to be able to begin operations at his signaling station within six months.

The New England Wireless Telephone and Telegraph company has been incorporated as an operating sub-company of the parent company (the American Wireless Telephone and Telegraph company), to operate the wireless system in the New England states. The officers of the new organization are: President, James N. Huston of the Manhattan Steamship company of New York; secretary, Thomas B. Bishop; treasurer, F. D. H. Banks, president of the Imperial Portland Cement company. The authorized capitalization of the company is $5,000,000.

A dispatch from London to the New York Sun says that a deputation of the directors of the Marconi companies was received by the Marquis of Londonderry, postmaster-general, Friday, April 26th. The directors asked for a license for the transmission of wireless messages within territorial waters between ships and land stations; they also asked for a license in order to arrange for dealing with telegrams to and from foreign places and for land purposes. The marquis promised to consider the matter and consult the heads of the various departments concerned.

An automatic system of signals for the purpose of warning vessels in stormy weather against the proximity of reefs and rocks has been exhibited to German marine experts, according to a consular report. The automatic part of the apparatus is said to consist of a wheel with a number of cogs, arranged at suitable intervals, which slide over a Morse apparatus. The latter is connected with a ladder placed vertically on rising ground on shore or on a lighthouse. The electric waves emanating are taken up by receiving apparatus on vessels hav-

ing such within a radius of seven miles. A bell sounds and the receiver notes the spot against which vessels should be warned.

Owing to the number of companies advertising in America to sell stock in wireless-telegraph and telephone companies in which large dividends are promised, Mr. Marconi, before sailing for Europe, requested his counsel to cause the publication of a letter in which Mr. Marconi denies that he is associated in any way with any American company having for its object the development of wireless telegraphy in this country.

M. Tommasina is said to have discovered recently a new application of the coherer, whereby atmospheric electrical discharges or storms can be detected, even when these occur at great distances. An instrument called the electro-radiophone has been devised, with the assistance of the Italian scientist, Professor Boggio Lera. During his experiments Professor Lera observed a storm 12 hours before it passed over the point of observation. As the new apparatus is very simple and free from necessity of regulation, it is predicted that it will render great service in detecting the approach of storms, especially on shipboard.

POWER TRANSMISSION.

The Twin City Power company is to build a power plant on the Savannah River, near McCormick, Ga., to furnish power for neighboring towns. D. M. Mackaye of New York is at the head of the enterprise.

The Cape Fear Electric Power company, Farmville, N. C., has completed all financial arrangements, and before January next current will be transmitted to that city from Buckhorn Falls, 30 miles distant.

In obedience to the order of the secretary of war the flow of water in the Chicago Drainage Canal has been reduced from 300,000 to 200,000 cubic feet a minute. If the latter rate of flow is maintained it will seriously affect the prospect of utilizing the waterpower of the channel, as all existing calculations have presupposed a flow of 300,000 cubic feet.

The Great Falls Power company, which controls the rights and property at Great Falls, Md., will, it is reported, proceed with the work of establishing a system for utilizing the power of the Potomac River at Great Falls for the production of electricity. It is understood that this work will require an expenditure of $2,000,000. The offices of the company are at Washington, D. C.

A $50,000,000 steel and iron plant, to employ 10,000 men, is projected for Sault Ste. Marie, Mich. The plant will make use of some of the great waterpower to be developed from the falls of the St. Mary's River, and the enterprise is the greatest that has been mentioned in connection with that improvement. It is expected that the use of the waterpower will very materially reduce the price of steel.

A bill has passed the state Senate of Connecticut granting powers to the Consolidated Lake Superior Power company, a $20,000,000 corporation, of which Lynde Harrison of New Haven is president. The company is permitted to engage in owning and operating railroads, steamships, sailing vessels, express business, furnishing water and light, to buy and sell all kinds of stocks, bonds and securities, and it may do business in the United States and Canada.

MISCELLANEOUS.

Plans have been laid for the establishment of a permanent exposition of machinery and models in the city of Frankfort, Germany.

Mr. Yerkes was recently interviewed by a representative of an English periodical, and was asked: "To what do you attribute your success?" He answered: "To the fact that I have studied the subject thoroughly in every detail, surrounded myself with intelligent, hard-working men who were as willing to work as I, which means that they worked from seven in the morning till as late as necessary at night. From the moment I took up my life work I never strayed from the project, but concentrated every nerve and brain power upon the end I had in view. Whenever I benefited greatly by an enterprise I made it a rule to present the faithful half-dozen employes in immediate touch with me with a few hundred shares, with the advice to hold on to them. It is a pleasant as well as a profitable thing to reward fidelity."

TRADE NEWS.

The Illinois Insulated Wire company's principal office has been changed from Sycamore, Ill., to Chicago.

The Reynolds Electric company, Chicago, has been incorporated, with $2,500 capital stock, for the manufacture of electrical machinery, devices and supplies.

The Chicago Armature company has removed its office and works to its new plant at Blue Island, Ill., a suburb of Chicago. Improved facilities are now available.

A dispatch, dated April 25th, from Kenosha, Wis., to the Chicago Chronicle, says: "A $100,000 incorporated company, composed of well-known Chicago capitalists, has provisionally leased the Gottfredsen brewery on Milwaukee avenue, for the manufacture of electric dynamos of all descriptions. The parties interested have asked Mr. Gottfredsen not to give out the names until the deal is consumated."

Mr. Wylie Brown of the Bridgeport Brass company, New York, manufacturer of the well-known "Phono-electric" wire, was in Chicago this week, in the interests of his company. Mr. Brown states that the demand for "Phono-electric" wire was never as large as it is at the present time and that users of wire realize more and more the peculiar merits of the Bridgeport company's product. "Phono-electric" wire is used in some of the largest trolley, telephone and telegraph installations in the United States.

Bids for installing an electric elevator in the Patent Office at Washington were opened in the office of the chief clerk of the Department of the Interior on April 23d. The bidders were: Sprague Elevator company, New York; Ellithorpe Elevator Works, Chicago; Electron Manufacturing company, Springfield, Mass.; Marine Engine and Machine company, New York; Ohio Elevator company, New York, and the Baltimore Machine Works. The Ellithorpe company of Chicago was the lowest bidder, its bids being: On specification No. 1, $5,350; specification No. 2, $4,300; specification No. 3, $5,200; specification No. 4, $4,200.

BUSINESS.

Persons in the market for alternating-current wattmeters are requested to write to the Electric Appliance company, Chicago, and become informed regarding the Gutmann wattmeter.

W. N. Matthews & Bros. of St. Louis, general distributing agents for Stombaugh guy anchors, have recently made arrangements with all dealers in electrical and telephone supplies to handle their anchors. Their sales in April were four times as great as in March.

The Harris Machinery company, Minneapolis, Minn., announces that it has on hand a large stock of second-hand boilers, engines, pumps, pulleys, shafting, belting, etc., in first-class condition. The Harris company makes a specialty of handling this class of goods, and states that it guarantees everything to be as represented.

The Swarts Metal Refining company, Chicago, is doing a large business in its particular line—the refining of scrap-copper wire and other metal. This company has purchased scrap copper from most of the leading electric-light and railway companies in the United States, and has enabled managers of plants to realize on what might otherwise be a waste. The company states that it pays the highest market prices for scrap copper and other metals.

The new large machine shops being erected at Elizabethport, N. J., for the Central railroad of New Jersey, for which George Hill is consulting engineer, will be equipped exclusively with the well-known Lundell power apparatus manufactured by the Sprague Electric company. The equipment will consist of three 100-kilowatt generators of 240 volts and 250 revolutions per minute, direct-connected to Ball & Wood engines, and 75 motors of various sizes for driving the machine tools. The Lundell generators and motors have long been recognized as having a high degree of excellence in the qualities pertaining to efficiency, durability and mechanical construction. All of the motors and one generator are booked for delivery in June, and the other two generators will be delivered in July.

The Western Electrical Supply company of St. Louis reports that the success with which it has met in introducing its new G. I. flush push-button switches is extremely gratifying. It states that this switch is designed to obviate many of the difficulties encountered in other switches. The company's business in its lighting-supply department has never been better, and its salesmen report that business is opening up from all over the country in a most satisfactory manner. The Western company has also gotten out an electric time switch which is believed to be one of the best and most practical of its kind on the market. The switch is especially adapted for show windows, storerooms, advertising signs, etc., and it is claimed that by its use the cost of lighting will be reduced at least 75 per cent.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 23 1901.

672,445. Actuating Mechanism for Automatic Railway Appliances. Slaughter W. Huff, Baltimore, Md. Application filed January 17, 1898. Renewed September 12, 1900.

A signal system comprising the combination of a main signal, a supplemental signal included in a circuit having two breaks, one of which is closed by the main signal when standing at danger, and a setting arm for the main signal having a bridge plate which is moved into contact with the terminals of the other break by the act of setting.

672,449. Electrical Conductor. William A. Markey, Saginaw, Mich., assignor to Emmet T. Bowen, Saginaw, Mich. Application filed August 31, 1900.

A conductor comprising a porous body having silver distributed uniformly throughout its pores, and a second porous body having silver distributed non-uniformly throughout its pores.

672,451. Electric-light Vacuum Tube. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical company, New York, N. Y. Application filed March 26, 1898.

A vacuum-tube lamp is described, consisting of an exhausted hermetically sealed tube of glass or like material devoid of interior electrodes, and having its extremities roughened and electroplated with a conducting material.

672,452. Electric-light Apparatus. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical company, New York, N. Y. Application filed April 15, 1898.

An apparatus for generating electric waves, vibrations or disturbances suitable for producing light, Roentgen rays, or similar effects, is described. In combination with a circuit of induction there is a circuit-breaking wheel having two or more brushes or contacts arranged to break successively the circuit of induction momentarily and maintain it closed in the interims; also a discharge circuit common to the brushes, and vacuum-tube lamps in the discharge circuit. (See cut, next page.)

672,466. Adjusting Mechanism for Rolling Mills. Richard Wayland-Smith, New York, N. Y. Application filed October 1, 1900.

The combination with the main rolls and gauge rolls of electric means operatively connected with the gauge rolls for automatically adjusting the main rolls when the gauge rolls are actuated.

672,489. Supporting Device for Electric Lamps. Edwin J. McAllister, Almon D. Page and Louis C. Werner, Newark, N. J., assignors to William Farley Brewster, New York, N. Y. Application filed January 11, 1901.

A series of lamp sockets or receptacles adjustably connected by straps or bands of iron, each strap or band being looped at each end, the free ends being returned and bolted or pinned together and to the strap or band.

672,513. Electric Switch. James Reid, Jr., Watervliet, N. Y., assignor to Consolidated Carheating company, Albany, N. Y. Application filed January 28, 1899.

This patent comprises a snap switch, a switch arm pivoted upon a post, an upwardly projecting lug on the switch arm, two spring-actuated arms mounted on the post adapted to engage with the lug, a spring placed about the hubs of the arms, the ends of the spring being attached to the arms, respectively, a switch handle adapted to engage with the ends of the spring-actuated arms near their ends adjacent to the lug, so arranged that a movement of the switch handle will tend to move one of the spring-actuated arms and place the spring under tension, a resilient stop arranged to hold one of the spring-actuated arms until it is pressed out of engagement therewith by the other of the spring-actuated arms after the spring has received its maximum tension.

672,524. Amalgamator. Guglielmo Ghiglieri and James M. Schofield, Stockton, Cal. Application filed August 4, 1899.

Features of this amalgamator are a pendulating tray, with means for imparting a longitudinal and a transverse vibrating movement thereto, conductor strips fixed to and insulated from the tray, and a conductor connecting the strips with the negative of a source of electrical energy, a conductor connecting the tray with the positive of the source of electrical energy, and a series of amalgam rollers and aprons in electrical connection with the strips.

672,546. Telephone Metering System. Donald M. Bliss, Lowell, Mass., assignor to the Automatic Telephone Meter company of New Jersey. Application filed November 27, 1899.

An improvement in the art or method of measuring or recording telephone usage, which consists in superimposing on the line an inaudible pulsating or alternating current adapted to operate a recording instrument while conversation is being carried on.

672,563. Accumulator Battery. Pascal Marino, Brussels, Belgium. Application filed April 10, 1900.

The positive electrode consists of a lead plate and the negative one is made of a metallic plate which the electrolyte cannot attack; the combination with the electrodes of a frame of non-conducting material at each side of each of the plates, the frames being each filled with formed active mass, the plates being arranged horizontally, porous partitions made with pure peat tissue and wooden boards saturated with cold concentrated sulphuric acid, the plates and partitions being perforated and cylinders of non-conducting material provided with small central channels extending into the perforations so as to facilitate the free circulation of the electrolyte and to allow the escape of gas.

672,588. Electrical Switch. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction company, Utica, N. Y. Application filed December 4, 1900.

A spring clip made from a single piece of metal doubled upon itself, the loop forming a footpiece of double thickness from which the ends of the piece are bent at right angles, and extended parallel with each other and separated, having two perforations through the footpiece, one in the doubled part and the other in the single part between the separated ends.

672,597. Electric Arc Lamp. Albert De Puydt, Liege, Belgium. Application filed December 4, 1900.

The combination with carbon holders of an electromagnet, fixed supports engaging the ends of the core of the electromagnet to permit its oscillation, an actuator for the carbon holders rotatable about the electromagnet, and means for coupling the actuator and the electromagnet together.

672,601. Tapping Device for Electric Furnaces. Oscar Frölich, Steglitz, near Berlin, Germany. Application filed May 15, 1899.

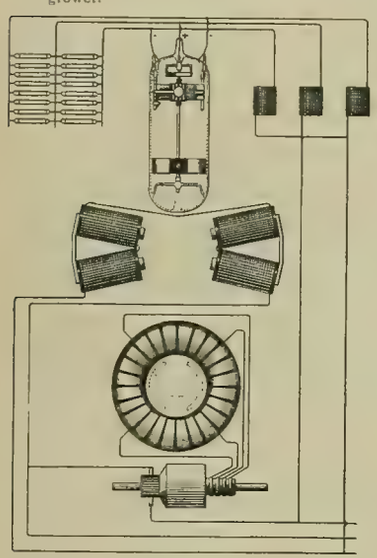
An electrical furnace having a tapping hole at its lowest point and a tapping arrangement consisting of an elbow-shaped piece of rigid tube, which is provided at its upper end with a hollow rim fitting the edge of the tapping hole, has means for heating the upper end of the elbow piece. An asbestos hose is fixed on to the lower end of the elbow piece and has means for lowering and raising the free end of the hose.

672,603. System of Electric Distribution. Albert S. Hubbard, Belleville, N. J., and Rufus N. Chamberlain, Depew, N. Y., assignors to the Gould Storage Battery company, New York, N. Y. Application filed March 13, 1901.

A main generator supplies current to the main line. There are also a storage battery, a switch for cutting cells in or out, a motor for shifting the switch, a coil arranged in series with the main generator and main line, a counteracting coil arranged in a shunt line across the main line, a variable resistance in the shunt line, and a generator which supplies current to the motor and has its field magnetically controlled by the counteracting coils.

672,607. Glower-supporting Plug for Electric Lamps. John Van Vleck and William N. Stevens, New York, N. Y. Application filed April 27, 1900.

In this device a cylindrical plug of insulating material has at one end a circular face. There is also a glower supported upon the plug in proximity to the face, and contact pieces on the plug are electrically connected to the glower.



NO. 672,452.

672,639. Conductor and Contact for Electrical Glow Lamps. Julian A. Halford, Bayswater, England, assignor to the Electric Lighting Boards, Limited, London, England. Application filed January 21, 1901.

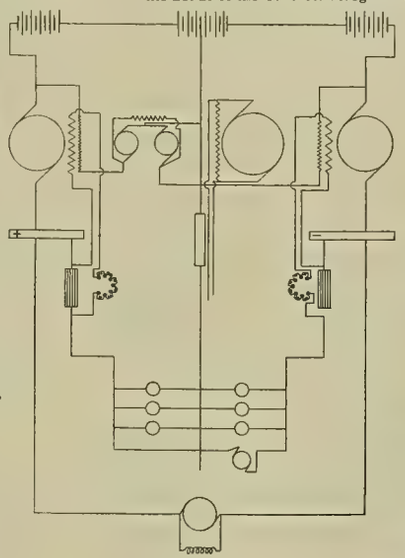
A support is provided with suitable grooves, with electrical conductors mounted therein. A lamp with spikes connected to it is adapted to penetrate the conductors. The lamp is adapted to engage in the groove connecting it to the support.

672,640. Automatic Booster in Connection with Multiple-wire Systems. John S. Highfield, St. Helens, England. Application filed February 2, 1901.

A three-wire electrical installation, supplied from an accumulator battery, is combined with a booster interposed between each terminal of the battery and the corresponding bus-bar, the booster having a double-coiled field magnet, of which one of the coils is of fine wire and connects the pole of the battery to which the booster is connected to the armature of an exciter driven at constant speed by an electric or other motor which also drives the booster. (See cut.)

672,642. Electric Incandescent Lamp. Louis J. P. Hollub and Henry Mignal, Paris, France. Application filed November 8, 1900.

A lamp having a T-shaped head is combined with a socket having a disk or diaphragm therein with a central opening to receive the head, which interlocks with the diaphragm when the parts are given a quarter turn, an insulating body arranged below the disk and contacts carried by the body, the heads of the contacts being substantially flush with the top of the body, whereby the T-shaped head is prevented from entering between the contacts and being broken when turned to interlock the parts.



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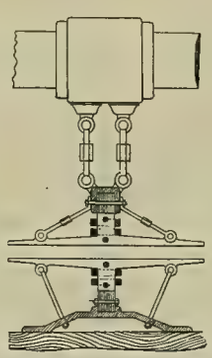


NO. 672,712.

672,653. Trolley for Electric-railway Cars. August Schneider, Lexington, Ky., assignor of one-half to Frederick R. Toe Water, Lexington, Ky. Application filed October 15, 1900.

A trolley-wheel support comprises a single integral metallic body substantially U-shaped and screwed at its base to the end of the trolley pole. A trolley wheel is journaled in the parallel arms of the support. The arms diverge from one another above the trolley wheel at an angle of substantially 90 degrees, and the divergent arms are deflected forward at an angle to the parallel arms.

672,662. Desk Telephone. Albert K. Andriano, San Francisco, Cal., assignor to the Automatic Interconnecting Telephone company, San Francisco, Cal. Application filed September 25, 1899. Renewed September 17, 1900.

A desk telephone combines a switch stand comprising a hollow base having slanting sides or faces constituting a receptacle for the switching mechanism and a hollow post forming a support for the receiver and the transmitter, stationary contacts beneath the slanting sides of the base in line with a guide slot therein, a movable contact cooperating with the stationary contacts and slidable along the slot from the outside, a slide carrying the movable contact, a ratchet bar engaging the slide to lock the same at any point in the length of the slot, a spring adapted to return the slide to the top of the slot when released from the ratchet bar and means actuated by the movement of the telephone hook on the post when the receiver is hung up to throw off the ratchet bar and release the slide.

672,665. Coin-controlled Electrotherapeutic Machine. Winfield S. Bosley, Chicago, Ill., assignor to the Mills Novelty company, Chicago, Ill. Application filed July 2, 1900.

A machine which combines a battery, a solenoid in the circuit thereof, two contact points in the circuit and normally out of engagement with each other, circuit-closing means engaging one of the contact points and projecting into the path of a coin, operating mechanism for moving the circuit-closing means, means for interlockingly connecting the circuit-closing means to the operating mechanism when the circuit-closing means is moved by a coin, and handles in the induction circuit of the solenoid.

672,712. System of Electrodynamic Propulsion. Leon Rosenfeld, Constantin Zelenay and Julien Dulait, Charleroi, Belgium. Application filed January 31, 1900.

An electric-traction system has polyphase currents, with no connection other than the sliding magnetic field between the induction element suspended on the vehicle and the inductor extending on the track; the inductor and the induced element are constructed respectively with pole-pieces in T form extended laterally in relation to the diameter of the magnetic core. (See cut.)

672,715. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor to the Waterbury Battery company, Waterbury, Conn. Application filed October 30, 1900.

A galvanic battery has a positive and negative element combined with an insulating column interposed between the two and resting upon the jar and having supports upon its inner sides upon which to rest one of the elements and similar supports upon the outer side to accommodate the other element. (See cut.)

672,741. Electric-railway Trolley. Charles H. Myers, Buffalo, N. Y. Application filed November 30, 1897. Renewed September 8, 1900.

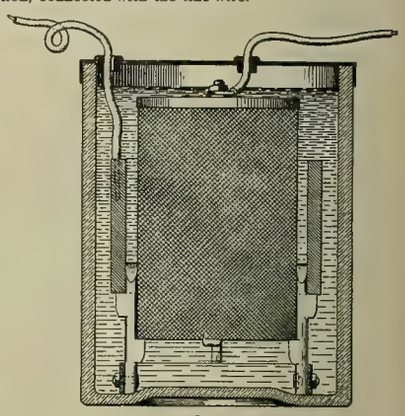
A trolley comprising a fork having its members electrically insulated from each other and bifurcated, contact wheels journaled in the bifurcations of the fork members, in combination with a wheel of insulating material journaled in the crotch formed between the fork members.

672,770. Electric Arc Lamp. Charles Holmok and Julius Holmok, Cleveland, Ohio. Application filed January 21, 1901.

A magnetic circuit comprises a magnet space and pole endings therefor, the magnetic circuit being magnetically discontinuous between the magnet core and one of the pole endings, and an armature adapted to span such discontinuous portion of the magnetic circuit in combination with a non-permeable, arc-striking limit stop adjustably secured upon the armature.

672,830. Railway Signal System. William W. Hoffman and Francis W. Powers, West Lafayette, Ind. Application filed June 6, 1900.

In a railway-signal system the combination with a main-line wire, a car in constant electrical connection with the main-line wire, and terminal stations at the end of the line wire. For intermediate stations a rheostat is provided having both ends of the line wire connected therewith and receiving instruments connected in multiple with the rheostat. A switch is connected with one end of the line wire and adapted to connect with either of the wires from the receiving instruments; also a switch connecting the receiving instruments with the ground, an electric generator, and sending instruments at the intermediate station, connected with the line wire.



NO. 672,715.

672,621. Telephone Transmitter. Charles C. Hughes, Baltimore, Md. Application filed April 14, 1900.

Enumerated as features of this transmitter are a diaphragm, an electrode operably connected with the diaphragm and a second electrode in operative relation to the first electrode to conduct current thereto. One of the electrodes has a curvilinear slot presenting a concave wall and a convex wall, and in which slot the other electrode is engaged for movement over a wall toward and away from the bottom of the slot. The second electrode has a curvilinear surface, and the different arcs of contact between the electrodes have different radii whereby the second electrode may engage a convex and a concave wall when moved inwardly to its limit and may be forced therebetween with an increase in area of contact surface.

672,626. Railway Signal. Jonathan D. Price, Aurora, Ill., assignor to the Miller Signal company, Chicago, Ill. Application filed April 11, 1900.

A track is divided into blocks and has insulated track-rail sections. A local source of energy is connected with two insulated sections near a division between blocks, one of the last-named sections being in advance of the other. There is also a circuit-maker and breaker for the partial circuit thus formed, a source of electric energy connected with both track rails near the advance end of the advance block, and automatic means connected with the last-named block and with the circuit-maker for closing the same when the block is clear and opening the same when the block is obstructed.

672,629. Telautograph. George S. Tiffany, Highland Park, Ill., assignor to the Gray National Telautograph company, Richmond, Va. Application filed August 26, 1898.

A telautograph combining a transmitting pen, means for transmuting the movements in extent of the transmitting pen into pulsations of high electromotive force, means for transmitting changes in the direction of movement of the transmitting pen into changes of condition in a current of low electromotive force, a receiving-pen mechanism for moving the receiving pen step by step, mechanism for effecting reversal in direction of movement of the receiving pen, and circuits at the receiver arranged so that selectively by inductive effect the high-tension impulses shall control the mechanism moving the receiving pen and the low-tension current shall control the mechanism effecting the reversal in direction of movement of the receiving pen.

672,630. Telautograph. George S. Tiffany, New York, N. Y., assignor to the Gray National Telautograph company, New York, N. Y. Application filed November 22, 1900.

A telautographic instrument having a writing pen, a pad for receiving the point of the pen when the pen is in its position of rest, having a flexible elastic surface adapted to conform to the point of the pen and seal the orifice thereof.

672,631. Telautograph. George S. Tiffany, New York, N. Y., assignor to the Gray National Telautograph company, New York, N. Y. Application filed November 22, 1900.

A telegraphic transmitting instrument having a transmitting pen is combined with an alarm circuit, and has means whereby break in the alarm circuit is closed when the transmitting pen is in the position of rest.

672,831. Trolley. William W. Hoffman and Francis W. Powers, West Lafayette, Ind. Application filed October 1, 1900.

A trolley, in combination with a trolley pole, has a frame mounted to turn on the pole. A second frame is pivoted beneath the first frame, and a trolley wheel journaled in the second frame and projecting through the first frame has means for holding the trolley wheel against the wire.

672,841. Electric Mallet or Hammer. Charles D. Olsen, Denver, Colo. Application filed January 18, 1900.

The combination of a hammer, held in suspense by a spiral spring, with a, small spiral spring attached to the upper end of the hammer and holding a weight and contact in suspense.

672,851. Electrical Transmission of Motion for Steering Ships or for Other Purposes. Harry A. Spiller, Boston, Mass., assignor to the General Electric company, Schenectady, N. Y. Application filed October 30, 1891.

An electric motor has a shaft mechanically connected thereto. A circuit-interrupting switch is connected to the shaft, and means are provided for determining at will the extent of movement of the motor and shaft from either one of a plurality of selected points.

672,875. Sparking Igniter for Explosive Engines. Abraham Bath, New York, N. Y., assignor to the Safety Three-wheel Vehicle company, New York, N. Y. Application filed February 17, 1900.

A sparking device for motors comprises a core, a thimble-shaped terminal mounted on the inner end thereof having a serrated edge, a bolt passing through the core and securing the terminal thereto, a second terminal surrounding the core intermediate of the ends thereof, and suitable electrical connections with the terminals.

672,877. Electric-lighting System for Railway Cars. James W. Guillott, Chicago, Ill., assignor to George W. Cass, trustee, Chicago, Ill. Application filed May 15, 1896.

An electric generating system for moving bodies comprises a wind-operated motor located on the moving body, so as to be operated by the movement thereof. The motor is placed in front of an exposed surface against which the wind normally strikes when the body is in motion. A dynamo-electric machine is operatively connected with the motor so as to be driven thereby, and one or more translating devices on the moving body are electrically connected with the dynamo-electric machine.

672,878. Electric-lighting System for Railway Trains. James W. Guillott, Chicago, Ill., assignor to George W. Cass, trustee, Chicago, Ill. Application filed July 20, 1896.

This device for developing electricity in connection with moving trains combines an electric generator with means for driving the same from the axle or wheel of the car, and a fan responsive to the speed of rotation of the driving part and adapted to regulate the speed of the generator.

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Lacombe Central Station in Denver.

On April 1st the machinery in the new central-station plant of the Lacombe Electric company in Denver, Colo., was set in motion, and the throbbings of the steam engines announced the successful launching of an enterprise that has required undoubted qualities of patience, courage and ambition.

The old electric-lighting company in Denver has enjoyed a monopoly in the lighting field since Denver first had an electric-lighting plant, and it had become the opinion of the average citizen that for a new company to get a franchise through the Denver council would be the next thing to an impossibility. However, Mr. C. F. Lacombe quietly set to work, perfected an organization and gathered about him a force of competent and trusty lieutenants. An application for franchise was submitted to the council at the proper time. It was allowed and followed up by a 10-year contract for street lighting at a price of $90 for each 2,000-candlepower arc light per annum. Orders were immediately placed for complete equipment.

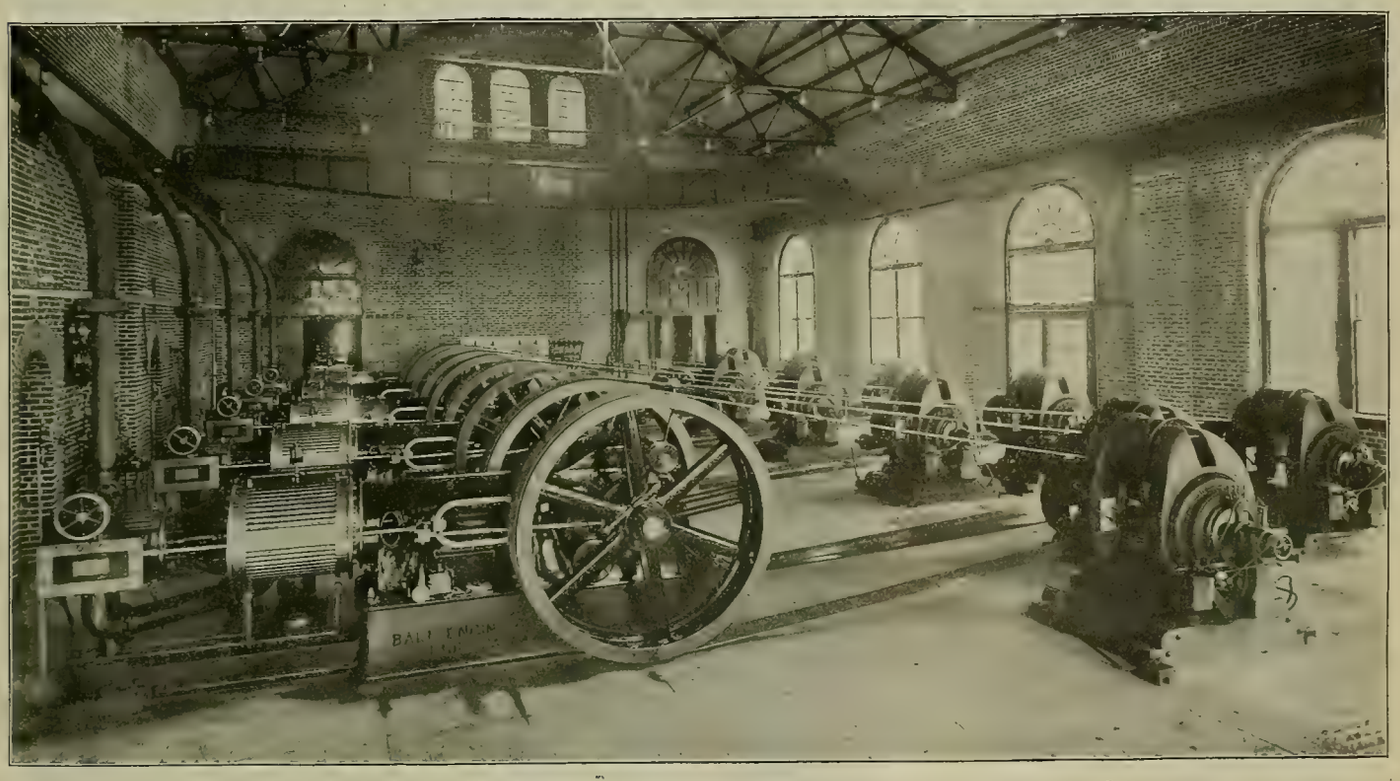


FIG. 1. LACOMBE CENTRAL STATION IN DENVER.—ARC-LIGHTING DEPARTMENT.

The main station, illustrated in Fig. 2, on the next page, has been located on a well-selected site in West Denver, on the Platte River, the location affording an abundance of water for the condensers as well as trackage facilities. The station is divided into two separate departments, one being for arc equipment and the other for commercial lighting. The arc building is a substantial structure, 106 by 58 feet, of pressed brick, with steel trusses and corrugated-iron roof. It is well lighted and ventilated and is provided with a wire tower, from which the main feeders are taken out, and a 10-ton Whiting traveling crane. Allowance has been made for an increase in capacity of the plant.

In the arc-lighting station there are installed five separate belted units, which provide energy for 1,250 2,000-candlepower arc lights for lighting the streets of Denver. The five engines are each 12 by 22 by 18-inch Ball horizontal, heavy-duty, internal self-oiling, tandem-compound, condensing machines, with extended sub-base under cylinders and divided heads, and were furnished by Duncan Bond of Denver, Colo., representing the Ball Engine company of Erie, Pa. Each engine is built to develop 250 horsepower at 200 revolutions with 150 pounds steam at the throttle and 21-inch vacuum, with a maximum rating of 300 horsepower. These engines are belted to type F Western Electric arc dynamos, furnished by the Western Electric company of Chicago, each engine being belted to two dynamos, as indicated in Fig. 1.

A 14-foot pit has been provided in an out-of-the-way corner of the engine room. In this pit there has been placed a Wheeler condenser, equipped with independent air and circulating steam-driven pumps. The circulating pump is of the centrifugal type and the air pump of the Wheeler valveless suction type. A pair of oil pumps, made by the Siegrist Lubricator company of St. Louis, supplies lubrication oil to the engine cylinders. The switchboards and gauge boards are of marble and have been made a special feature. The dynamo leads to the bus-bars are enclosed in one-half-inch rubber hose and laid in conduits under the cement floor.

The boiler room (Fig. 3), from which steam is furnished for both arc and commercial engines, is 94 by 46 feet, of the same construction as the arc building and running parallel to the latter, the floor, however, being six feet below the engine rooms. In this room a battery of three Heine safety-tube boilers is located, each boiler having a capacity of 375 horsepower. These boilers, together with two more of the same type for commercial engines, were furnished by the Stearns-Roger Manufacturing company of Denver, Colo.

Water is taken from the Platte River, through a perforated conduit, laid in gravel, to a well 20 feet in diameter, eight feet below the bottom of the river. A 10-inch pipe supplies water from this well to the various pumps. The boiler-feed pumps consist of two of the Buffalo make, each having 10 by 6 by 10-inch cylinders and outside-packed plungers. A 5 by 6 by 10-inch Union steam pump elevates the water from the well into a 12,000-gallon tank. This permits the water to settle before it is taken into boilers. The feed-water heater is a 1,000-horsepower horizontal Wainwright heater. A hot well, provided with filter, is located in the boiler room beside the feed pumps. The induced-draft equipment was furnished by the American Blower company, and consists of two fans, each 110 inches in diameter, driven by two direct-connected engines. One of these fans is intended for reserve.

A 5 by 5 by 6-inch Union steam air pump, located in the boiler room, forces air into a 3 by 6-foot receiver. This air is then piped to all of the generators, and is successfully employed in blowing dust out of these machines.

All high-pressure mains, both for steam and water, are extra heavy, to stand a working pressure of 165 pounds' gauge pressure. Between each boiler and the main there has been placed a Webster high-pressure steam separator, the drips from which are conducted to a trap which discharges into the hot well. On each end of the steam main there has been placed a T, with a short length of pipe, to form a pocket for condensation, which drains into separate trap, thence into hot well. Each boiler is tapped to receive 1½-inch pipe, which is connected to a three-inch main; this in turn is cross-connected at the feed pumps and the draft engines with the main steam pipes, and is used as an auxiliary steam pipe.

There are three exhaust mains, one leading from the main engines to the condenser, one from the main engines to the atmosphere and one from the auxiliary engines and pumps to the heater, and thence to the atmosphere. The exhaust pipes from the main engines branch into two pipes at the engines, one branching into the vacuum pipe and the other to the atmosphere. The suction pipes of the boiler-feed pumps are connected to the hot well, the water-supply tank, the water intake and the bottom of the condenser and pump pits. The pipes and valves are so arranged that each of the boiler-feed pumps can pump from the places mentioned separately and without interfering with each other. All expansion in all pipes has been allowed for by right-angle turns of proper extent. C. J. Reilly of Denver, Colo., furnished all pipe and fittings and placed the piping in position.

The commercial light and power plant is installed in a substantial building, 60 by 100 feet, adjoining the other station buildings, and consists of two 500-horsepower E. P. Allis cross-compound, condensing, Corliss engines, each direct-connected to a 375-kilowatt, two-phase Westinghouse generator. One of these units is shown in Fig. 4. These engines are furnished steam from two 375-horsepower Heine type M-16 boilers, located in boiler room, as described above. The present indications are that the commercial plant will be increased in capacity at an early date.

C. M. Einfeldt of Denver, Colo., was employed as consulting engineer. He has had the entire

responsibility of designing the station and selecting the necessary equipment. His work on the very complete installation of the Lacombe company speaks for itself.

The entire pole line is constructed in a substantial manner and is a credit to the company. The poles were obtained in the state of Washington, and are by far the finest lot ever brought to Denver, some of them being 80 feet long with 10-inch tops and straight as an arrow. Four men with a team and traveling derrick placed the poles in position quickly and with little effort. The circuits represent something over 250 miles of wire, which is entirely placed above all other wires in the city. This removes possibility of interruption of service by other wires falling down on the Lacombe wires. In the downtown business district iron poles have been adopted, from which the street arc lamps are suspended by means of ornamental mast-arms. In the residence districts the arc lamps are suspended by means of steel mast-arms, bolted to wooden poles. The arc lamps are of the latest improved open type made by the Western Electric company and consume 50 watts each. The pole line was constructed under the supervision of John Brannan, superintendent of the Lacombe company, and reflects credit on his ability in this direction.

FIG. 2. LACOMBE CENTRAL STATION IN DENVER.—POWER STATION.

M. L. Stern, who for a number of years was connected with the old electric company in Denver and also served in the capacity of city electrician for several years, has rendered much assistance to the Lacombe company in the successful completion of its plant as assistant general manager.

It is stated that the Lacombe company has ample funds at its command and that its service will be second to none. The entire equipment has been selected with the greatest care in view of procuring quality, rather than low cost. The new company has the good will of the Denver public, it is said, and anticipates a successful career.

Nernst Lamps at the Pan-American Exposition.

One of the prettiest pieces of decoration in connection with the interior of the Pan-American Exposition buildings is that in the grand dome of the Electricity building. The colors of the decorations in this beautiful structure are cream, light green and heliotrope. Tarlatan drapery is the material used, and high up in the dome, right over the Westinghouse exhibit, a canopy top is formed, the drapery stretching out in graceful form to all sides from a common center. Midway between the floor and the top of the dome four large signs of the Westinghouse company are placed, one on each side of the square occupied by the company's exhibit. In these signs there is a total of nearly 1,000 incandescent lamps.

It is especially interesting to note that the dome of the Electricity building is to be lighted by Nernst lamps. There are about 100 of these new lamps, representing, approximately, about 45,000 candlepower. These lamps are of great interest to electrical men, and all who visit the Electricity building should take pains to see them. It is said that one feature of the light of the Nernst lamp is that it does not change color values and thus is of especial value as a part of variegated decoration schemes to be shown at night.

The Westmoreland Electric company of Greensburg, Pa., is improving and enlarging its plant.

Rate War Predicted in Denver.

The following rate schedule of the Denver Gas and Electric company, which is dated April 1st, is interesting in two respects—it gives a practical illustration of Mr. H. L. Doherty's ideas of rate charging, about which there has been considerable discussion at recent electrical conventions, and it predicts a "long-continued rate war" in Denver:

To Consumers of Current for Incandescent Lighting:
$12.00 fixed charge per year per consumer, plus
1.80 fixed charge per year per 16 C. P. connected lamp, plus
.05 per kilowatt-hour for current used.

To Consumers of Current for Power Purposes:
$12.00 fixed charge per year per consumer, plus
24.00 fixed charge per year, connected H. P., plus
.03 per kilowatt-hour for current used.

To Consumers of Current for Series Arc Lighting:

3:30 P. M. to 6:30 P. M.	$ 66.00 per year.
Dusk to 10 o'clock P. M.	72.00 per year.
Dusk to 12 o'clock P. M	90.00 per year.
Dusk to Daylight (All Night)	144.00 per year.

Unless some different division is desired by the consumer one-twelfth of the fixed yearly charge for "readiness to serve" will be payable before the 10th of each month, together with the current used during the preceding month.

As our first move to meet threatened competition, we will make a reduction of 50 per cent. on the bills of all consumers purchasing current under the above schedule of rates.

Consumers who do not wish to purchase current under this rate system will be supplied at the rate of 20 cents per kilowatt-hour, with a minimum charge of $1.50 per month.

A discount of 10 per cent. will be allowed on all bills paid at our office on or before the 10th of each month succeeding that month in which the current was consumed.

Application of this rate schedule to consumers who would be unfavorably affected by it will be deferred until August 1st to enable them to obtain service from our competitors.

The future policy of this company will be to treat all consumers alike, no matter how large or how small, and regardless of their location. All further reductions in our rates will be published and will be open for acceptance to all consumers.

Lamp renewals will be made free, and our uniformed employes will visit your premises at frequent, periodical intervals for this purpose.

Our office is and will be open for the transaction of business until 12 o'clock every night except Sunday, and "emergency men" are and will be kept on duty at our office at all hours of the day and night and every night in the year, to repair promptly any trouble, causing interruption or unsatisfactory service.

After May 1st, all incandescent and power circuits will be energized continuously throughout the 24 hours of the day.

We advise all consumers to be prepared to get full benefit of a long-continued rate war and to sign no contracts to exceed one year and then only with proper safeguards which will enable them to get the benefit of further reductions and to be canceled at the option of the consumer. To those who remember the old water fight, this advice is superfluous.

Propositions for service under this rate schedule will be sent out after April 10th, but will be made to take effect April 1st.

The Denver Republican of April 30th says: "Judge Palmer yesterday rendered his opinion in the suit brought by Perry L. Hubbard against the city of Denver and the Lacombe Electric Lighting company, to restrain the defendants from entering into a 10 years' contract to supply the city with 1,000 arc lights for $90 a year a light. The plaintiffs contended that, under the charter, the city could not enter into a contract for which no appropriation had been passed to cover all the indebtedness implied in the contract. The effect of the decision is to make inoperative the contract between the city and the Lacombe company until the suit is finally determined in the Court of Appeals. The decision does not involve the validity of the franchise granted the new company, but only the contract between the city and the company. The Lacombe company is still empowered to operate its commercial plant and furnish light to private consumers."

Electric Railways in New Hampshire.

The report of the railroad commissioners of the state of New Hampshire just issued shows that, with the exception of 52 miles of the Grand Trunk railway, all of the steam roads of the state are under the control of one corporation, the Boston and Maine Railroad company. Regarding electric roads, it says:

The Legislature of 1899 granted charters for eight electric street roads, and as many more unused ones granted by the preceding Legislatures are alive, but not a rod of road has been produced by the corporations thus created. Nevertheless, street-railway development has proceeded under the general laws of 1895, and there have been material additions to the total mileage reported. The most important of these, because it was an experiment, out of which there promises to come most of the construction of the future, was the building by the Boston and Maine company of an electric line in the streets of Portsmouth and through the towns of Rye and North Hampton to a connection with the Exeter, Hampton and Amesbury—a distance of 16½ miles. This road parallels the steam tracks of the Boston and Maine, and its success as a dividend earner was very problematic. Its business has greatly exceeded expectations, and the line will be extended to Newcastle this spring. The Nashua road has been leased for a long term to the Lowell and Suburban. The Boston and Maine contemplates changing its Portsmouth and Dover branch for electric operation. The Exeter, Hampton and Amesbury has now 22 miles of track. A new road has been constructed in Keene. Statistics of mileage and liabilities are as follows:

	Miles.	Amt. Stock and Debts.
Chester and Derry	7.75	$100,000
Concord	12.05	216,000
Exeter, Hampton and Amesbury	22.20	437,000
Laconia	8.56	191,000
Manchester	21.70	629,000
Nashua	13.98	400,000
Union	7.20	239,000
Springfield	1.50	12,000
Portsmouth	16.50	387,735
	111.24	$2,612,735

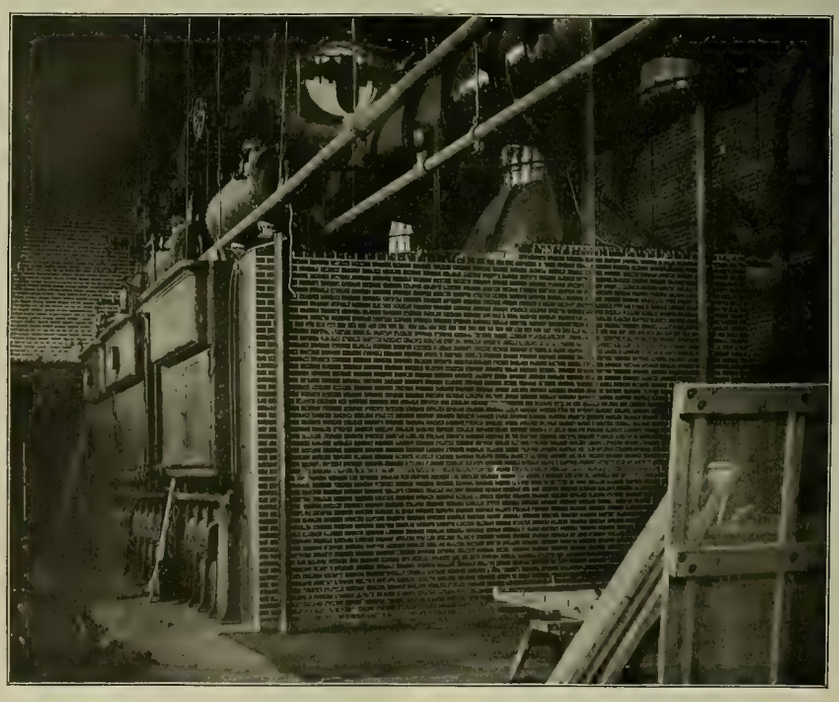


FIG. 3. LACOMBE CENTRAL STATION IN DENVER —BOILER ROOM.

Canadian Power Development at Niagara.

It is announced by the Niagara Falls Power company that it will at once begin the development of the power of the Horseshoe Fall on the Canadian side at Niagara under the franchise or charter of the Canadian Niagara Power company, which it controls.

The contract for the shaft has been awarded to Anthony C. Douglass of Niagara Falls. Mr. Douglass recently completed the shaft and tunnel extension in connection with the new wheel-pit at Niagara Falls, N. Y., and he has made arrangements for the installation of his plant on the Canadian side. Work will be commenced at once. In fact, by the time this article is read the first sod will have been turned.

The plans call for an initial development of 35,000 horsepower, and this force can be used only outside the limits of beautiful Victoria Free Park. It is expected that much of the developed power will be used in the building up of great industries on the Canadian side at Niagara very similar to what has already taken place on the New York side. The expectation is that 10,000 horsepower will be transmitted to Toronto, which has long been hopeful of being benefited by the coming of the transmitted force of the Horseshoe. A suitable amount of power, probably 10,000 horsepower, will be held in reserve for the Niagara Falls Power company and its uses on the New York side. An additional development will be made as the requirement presents itself.

The work will commence with the construction of an inlet canal situated at the head of Cedar Island and leading to the site of the power house, which will be at the foot of the high bank west of the head of Cedar Island. It will be at this point that the wheel-pit will be located, and this will have a capacity of 100,000 horsepower. The water from this tunnel will discharge at the foot of the Horseshoe Fall. It is the purpose of the construction to develop a head similar to that in use on the New York side, and it is understood that the details of the construction on the New York side, as well as the details of the machinery, both dynamos and turbines, in use there will also be followed.

The Niagara Falls Power company will finance and manage the undertaking in harmony with the development on the New York side. The Canadian power house will be connected with the two power houses of the Niagara Falls Power company on the New York side by cables, so that all customers using Niagara power on the Canadian side or the New York side will have the benefit of the force of the other power houses should necessity require an exchange of current service. This gives full assurance of an interrupted supply, a fact of great importance where a city's street-car or lighting service depends upon the transmitted energy.

The original agreement between the commissioners of Queen Victoria Niagara Falls Free Park and the Canadian Niagara Power company was signed April 7, 1892, and it remained in force until July 15, 1899, when a new agreement was made. Under the provisions of the first agreement, the Canadian Niagara Power company held the exclusive right to the development of power in the Victoria Park. With the advent of the Ontario Power company, or just previous thereto, the Canadian Niagara Power company showed a willingness to give up the exclusive right, and a new agreement was made. Under this later agreement the Canadian Niagara Power company is given until July 1, 1903, to have 10,000 developed horsepower ready for use, supply and transmission, and also to have water connection made for 25,000 horsepower.

The rental for the first 10 years under the original agreement was to have been $25,000 per annum, and during the second 10 years it was to increase $1,000 annually until it had reached $35,000, at which sum it was to continue if the company desired a renewal of the permit. Under the new agreement the terms of rental were so amended by providing that from and after May 1, 1899, the rent payable up to May 1, 1949, shall be $15,000 per annum, and in addition thereto payment at the rate of $1 per annum for each electrical horsepower generated and used and sold or disposed of over 10,000 electrical horsepower up to 20,000 electrical horsepower, and the further sum of 75 cents per horsepower over 20,000 horsepower up to 30,000 horsepower, and the further payment of 50 cents for each electrical horsepower over 30,000 horsepower, which is to say, by way of example, that on generation and use and sale or disposal of 30,000 electrical horsepower the gross rental shall be $32,500 per annum, payable half-yearly. These rates are to apply for power used or supplied in the United States or Canada. Within 10 days of the first day of May and November the company is to furnish the commissioners a verified statement of the power generated and sold.

After May 1, 1949, the same rentals are to continue unless the lieutenant-governor in council shall desire a readjustment, in which case a readjustment shall take place for a further period of 20 years, and if the parties cannot agree the matter shall be arbitrated. The commissioners on their part agree not to compete in the development of power, but should they grant privileges to other parties who shall fail to keep their agreement, and the commissioners be forced to take over the plant, then the agreement in question will not prevent them from operating such works. The commissioners agree not to allow any other company cheaper rental for similar privileges. The Canadian Niagara Power company agrees not to amalgamate with any other company heretofore or hereafter incorporated under the laws of the Dominion without the consent of the lieutenant-governor in council.

The fact that the Canadian Niagara Power company will at once break ground will enable it to complete its work in two years.

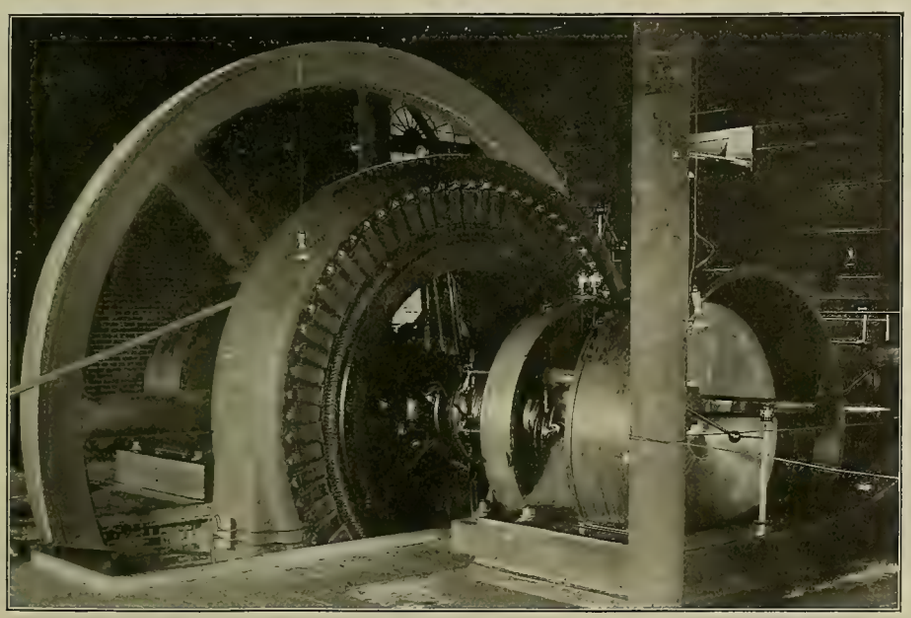


FIG. 4. LACOMBE CENTRAL STATION IN DENVER.—A COMMERCIAL-LIGHTING UNIT.

Large Motor Contract.

The contract for the electrical equipment of the elevated cars for the Manhattan Railway company of New York city was placed last week with the General Electric company. The amount of the order is said to be approximately $3,000,000. Included in the contract are the furnishing of 1,600 100-horsepower motors and the equipment of the rolling stock with the system of train control recently perfected by the General Electric company. There will be 800 motor cars, each provided with two motors, and 400 trailers. The trains will consist of six cars, as a rule, four of which will be motor cars and two trailers. By the controlling system the train can be controlled from either end or from any car, no matter what the size of the train. The contract calls for the delivery of the order within a year and a half, and the first delivery is to be made in about four months. This is believed to be the largest contract for electric motors ever awarded. Some time ago the Westinghouse Electric and Manufacturing company secured the first large contracts for the power station and generating machinery of the Manhattan company, involving about $2,000,000. By this division of the contracts the Manhattan Railway company is getting more expeditious service by having the plants of two large companies at work in its behalf.

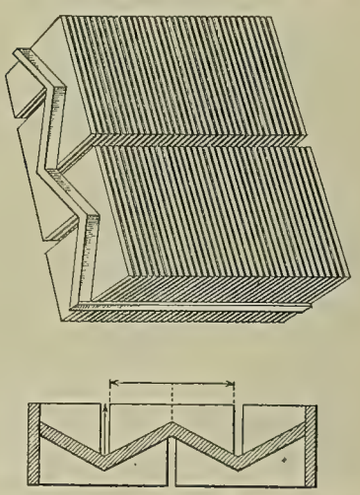
New Planté Battery Plate.

The new storage battery known as the "Omega," invented by Dr. Lehmann and manufactured in Germany, has an electrode of peculiar construction which makes it easily suitable for stationary batteries for light and power and also for railway batteries. This electrode, which is described in a recent issue of the Centralblatt für Accumulatoren und Elementenkunde, can only be used as a positive electrode and is a so-called large surface plate. The plates are provided on both sides with ribs or projecting flaps, and have their cores formed in waves or zig-zag shape.

The construction of the plate is illustrated in Figs. 1 and 2. For practical use the zig-zag shape is preferred for the core, and on it are placed on each side triangular blades, side by side, a short distance apart, which hang together on the point of a prong, while on the deepest part of the core, on the other surface opposite this spike, a groove is provided whereby each blade can expand freely in all directions. The shape of the core guarantees an extraordinary power of resistance in the plate against impressions and bucklings. The construction has the further advantage that a large active surface is obtained which is about 17 times as large as the projection surface of the plate. The manner of arranging the blades further assures a good circulation of the electrolyte. In the most serviceable form of construction the plate is 22 centimeters (8.66 inches) broad, 27 centimeters (10.63 inches) high, and 14 centimeters (5.5 inches) thick, and the weight of such a plate amounts to about five kilograms (11 pounds).

With a discharge current of 30 amperes the capacity of a positive plate between two negatives was determined by the Société Internationale des Electriciens at the Laboratoire Central d'Electricité at 32.9 ampere-hours with an initial potential of two volts and a final potential of 1.75 volts. Further measurements yielded a capacity of 25 ampere-hours with a discharge of 100 amperes and a fall of potential to 1.7 volts. After continuous charging and discharging with 80 amperes, no injurious effect was found by this extraordinary demand on the plate. With a three-hour discharge the capacity of the plate increases to 54 ampere-hours.

It was very important for the practical manufacture of the plate that a peculiar method of formation was found, making a complete formation in three days feasible, and at the same time avoiding the employment of chemicals, which might have been followed by a destructive action. With this extremely simple and cheap process, it is said to be possible to form plates as rapidly and easily as grid plates filled with paste, so that the difficulties connected with the formation of Planté plates may be definitely considered as overcome, the more so as the process, modified for each particular case, has shown its applicability to Planté plates of other construction. In conclusion, the article states that a great number of storage batteries have already been set up with these plates for light and power central stations, and the construction has fulfilled in every respect the expectations founded on it.



FIGS. 1 AND 2. NEW PLANTÉ BATTERY PLATE.

The Indianapolis and Martinsville Electric Railway company, Indianapolis, Ind., has been incorporated, with a capital stock of $600,000. The company will begin this month to construct an electric road from Indianapolis to Martinsville, a distance of 30 miles. Charles F. Smith is at the head of the company.

Changes at Sewall's Falls.

The plant of the Concord Land and Water Power company at Sewall's Falls, N. H., has just undergone extensive alterations. This plant was the first one in this country to use three-phase current for general distribution, and the plant installed in 1892 has been added to several times, but a large power contract to supply the Boston and Maine railroad shops and the increasing use of alternating-current arc lamps made radical changes imperative.

Five new three-phase generators of 200 kilowatts' capacity, to operate at 2,500 volts and 60 cycles, of the revolving-field type, have been installed. Each generator is belted to a 275-horsepower waterwheel and is controlled by a Lombard governor, thus giving five separate units. A motor-driven exciter of 25 kilowatts' capacity supplies the entire five. A number of Thomson-Houston direct-current arc dynamos are driven by a 180-horsepower, synchronous motor.

The change from one set of machines to another was made in remarkably quick time. The change of cycle from 50 to 60 necessitated in many cases a change of motor pulleys by customers, the company furnishing the new pulleys. The old machines were of the 250-kilowatt, 50-cycle, stationary-field type, and were belted from a countershaft, which had to be removed. The old machines were moved forward and the new ones were placed; connections were made with the switchboard and adjustment accomplished—all in 31 hours, by the regular station force.

The original system of three-phase transmission will be continued. There will be a three-phase line direct to the Boston and Maine shops. Three 150-kilowatt, air-blast transformers step up from 2,600 to 10,000 volts at the Falls and two 200-kilowatt, air-blast transformers step down from 10,000 to 460 volts at the shops and transform from three to two-phase. A line auxiliary to the original line will be stepped up from 2,600 to 10,000 volts and stepped down to 2,300 volts at the city sub-station. The changes were designed and recommended by George H. Lander, superintendent of the Concord Land and Water Power company.

Death of John C. Henry.

John C. Henry, one of the earliest experimenters in electric traction, died at his home in Denver, Colo., on May 4th. Mr. Henry was born in Woodstock, Ont., in 1848. After a public-school education he became a telegraph operator, and for 10 years was employed as superintendent of telegraph lines and train dispatcher for the Philadelphia and Erie, the Union Pacific and other railroads. He was a persistent student of electrical science and made a number of valuable inventions, including the Henry velocimeter, a speed recorder.

In 1884 and 1885 Mr. Henry constructed in the suburbs of Kansas City an overhead electric railway, which was one of the first trolley roads built in the United States. During the next year he converted the East Fifth street horse line in Kansas City (until recently known as the Heim line) to electric traction. This road was operated with four motor cars for some time. After his Kansas City work Mr. Henry went to San Diego, Cal., where he built a number of electric roads, on one of which a nine per cent. grade was successfully surmounted by cars equipped with his apparatus. In 1889 he went East and became connected with the Thomson-Houston and General Electric companies as an expert in patent matters. Since 1894 Mr. Henry has resided in Denver, his removal to that city being necessitated by a breaking down in his health.

JOHN C. HENRY.

Elberfeld-Barmen Suspended Railway.

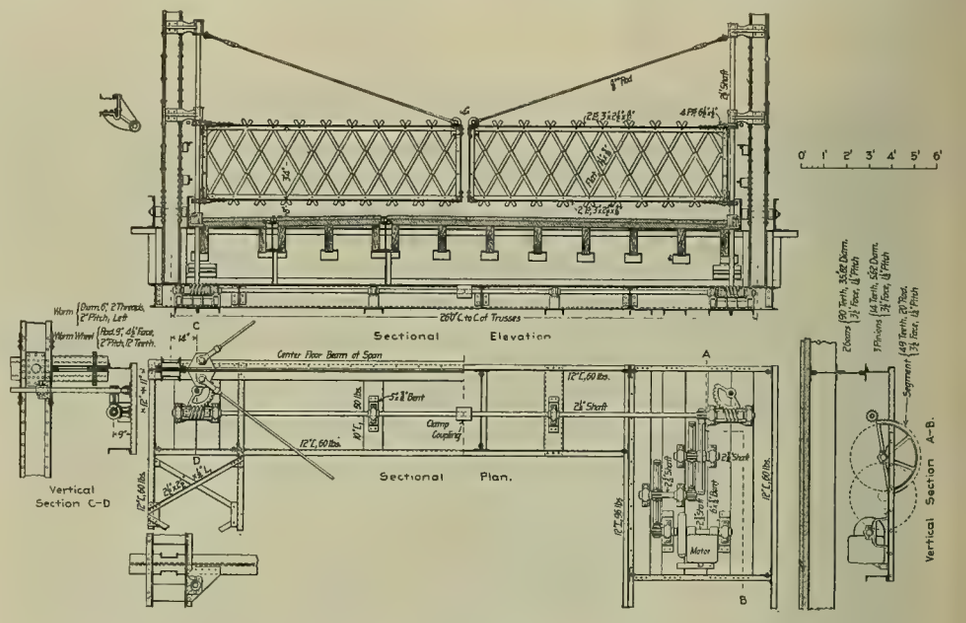
Consul-general Guenther of Frankfort, Germany, reports that on March 1st the electric suspended railway across the valley of the River Wipper, from Elberfeld to Barmen, was opened for passenger traffic, and the result is said to be highly satisfactory. Although the crowds were immense and all the cars filled to their utmost capacity, the trains ran smoothly, and no accidents occurred. The cars did not swing at all, even where the curves were sharpest, and they ran into the stations in a quiet way. Ingress and egress are effected in a moment. The surface railway makes the trip in 25 minutes, while the suspension railway accomplishes it in half the time, and it is contemplated to still further increase the speed. The fare is 10 pfennigs (2.38 cents).

An Interlocking Electrically Operated Drawbridge Gate.

By H. G. Tyrrell.

The frequency with which serious accidents occur at open drawbridges has prompted the writer to design a mechanically operated gate which he believes to furnish an absolute safeguard against disasters of this sort in all but extraordinary cases. The essential idea of this design is that the bridge and the gate cannot be open at the same time. The first cost of these gates is, of course, high in comparison with the first cost of the ordinary style of hand-operated wooden gates, but they dispense entirely with the services of a gateman, and for this reason will prove more economical in the long run.

The accompanying drawings show a pair of gates applied to a bridge with approach spans at either end, and having a 26-foot roadway and no sidewalks. The design can, however, be modified to suit any width of bridge, either with or without sidewalks. As will be seen, the gates are keyed to vertical shafts, which are shown turning in boxes fastened to the web posts of the fixed span. At the foot of these shafts are toothed segments worked by worms, which lock the gates in any position. These worms turn in oil baths, as shown. The worm shaft is connected by a system of reducing gears with the motor. In this system of gears is included a half-gear, which insures a movement of 90 degrees only to the gates, and at the same time gives the operator a few seconds' leeway in shutting off his power from the gate motor. Power is supplied by a General Electric three-horsepower enclosed motor, shown in the lower right-hand corner of the drawing, and this receives its current from wires on the draw span, through contact plates. When the gates are closed and the draw span is swung open, the electric connection is broken and the gates cannot be moved. Hence, the gates are controlled entirely by the operator on the draw span. The service of one man only is required on the bridge at any one time.



ELECTRICALLY OPERATED DRAWBRIDGE GATE.

A bridge equipped with these gates can be opened and closed very quickly, since no time is lost in walking to and from the gates, as in the case of wooden gates operated by hand. The gates are always locked in every position, either open or closed. As an extra precaution they may be placed, say, 100 feet from the draw span. Then, should a car or train break through them, it would certainly come to a standstill before reaching open water. As a further precaution a derailing switch may be placed inside the gates; then in case of a car breaking through the gate it would be thrown from the track and stopped, rather than pitching over the end of bridge. This switch may be operated by the gate motor through a series of wheels or levers.

At all times of both day and night the roadway should be well lighted and the gates themselves painted white, so that they may be more easily seen. Danger lights should be located on the gates, showing white when open and red when closed. It is desirable to have these located sufficiently high above the floor that they may be plainly seen above a crowd. An estimate, based on the accompanying plan and including both ends of the bridge, is as follows:

Weight of gates	2,100 lbs.	
Weight of machinery	5,600 lbs.	
Weight of machinery support	5,200 lbs.	
	12,900 lbs. at 5 cents	$645
Two motors, three horsepower		300
Total cost		$945

Rasch Rare-oxide Arc Lamp.

Ewald Rasch, a German, has invented an arc lamp in which the carbon rods of the ordinary arc lamp are replaced by rods of refractory material, such as the oxides of magnesium, thorium, zirconium, etc. These substances, when cold, are non-conductors, but when warmed, as in the case of the Nernst lamp, they permit the current to flow, and when the arc is established, the heat maintains the conductivity. The preliminary heating is more simply accomplished than in the case of the Nernst lamp, an auxiliary arc being employed, the electrodes of this heating arc serving also as leads for the main arc.

Apart from the great advantage of employing permanent electrodes which require no renewal, the new lamp is said by the Elektrotechnische Zeitschrift to possess a far higher efficiency than the carbon arc, the light emitted by the incandescent electrodes being much greater than with carbons. This is due to the high concentration of energy at the white incandescent ends of the electrodes amounting to 30 to 40 watts per square millimeter, and more. The limit in this respect is only reached when the very high melting temperatures of the available materials are reached.

The light emitted by this arc lamp differs materially from that of the Nernst and other incandescent lamps in that the spectrum is not continuous, but consists of various bands, according to the composition of the electrodes. Thus with electrodes of magnesia or zirconia a sun-white light is produced, the illumination being due not only to the incandescent rods themselves, but also to the minute particles electrolytically transferred from one terminal to the other. By the use of other materials, such as oxides of chromium or of nickel, lights of various colors may be produced and brilliant effects obtained.

In the course of his experiments, Herr Rasch discovered that different materials possess varying availability for use as electrodes, and he classifies them according to their resistance and according to the temperature at which they permit the starting of the arc. Those electrodes which have a high resistance when cold also require to be heated to a high temperature before the arc can be started, and these he calls "hard" materials, while those with a lower resistance and a lower starting temperature he calls "soft." Although the latter are more convenient as regards starting, they do not stand so high a temperature before fusion when the arc is closed by the fused material. The hard electrodes give a better light and are more efficient and hence well worth the additional heating which is required before starting.

Herr Rasch gives data and results of many of his experiments, showing the high efficiency of this new form of arc lamp. With electrodes five millimeters in diameter, and a current of 40 volts and five amperes, an average horizontal illumination of 900 Hefner candles was obtained.

The following comparative table, given by Herr Rasch, seems to show the superiority of the improved arc:

	Hefner Candles per Watt.
Incandescent carbon lamp	0.29
Nernst incandescent lamp	0.66
Arc lamp, alternating current	1.25
Arc lamp, continuous current	2.00
Rasch arc lamp	3.00 to 4.00

This shows the new lamp to be practically double the maximum efficiency of the carbon arc lamp, apart from the great advantage of the permanency of the electrodes. The disadvantage of the necessity of preliminary heating must, of course, be considered.

A Power Transmission Plant in Sumatra.

The development of some of the gold mines in the Dutch Indies has led to the installation of an interesting water-driven, three-phase power transmission plant in one of the mines. The mine is the Redjang-Lebong, and is located near Lebong Donok, in the interior of Sumatra. In the working of a gold mine mechanical power is used for drilling holes for blasting, the transportation of the ore, operating the crushing machinery, pumps, etc., and for many other purposes, and in this particular mine electrical energy has been adopted almost exclusively. For the operation of the stamps, including the rough crushing stamps, and the separators for separating the coarse from the fine material coming from the stamps themselves, a total of 66 horsepower in motors is used. An extension of the stamping equipment requires 37.5 horsepower, an air compressor for working the drills 37.5 horsepower, the workshop 10 horsepower, pumps for the cyanide solution used in the final treatment of the ore 10 horsepower and for lighting the mine 10 horsepower.

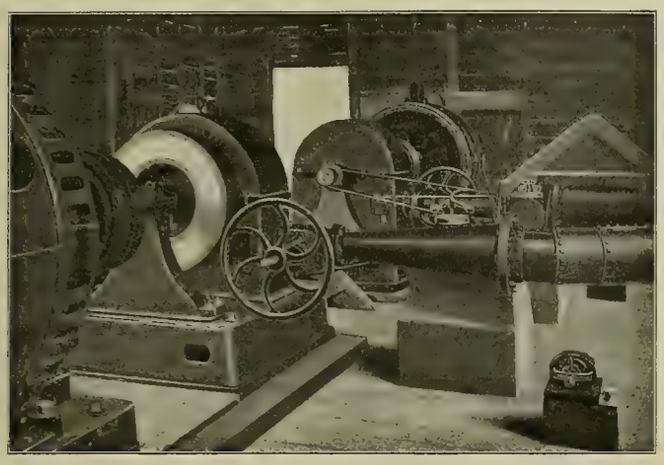


Fig. 1. Generating Station.

Fig. 2. Carrying Shaft Through the Forest.

A POWER TRANSMISSION PLANT IN SUMATRA.

The waterpower, which is at a distance of two miles from the mine, has a fall of 133 meters (436 feet). The London Electrician, from which this account is taken, says that at first only about 10 cubic meters (2,200 gallons) of water per minute will be made use of, so that, assuming an efficiency of 85 per cent., about 125 horsepower will be available. Pelton wheels were adopted in view of their simplicity and the advantages they offer in the case of a high fall. There is sufficient water for a considerable extension of the present installation. The Pelton wheels are directly coupled to three-phase generators, this being the natural arrangement in view of the high speed of this class of water motor. A view of the complete generating station is shown in Fig. 1. A pressure of 2,200 volts has been chosen, and this is generated directly from the machines without the interposition of transformers. Each of the three generators is rated at 100 kilowatts for an inductionless load. In erecting the station a considerable difficulty was experienced, owing to the absence of transport facilities, the generating station being at a distance of 170 kilometers (106 miles) from the coast. The nature of the country to be traversed was such that a light railway was out of the question, and all the parts of the machinery had to be carried in small, low, two-wheeled carts or else by hand. Fig. 2 shows a gang of natives carrying a shaft through the forest. On account of these transport difficulties, no single piece was allowed to weigh more than 600 kilograms (1,200 pounds), and this necessitated quite special designs in the case of some of the larger motors and the dynamos. For instance, the stators of the larger machines, which, according to usual practice, would be made in one casting for machines of this size, had to be made in four pieces, and the iron stampings had to be delivered separately and fitted into the casting on the spot. Thus the dynamos could not be wound at the works of Siemens & Halske of Berlin, who furnished the plant, and this had to be done during erection. In order that the winding might be carried out in the easiest and quickest possible manner, mica troughs were employed for the insulation, and these were laid directly in the open slots of the cores. Fig 3 illustrates the winding of the stator of one of the generators.

A staff of three was sent out to erect the plant, the man in charge being assisted by a dynamo fitter and a second fitter for the erection of the overhead line, the latter member of the staff being considered as a reserve hand, to take the place of one of the others in case of illness.

The smaller motors, and also the two 37.5-horsepower motors, did not occasion the same difficulties as the three dynamos. The 37.5-horsepower motors merely had their stators divided into two halves, and each part of the machine separately packed, and in the case of the switchboard, also, by dividing it up suitably, it could be packed in cases within the maximum limit of weight without any modification in the standard design. It took some weeks to carry the dynamo shafts from the coast to the works. As already mentioned, this was done by coolies, in the manner shown in Fig. 2. The two wooden frames seen at each end were to guard against damage to the shafts when setting it down. Considerable difficulties were experienced on the way, and in one case the journey was stopped by an earthquake, followed by landslips. The buffalo carts employed for the other dynamo parts afforded a relatively convenient and advantageous means of transport, but even in this case trouble was occasioned by the tropical rains, which not only spoilt the roads, but also frequently caused damage to the contents of the cases. Some of the dynamo windings and instruments suffered in this way, either owing to their cases having been broken in transit, or to the heavier ones having been unpacked on arrival at the coast, their contents divided, and repacked in smaller cases without proper provision for rendering them watertight. Fortunately, the possibility of mishaps of this sort had been anticipated to a large extent, and plenty of spare parts, especially material for winding, etc., had been sent out. It took four months to erect the plant, once it had arrived at the station, and in this work the German fitters were assisted by native labor.

The poles of the high-pressure transmission line through the jungle were chosen as high as possible, so that the line should not be damaged by the quickly growing trees, and a thorough inspection of the line takes place at regular intervals of time. Three horn-shaped lightning protectors are provided where the line enters the station. As the walls of the building are only of thin boards, it was necessary to add a panel to hold the insulators and the porcelain leading-in tubes.

The smaller motors and lighting are provided for on low-pressure circuits through transformers, but some of the larger motors are supplied directly at 2,000 volts. In order to be secure against accidents, the switches, cut-outs, ammeters and voltmeters are enclosed in cases which are carefully earthed. Rubber cable, with extra good insulation, is employed within the buildings, and fixed to the wall with iron fastenings, which are earthed here and there. Up to the present no accident has occurred. A telephone enables communication to be held between the generating station and the mine. The telephone wire is placed beneath the high-pressure wires on the same posts. In order to guard against injury, should a high-pressure wire fall and come in contact with the telephone line, a telephone set, specially designed for such cases, is employed, in which the mouthpiece and rubber earpieces are connected to the instrument by rubber tubes, and are not in metallic connection with it. The whole installation has been working for several months to the satisfaction of the owners of the mine.

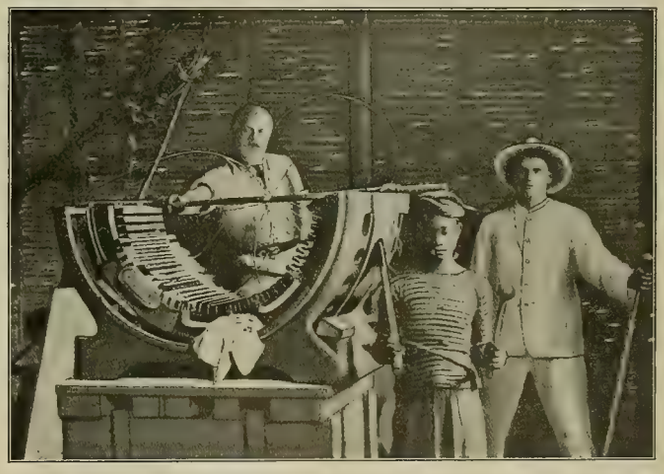


FIG. 3. A POWER TRANSMISSION PLANT IN SUMATRA.—WINDING THE STATOR OF ONE OF THE GENERATORS.

Queer Freak of Lightning.

During a severe thunderstorm on Thursday, May 2d, the eight-story Ozark apartment building at Wabash avenue and Thirty-fifth street, Chicago, was struck by lightning. The bolt struck the cupola on one corner of the building, followed the iron cornice for a few feet and then seemingly disappeared, no trace of it having been found any place in the immediate vicinity of the cupola. However, at the moment the bolt struck, the fuses for the incandescent-lamp circuits on every floor were blown out, leaving the fuse in the basement alone intact and the lamps lighted. At the same time two of the wires in the lighting circuit on the seventh floor were short-circuited, forming an arc close to a gaspipe, and in doing so melting a hole, about one-sixteenth of an inch in diameter, through the pipe. A small fire resulted, but it was quickly extinguished.

Y. M. C. A. Electrical Exhibition.

An interesting and instructive exhibition of recent electrical developments, together with a display of electrical classwork, was given in the parlors of the Chicago Y. M. C. A. on the evening of April 7th by the Y. M. C. A. Electrical Club.

Features of the evening's entertainment which attracted special attention were a demonstration of wireless telegraphy by R. C. Taggert of the Lewis Institute, Chicago, the receiving and sending stations being placed at opposite ends of the room; vacuum-lighting effects, produced by Geissler tubes, shown and explained by C. H. Stoelting of the Chicago Laboratory Supply and Scale company, and an exhibit and operation of a large static machine and also an X-ray machine by E. E. Jewell of the McIntosh Battery and Optical company of Chicago.

A display of fan motors and cooking, heating and ironing appliances was shown by the Chicago Edison company, and automatic telephones by the National Automatic Telephone company of Chicago. An electric typewriter, phonographs, many varieties of measuring instruments, and laboratory apparatus of all kinds, from the club's laboratory, were also displayed.

The spacious parlors were taxed to their utmost capacity, it being estimated that between 500 and 600 guests of the club inspected the various exhibits during the evening, many ladies being among the number. The club, which consists of members of the evening electrical classes conducted by the association and others interested in electricity, feels much gratified by the success which its efforts attained.

Electric Lighting in India.

A Calcutta newspaper says that there is a dearth of electric-lighting and power plants in India. Though Lahore is about to build an electric plant, it is one of a very few. The following list will show the many large cities that are without electric plants: Madras (452,000), Delhi (115,000), Lucknow (150,000), Allahabad (100,000), Agra (200,000), Cawnpore (120,000), and Benares (225,000). Madras has a power house for street railways, but not for lighting, and Bombay, with a population of 750,000, has no electric-light plant, and its street railway is operated by animal power.

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CONVENTIONS AND EXPOSITIONS.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Independent Telephone association of the United States, Pan-American Exposition grounds. Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Northwestern Electrical association, Sheboygan, Wis., June.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

A rather curious arrangement is that in the Lacombe central station at Denver, described in this issue, where there are two engine and dynamo rooms, one exclusively devoted to street arc-lighting plant and the other for machinery for furnishing light and power to commercial users. But the plant is an outgrowth of local conditions and is interesting as an example of recent practice in the Rocky Mountain region. We note with regret, however, that there is a prospect of a disastrous rate war in Denver and trust that the brethren, while giving customers good service at moderate rates, may yet find means of dwelling together in friendship and with mutual respect.

The growing tendency of municipalities and state legislatures to authorize or compel the placing of electrical wires and cables underground is one that is worthy of attention. The progress in the knowledge of methods of safely handling heavy currents of electricity now enables the placing of wires underground which a few years ago could not have been buried with safety or economy. In Chicago the recent development of a combination conduit by the Department of Electricity and its adoption on certain streets by the city, one of the traction companies, a telephone company and a telegraph company are steps in advance in the interests of economy, safety and public improvement. A combination conduit, to be used by several different electrical companies, embracing telephone, telegraph and comparatively high-tension wires, will certainly result in the improvement of the appearance of the streets, will facilitate the placing of new cables and will tend to make the operation of all the companies more economical.

From the report of the formal opening ceremony of the Glasgow electric-railway system last month we note that superlatives are not unknown on the other side of the water. Toasts and the presentation of silver bowls—not "flowing bowls" but flower bowls—were in order, and one gentleman congratulated the corporation on its magnificent power house, "unequaled on earth." Another, Mr. H. F. Parshall, the consulting engineer, and an American, who should therefore be accurate and capable, said that the corporation of Glasgow would shortly be in possession of the finest power station in the world; there was nothing to equal it in the United States. He had adopted the polyphase system, of which the advantages had been demonstrated elsewhere, with a view to providing an up-to-date installation on a universal system which could be applied to lighting, traction, or any other purpose equally well. It is evident that Glasgow has a very fine plant, for the designers and contractors themselves do say it. America must look to its laurels.

Recent experiments carried on by Dr. Harry E. Small of Sterling, Ill., are likely to extend the application of Roentgen rays for the purpose of detecting false jewels. Dr. Small has been carrying on his experiments for some time, and without exception has been able to detect every manufactured or false jewel he has tested. In his most recent experiments he has used an extra-rapid photographic plate, which was encased in an orange envelope and three folds of heavy black paper. The rays were produced by a 14-inch-spark static machine. After a three minutes' exposure a clean, sharp skiagraph resulted. Every kind of jewel that could be obtained was tested, and in every case the image of the genuine jewel was faint and could hardly be seen, while the manufactured or false jewel was more opaque to the rays and left a black and well-defined image. Some of the tests were made with the finest imitation jewels that could be secured, and many of them had been previously pronounced genuine by experts. The evident accuracy and thoroughness of Dr. Small's tests seem to justify the announcement that a successful and reliable method has been found for detecting false jewels.

The Rasch arc lamp, with refractory electrodes, briefly described elsewhere, has interesting possibilities. But it also has drawbacks, and some of them are indicated by Dr. Nernst, whose incandescent lamp is similar in the principle of employing refractory oxides as the light-giving medium. Trust one inventor to detect flaws in the other fellow's scheme! It is pointed out that the electrodes become convex, so that probably the greatest illumination would be horizontal, and no tests of the spherical candlepower are given. Dr. Nernst attaches considerable importance to this point, which he considers militates against the practical employment of Dr. Rasch's electrolytic arc, and makes its efficiency no longer phenomenal. He further remarks that no figures are given in Dr. Rasch's article for rate of consumption of the electrodes. His own experiments with electrodes of a material similar to that employed in his incandescent lamp showed that the negative, and not the positive, electrode burns away the quicker (a phenomenon which he thinks may have an important bearing on the theory of the arc) and that the quick consumption would prevent the construction of a practical lamp on these lines. Alas, it was ever thus! But perhaps Dr. Rasch could indicate some improvements in the Nernst lamp, and thus both might be benefited.

No one who follows the subject of electrical development can fail to be impressed with the extraordinary activity in electric-railway construction at the present time. From all parts of the country comes news of new electric lines projected and building, and the movement is particularly marked in the states of Ohio, Indiana and Michigan, as the news columns of the Western Electrician attest. Many of the roads under discussion or construction are interurban lines from 30 to 300 miles in length, and the constant tendency is toward longer routes and more ambitious projects, such as lines to connect Chicago and Milwaukee, Chicago and Detroit, Detroit and Buffalo, Cleveland and Pittsburg, Washington and Baltimore, and New York and Philadelphia. In the case of nearly all the long lines now proposed or under way portions of the distance are covered by existing roads, and the task of the promoters is to secure control of the existing properties and supply the missing links. Freight and mail matter are now carried on many of the electric railways, and on some of the longer ones projected it is proposed to run sleeping cars and maintain a schedule of passenger service equal to that on the well-established steam lines.

It is evident that the "trolley," to employ a popular term in passing through a stage of development similar to that witnessed when the shorter lines of steam railroads were building in this country 50 years ago. But it is not so easy to foresee the end of the cycle. Will the steam locomotive be replaced by the electric motor on the long trunk lines? Perhaps not, but the electric railway is forming a veritable network over the country, and the well-tried locomotive may be forced to yield to its rival, formidable in a superior economy. This is not the view of electrical men alone. Indeed, well informed electrical engineers take a common-sense, work-a-day view of the possibilities of the electrical transmission of power, and are not the ones who prate about the "marvels of electricity," some popular opinion to the contrary notwithstanding. But the steam-railroad men themselves are keenly alive to the situation and are watching the development of the electric railway carefully. A leading steam-railroad journal is no doubt representative in stating the state of affairs thus:

> In the first two stages the trolley has become the feeder and in a measure the local rival of the steam railroad. But in its more ambitious scope as a trunk line it promises to raise an issue with the steam roads of much larger importance. Heretofore for long-distance travel the steam roads have had the advantage of speed. So long as trolleys run along the highways and make stops at every corner this handicap must continue. But many of the electric trunk lines are planning to run over private rights-of-way and, on express service, to make stops only at infrequent points. Add to this the tendency to extend the service to light freight and express business, and the electric road will prove a dangerous rival to steam. How dangerous, is a problem to be determined, since the trolleys as yet are but at the beginning of this third stage of their development. The public is becoming familiar with electric lines 40 and 50 miles long. If some plans now under way become realized, it will not be long before there will be systems in operation whose cars run in continuous lines of 200 or even 500 miles.

The issue is certainly "of much larger importance" than formerly; the electric road is "a dangerous rival" to steam. The electric railway is serving the people well and cheaply. Its extension is marvelous. Who shall say where its victories will end?

The Transformer Situation.

Much interest attaches to the decision of Judge Coxe of the United States Circuit Court of the Northern District of New York in the case of the Westinghouse Electric and Manufacturing company against the Saranac Lake Electric Light company, an equity suit charging the defendant with infringement of two patents owned by the complainant. The first of these is reissued letters patent, No. 11,031, granted September 24, 1889, to Rankin Kennedy of Glasgow, Scotland, for an improvement in the method of distributing and regulating alternating electric currents by secondary generators. The second patent is No. 469,809, granted March 1, 1892, to William Stanley of Great Barrington, Mass., for an improvement in systems of electric distribution. The judge decides the case in favor of the complainant, sustaining the Stanley patent, but holding as to the Kennedy patent that the inventor, by a letter published in 1886, abandoned his invention to the public.

Among other things, Judge Coxe speaks as follows of the Stanley patent:

"Stanley's contribution to the art of electric lighting is an improvement upon the method described in the Kennedy patent. It still remained to discover a way to prevent the varying candlepower of the lamps on a given transformer when a part of the lamps were turned off or on. If, for instance, there were 20 lamps on the transformer, and all were burning, the turning off of 10 would change the candlepower of the remaining 10, increasing the luminosity. If they were turned on again the candlepower of all would go down.

"The difficulty was a serious one and electricians generally were searching for a solution, but always along the same lines. Stanley found a solution by doing what no one had ever thought of doing before. He discovered that he could remedy existing faults by regulating the length of the wire on the primary coil of the transformer. The patent tells those skilled in the art how to accomplish this result. To the uninitiated Stanly's rule seems indefinite and obscure, but electricians have no difficulty in understanding it. He determines the correct length of the primary coil by winding on wire after the transformer, in circuit, is connected with a dynamo, until the loss of voltage represented by the formula C^2R equals the predetermined loss of energy to be suffered in the system. The length of the wire is varied until the desired results are attained.

"What Stanley did was an exceedingly valuable addition to the art. He remedied a serious defect; he secured, without unnecessary waste of current, constancy of secondary pressure as lamps were turned on or off; he struck out into a new path and brought back the prize, which, if he had continued upon the old paths, he never would have found. Such a discovery cannot be attributed to the 'skill of the calling.'"

The patent to Rankin Kennedy, while in appearance specific, is in effect a patent covering the mode of operation of transformers connected in multiple arc. The claim is as follows:

The method of distributing and regulating alternating electric currents by secondary generators, which consists in producing in two or more derived circuits constituting the primaries of two or more secondary generators a counter-electromotive force, which, when any secondary is open, is practically equal to the applied electromotive force in its primary, and in controlling said electromotive force by the current flowing in the corresponding secondary when the secondary is closed in such manner that the current in the primary shall vary with and be approximately inversely proportional to the resistance in the secondary, substantially as described.

It will be observed that the claim sets forth the necessary law of the operation of transformers as used in alternating-current circuits, and would be no broader if it read, in effect: "A method of distributing alternating electric currents which consists in connecting the primaries of the transformers in multiple arc with a source of alternating current, inducing current in the secondaries of said transformers, and passing the secondary current through translating devices."

It is not apparent how any system of transformers connected in multiple can operate commercially unless there is a counter-electromotive force produced in the primary when the secondary is open, which is practically equal to the applied electromotive force; nor is it apparent how the electromotive force in the primary transformer is to vary otherwise than in an approximately inverse ratio to the resistance in the secondary.

The Kennedy patent is a monument to the late Franklin L. Pope, who, during the progress of the litigation brought by the Westinghouse Electric and Manufacturing company against the Sun Electric company of Woburn, Mass., on the original Gaulard and Gibbs patent, discovered a few lines in a London electrical paper of the early 80's, which he considered sufficient basis for a broad claim upon transformers connected in multiple arc. It is said that Mr. Pope quickly took the steamer and called on Mr. Kennedy and secured from him his rights to an American patent, got Mr. Kennedy to execute the application, and brought it back and filed it in Washington in great haste to precede the expiration of the two years' prior public use of the invention in this country. The patent now has over five years to run, and if sustained by the Circuit Court of Appeals, is apparently broad enough to dominate the entire method of distributing current by means of transformers connected in multiple arc.

The patent to Stanley was issued March 1, 1892. It is for a system of electrical distribution, which is substantially the same as that set forth in the Kennedy patent above referred to. This patent brings in as elements the features which are essential to the operation of transformers connected in multiple arc. This will be seen from the first claim of the patent, which is as follows:

In a system of electrical distribution, and in combination, an alternating-current dynamo and converters electrically connected with the main-line conductors in multiple arc and organized to transform the current in the main conductors into currents of less potential and greater quantity in the secondaries, each converter made with a primary coil containing such length of wire exposed to magneto-electric induction that when operated by the dynamo with which it is to be used with its secondary circuit open the electrical pressure and counter-pressure in its primary circuit shall be equal with incandescent lamps or other translating devices in the secondary circuits, substantially as and for the purpose set forth.

The patent has eight years yet to run, and if broadly sustained in the Court of Appeals, it would apparently dominate all systems of alternating-current distribution in which transformers are connected in multiple arc.

There is much interesting history connected with the Stanley patent. It was applied for about two weeks after the issue of a patent, No. 368,936, to the late Marmaduke M. Slattery, in which the claims, or some of them, now found in the Stanley patent were included. An interference in the Patent Office resulted, and the decision of priority was awarded in favor of Stanley.

In the decision now rendered by the court sustaining the validity of the Stanley patent, there seems to be a discrepancy between the views now taken of the invention and the view taken during the progress of the interference. On this point Charles A. Brown, the well-known patent lawyer of Chicago, says: "Stanley was unable to prove in the interference that prior to the date of Slattery's patent he had ever conceived the idea of making the counter-electromotive force of the primary winding of a transformer equal to the impressed electromotive force by a primary winding of length suited to the dynamo with which it was connected. For several months, beginning in March, 1886, Stanley operated a plant at Great Barrington, Mass., in which a number of transformers were used. These transformers had magnetic fields exactly alike, and according to the Stanley patent would have to have the same length of active wire in their primaries, yet the active wire in their primaries varied from 292 to 625 feet. Although Stanley made copious records of his work, and had prepared an application for patent on his transformer system, none of his records show that he had in mind this single broad feature of the length of the primary wire, as alone controlling the counter-electromotive force, which is now adjudged to be the one essential feature upon which the patent is sustained.

"It does not appear that the court considered the question whether the use of the system at Great Barrington by Stanley constituted a public use. If the transformers there used embodied the invention, as was claimed in the interference, then the question is, whether the use was a public one. It was more than two years prior to the date of the application for the patent by Stanley, and, if a public use, would constitute a statutory bar to the Stanley patent."

It may be stated also that Walter K. Freeman has been in interference in the Patent Office over an issue which is broader in its terms than the claims of either the Stanley or Kennedy patents. Walter K. Freeman was, in the first instance, adjudged to be the prior inventor. Whoever secures this broad claim ultimately will have a patent which will run for 17 years from the date of issue and absolutely cover all means of operating alternating-current systems of distribution in which transformers are connected in multiple arc.

Uniform Accounting Needed.

In an address on "Municipal Ownership" at the annual meeting of the Illinois Association of Public Accountants in Chicago on April 9th, John Alexander Cooper said: "The most effective remedy with which to overcome this too constant element in disturbance of corporate profits is in a modern, uniform, concise and economical system of accounting and office statistics, that will not only serve with the utmost promptness every reasonable requirement of the management ordinarily, and without being a burden upon the revenues, but will also be of such a broad, general form or plan as to be amendable to subdivision and reclassification for the especial edification of the staff and servants as occasion may demand, and also display the results sufficiently to meet any of the usual governmental reports."

The Development of the Storage Battery.

By J. K. Pumpelly.

Not until the middle of the nineteenth century were the nature and practical use of the storage battery made generally known. Scientists like Faraday, Volta and others, who had studied its behavior years before, used the name, secondary battery, in contradistinction to primary battery, or the voltaic pile.

It was only by following up a thin thread of theory, brought out by experiments in other lines as far back as 1786, by Galvani and others, that the nature of the secondary battery was accidentally discovered, and a theory was guessed at. Volta's observation and experiments on the line of his voltaic pile suggested to Ritter the idea of the secondary battery. Ritter found that certain metals, oxidized by the action of an outside current of electricity in the presence of certain acid or alkaline-salt solutions, retained their charge of electricity as long as the chemical change produced in the pile remained stationary, and that this chemical change could be converted into electrical energy again by connecting the positively oxidized metal pole with the negatively energized metal pole through an outside conducting medium.

These experiments of Ritter were taken up by Gaston Planté in 1859. Planté, however, gives to another credit for the first practical experiments with oxidizable metals as electrodes in a secondary pile, four years before this, or about 1854.

Planté made the first practicable storage battery, oxidizing his metal electrodes by a long and tedious process—continuing for months. It is now acknowledged that R. L. Metzgen, in 1879, first did away with this tedious and expensive forming process of Planté by mechanically applying the active material—that is, the oxides of the metal—to the electrodes. This important discovery was not generally known until Camille Faure obtained his patents in 1881. In this country Charles Brush was evidently working on these same lines, and the United States courts have since decided that, to a certain extent, to him belongs the priority of the invention of "the mechanical application of the active material, or material to become active, to a conducting support." Brush made several other claims in his invention, but the above contains the gist of his claimed invention in this country.

Planté's opinion, founded on a large number of experiments on many metals, was that lead was the only metal that could be used, commercially, for the making of storage batteries, on account of the great cost of other metals, which might be even more efficient than lead, such as silver, gold, platinum, etc. For this reason nearly all following workers have exerted their inventive ingenuity in working out different and advantageous designs and forms of the lead support, and to-day, at the beginning of the twentieth century, we are still working in these old ruts.

Great weight in proportion to the work done has ever been a drawback to a method of the conservation and apparent storage of electrical energy, perfectly ideal in itself. Had it not been for the success of the trolley and the third rail, in the economical propelling of passenger cars, the storage battery would have developed into a vast business.

The end of the nineteenth century found much ingenuity and a large investment of capital devoted to the making of batteries for the propelling of electric vehicles.

Great advance has been made in lessening the weight of lead in the batteries and in increasing their efficiency. The twentieth century may show new discoveries in this line; the easily decomposed and heavy lead may give place to other metals lighter and more enduring; then the principle established by Ritter, that oxidizable metals can be made to conserve electrical energy when charged from an outside source of electrical energy, may reach its highest ideal.

Even now, the science of battery making has advanced so far that 80 pounds of lead electrodes give for vehicle work one horsepower-hour of energy and an efficiency of 87½ per cent. of the ampere-hour charge. There has been very little deviation from Brush's mechanical form of plate. What will be done when his patents expire, only those who continue the work on this line can tell.

There are to-day 120 different forms of storage batteries patented in the United States. The number of inventors in this country and Europe reaches into the thousands. But the problem for the twentieth century is the perfection of the experiments for the production of electricity direct from coal without consuming it by fire. When this is done we shall have a perfect storage battery.

The Suburban Railroad company, Chicago, Ill., began on May 1st to deliver its passengers to the Metropolitan West Side Elevated Railroad company, transferring its business from the Lake Street Elevated Railroad company. The Metropolitan will thus add 2,000 fares a day to its revenues.

DEVELOPMENT OF THE TELEPHONE FIELD.

Important Contracts Awarded in Detroit.

Preparations now under way in Detroit indicate that the new People's Telephone company of that city, under the energetic management of Mr. J. B. Ware, formerly of Grand Rapids, will be one of the most important of the Independent companies. Contracts have been let for switchboards and instruments at a price, it is said, of $203,000. But this is the figure stated in the daily papers and has not been officially confirmed. It is certain, however, that the Stromberg-Carlson Telephone Manufacturing company of Chicago secured these contracts and that the exchange is planned to be one of the very largest in the United States. The initial switchboard equipment calls for a switchboard to have a capacity for 14,400 subscribers' lines of the multiple, lamp-line-signal, central-energy type, equipped for the immediate operation of 6,000 subscribers' lines, with complete power, battery and ringing equipment in duplicate, and with a capacity sufficient for the complete operation of the full ultimate capacity of the switchboard. The telephone contract is for 6,000 instruments. It is said that the Stromberg-Carlson bid was the highest received. "We placed our order just in time," said Mr. Ware, "to get in ahead of Philadelphia and other eastern and southern cities where new telephone companies are figuring with the Stromberg-Carlson people. In fact, we hurried our order to be sure of having our work done first."

The installation date specified in the contract is February 1, 1902.

The People's Telephone company, after a careful search for adequate headquarters, decided that it could only obtain what it wished by buying a site and erecting an exchange building, and accordingly purchased a lot 80 by 90 feet, located on the southwest corner of Park and Elizabeth streets. This company's engineers have figured out that this site is within 200 feet of the telephone center of the city. The building will be six stories in height, modern in construction and especially designed for use as a telephone exchange. This building is favorably situated, so that it will receive light from the north and east sides and afford excellent opportunities of bringing a large and complex conduit system into the building without conflict with the existing conduit systems of other companies.

The underground material will be supplied by the Standard Underground Cable company of Pittsburg. The work of underground construction will be commenced at once.

The contracts for other materials have not yet been awarded. "But these can be obtained in the market at almost any time," says Mr. Ware; "the chief idea has been to get contracts placed on the work that requires time." It has fully been determined that only copper wire shall be used, making the entire Detroit system one of metallic circuits.

"We recognize that business demands make the question of service the vital and final one in the telephone field, and especially is this true in Detroit, inasmuch as there had been one Independent telephone exchange here which, owing to various causes, did not adequately meet the requirements," said Mr. Ware, "and this is the one point we have in view in constructing this system. The People's Telephone company's Detroit exchange will be the model exchange in the United States. In the concentration of lines in one big exchange building we shall be able to save time for our subscribers and largely increase the efficiency of the service. We do not believe at all in the branch-station system. Everything about the construction will be permanent and with a view to the accommodation in the not-distant future of the entire 14,400 subscribers' lines for which the exchange is being built."

The Coming of Mr. Sabin.

On May 1st the board of directors of the Central Union Telephone company held a special meeting and elected Mr. John I. Sabin president of the company and also appointed him chairman of the board of directors and member of the executive committee. Mr. Sabin is to enter upon his new duties on or about May 10th. Mr. Jackson, the retiring president of the Central Union, will take a well-earned rest for two or three months.

It is expected that by the time this issue of the Western Electrician reaches its readers Mr. Sabin will have been officially chosen as president of the Chicago Telephone company.

In an interview in San Francisco Mr. Sabin is thus quoted: "In the territory east of the Rockies, where telephonic communication has been established, there are 13,000,000 people against 2,500,000 people on this coast. Yet on this coast there are five times as many telephones in use as in the whole of the eastern section. The area to be covered in the East is but one-third as great as on this coast. The people there are more compactly settled. With these conditions prevailing in the eastern states there is an immense field for development and progress in the telephone business."

Control of the Erie Company.

Boston, May 4.—The indications all point to a quiet struggle for the control of the Erie Telegraph and Telephone company. Efforts to depress the stock, with the purpose of taking up large blocks, have met persistent opposition. It is said that one interest controls about 30,000 shares. The Old Colony Trust company and its friends hold about 10,000 shares, and New York and Philadelphia interests, representing the Telephone, Telegraph and Cable company of America, control 21,000 shares, which were turned over to the Old Colony Trust company in January. It is believed that it would not be difficult for two of these interests to combine and secure the property before the maturing of the outstanding notes for $7,500,000, and that they would have no difficulty in taking up these notes. It is rumored that one of these interests recently proposed to buy the other's stock at a price considerably above the present market, but the offer was declined, with the intimation that a materially higher figure would be considered. Good authorities hold that the Old Colony Trust company will ultimately control the property, and that after the company secures it, the price of the stock will be advanced to a level commensurate with its value as indicated by the recent examination of its affairs.

This examination was made by Stone & Webster, who report that about 40 per cent. of the company's subscribers are served through underground cables which contain 48 per cent. of the total exchange wire mileage. The average amount of wire mileage underground in the Bell systems is 52 per cent. Considering that the Erie company operates in only six of the 52 United States cities with populations of 75,000 or more, the proportion of underground wire is very satisfactory. The Erie companies own and occupy 51 buildings and 14 parcels of land. The buildings are generally commodious and creditable. Practically all the important towns in the territory served by the company are connected by toll lines, which are generally in good condition. B.

New England Company's Report.

From the report of the New England Telephone and Telegraph company for the year 1900, it is learned that the total revenue of the year was $4,518,396, an increase of $572,041 over 1899. The net revenue was $896,752, of which $838,635 was paid in dividends. The company's assets amount to $22,305,460. The net gain of private-line subscribers for the year 1900 was 659, and the net gain of exchange subscribers for the same time was 14,489. The increase of exchange stations has been greater than that recorded in any previous year. The total number of subscribers' stations operated under the management of the company at the close of the year, including the Southern Massachusetts Telephone company, was 74,828, against 58,691 at the end of 1899. Of the $1,565,127.56 expended for new construction in 1900, $557,901.64 was for aerial construction, $615,259.89 was for underground conduit and cables, and $391,966.03 was for equipment. Total mileage of exchange wire on December 31st was 118,610; toll wire, 47,875 miles; toll poll lines, 4,329 miles. The number of employes is 2,568; average number of exchange connections daily is 460,800; average number of daily exchange calls per subscriber is 6¼; average number of toll-line connections daily is 21,937. The 1901 expenditures for maintenance and extension are estimated at $3,700,000, of which $1,950,000 is for construction. No less than 49 new switchboards were installed in 1900, most of them replacing others.

Canadian Bell Company Increases Its Stock.

The committee on banking and commerce of the Canadian Senate has reported the bill increasing the capital stock of the Bell Telephone company from $5,000,000 to $10,000,000. The company has thus won out against all opposition. The proposal to restrict the rates the company may charge to such rates as were in existence in 1892, when the company got its original increase of capital stock, and the proposal also of making the company liable for any overcharges since that time, were rejected. The company, however, accepted part of the amendment compelling it to furnish telephones upon application from persons living adjacent to the telephone system. The company was ordered to produce a list of its shareholders before the bill was further proceeded with.

Telephone News from the Northwest.

The Wisconsin Telephone company contemplates a toll line from Rhinelander to Tomahawk and Merrill, Wis.

The Twin City Telephone company has completed a complete switchboard covering the new courthouse in Minneapolis. There are 23 instruments now connected.

The Northwestern Telephone company has been granted a new franchise at Vermillion, S. D., and will make numerous improvements at once.

The Twin City Telephone company plans to branch out in the residence districts of St. Paul extensively. The company expects to increase its connections in St. Paul from 1,200 to 3,000 before the season is over. A sub-exchange will be erected at Hague avenue and Dale street.

The Crookston Telephone company of Crookston, Minn., has ordered a new 400-drop switchboard, and will make a number of improvements to its exchange.

The Citizens' Telephone company of Mankato, Minn., is extending a line to Kasota, Minn., and will soon build to Mapleton.

The Wisconsin Telephone company is rushing work at Merrill, Wis., putting in a local exchange in opposition to the New Merrill Telephone company on the West Side. The home instruments will be thrown out on that side in favor of the Wisconsin. An exchange of 120 instruments will be installed.

The city of St. Paul and the Northwestern Telephone Exchange company have reached a stipulation in the matter of telephone rentals for the period between January, 1896, and January, 1901. The city is to pay $3,561 for the service during that time, and in the future is to have 25 free telephones and as many more as wanted above that number at half the regular charge.

The Peoples' Telephone company of Chatfield, Minn., has lately added a number of new features and improvements. The company started in August of 1897 with 20 connections, and now has 160.

The Hutchinson Telephone company of Hutchinson, Minn., has just installed another section to its switchboard. It has 175 connections and orders for more.

The Jasper County Telephone company of Newton, Iowa, has been incorporated, with a capital stock of $60,000.

The Nebraska Telephone company contemplates installing a local exchange for Shelton, Neb.

The Maxwell and Brady Island Telephone company will build a line from Brady Island to North Platte, Neb.

James E. Bell has been given a franchise for a local exchange in Everett, Wash.

A. B. Cooling of Iowa City, Iowa, is working to establish an Independent telephone system at Fremont, Neb. It is proposed to form a stock company among the local business men.

The Monona Telephone company has been incorporated at Monona, Iowa, with $10,000.

The Rural Telephone company has been formed at Humboldt, Neb., and will build lines in Humboldt and Spencer townships.

The Pass Creek Telephone company has been formed to build lines between Bozeman, Mont., and Pass Creek.

The Lewistown (Mont.) Telephone company will rebuild its exchange and place it on a metallic basis, and make other improvements.

The Gladbrook Telephone company has been formed at Gladbrook, Iowa, with $10,000 capital stock.

The mutual telephone companies centering in New Providence, Iowa, are having a merry war between themselves. Some of the companies seek to forbid, by their by-laws, connection with a toll line, or with any line that does connect with a toll line. Some of the lines enter a mutual switchboard at New Providence, and others are in the union switchboard at Union. These companies are trying to connect by a commercial line. The radicals are receiving messages and paying a messenger to transfer them from one board to another. R.

Ohio Telephone Notes.

At a special meeting of county auditors held in Columbus last week, the matter of taxation on telephone boxes of the Bell Telephone company, leased to other corporations, came up for discussion, and it was finally decided to make the minimum rate $10 a year. Above that the valuation may be fixed according to the earning capacity. The sentiment was strongly expressed that taxes on all incorporations should be increased in proportion to the increase that has been made on real estate, and some action in this direction will likely be taken at the annual meeting in the fall. This will include telephone, electric-railway and steam-railway companies.

Bayard L. Kilgour has been appointed supervising engineer of construction and supervisor of contracts of the City and Suburban Telegraph association of Cincinnati. For 10 years he had been the electrical engineer of the Cincinnati Street Railway company.

Lightning last week damaged the telephone exchange at Grove City, south of Columbus. It played some queer pranks on the wires, and citizens declare that great balls of bright-blue fire passed over

them. The storm was a local one, but was very heavy at that particular point.

The Home Telephone company of Jackson will soon commence the construction of a line toward Waverley, Pike County, and will connect with the United States Telephone company at Beavertown, Ohio.

A temporary restraining order has been granted against the assignee of the Farmers' Co-operative Telephone company of Mansfield, to prevent him from disposing of the property. O. M. C.

Indiana Co-operative Telephone Plan.

Indianapolis, May 6.—The value of the co-operative plan of erecting and operating telephone plants seems to be proved by the rapid spread of the telephones throughout the state. The latest venture is that of the Bowers Station Co-operative Telephone company. All persons concerned in the company say the plan is a success. The plan of the company is for all who have a permanent use of the telephones to help bear the expense of putting in the switchboard, and the farmers buy the instruments and pay for the wire that gives them switchboard connection. Where two or more people use the same wire, the expense is divided among them. In addition to this, each subscriber pays $3 for the privilege of joining the company. A monthly fee of 25 cents is also charged. All members of the company have the free use of any connections with the exchange, while non-subscribers pay toll. Those in the company say they are getting satisfactory service at little expense. The company is not organized for profit, the 25 cents a month being used to keep up repairs and the expense of the exchange. Over 40 towns are now represented in the company and over 6,000 telephones are connected. Among the towns connected with this co-operative system are North Salem, Clarkshill, Crawfordsville, Darlington, Colfax, Roachdale and others. Last week arrangements were made with the owner of the Kirklin exchange to give free connection to the members of the Co-operative company. The company will in time have connection with Indianapolis and will probably spread its operations over a large portion of western Indiana. F.

TELEPHONE MEN.

George B. McFarland, superintendent of the Iowa Telephone company, was in Chicago for a few days last week.

George A. Scoville of the telephone-engineering department of the Western Electric company, Chicago, will leave for California in a few days.

C. L. Boyce, general superintendent of the equipment department of the Erie Telegraph and Telephone company at Detroit, Mich., made a business trip to Chicago last week.

W. E. Doolittle, secretary and general manager of the Sterling Electric company, Lafayette, Ind., was in Chicago this week. Mr. Doolittle states that business was never better with his company.

E. E. Lentz, who has been with the Citizens' Telephone company of Columbus, Ohio, for two years, has accepted a position with the People's Telephone company of Detroit, to take full charge of its books. Mr. Lentz has made himself thoroughly conversant with the telephone business, and is therefore a valuable member of the staff of any company. Everett Marshall will take his place in the Columbus office.

The funeral services over the body of I. H. Farnham, chief electrician of the New England Telephone and Telegraph company, who was shot by George H. Brainerd, were conducted by the Wellesley (Mass.) lodge of Odd Fellows. The attendance numbered nearly 1,000 persons, including representatives of the New England and American Bell telephone companies' officers and employes and the Electric Potential association. W. J. Denver, assistant general manager of the New England Telephone company, was a pallbearer.

GENERAL TELEPHONE NEWS.

The New England Telephone and Telegraph company will disburse $206,291 in the payment of its dividend this month.

A complete report estimates that the Erie telephone plant can be reproduced for $26,300,000, exclusive of the right-of-way and franchise.

The Winnebago County Telephone company is about to ask the Rockford (Ill.) City Council for a franchise. The company has met with flattering success in its canvass for subscribers.

The Telephone Auxiliaries company, Chicago, has been incorporated, with an authorized capital stock of $10,000. H. P. Young, Nathan S. Smyser and E. J. Wilber are the incorporators.

The Central Union Telephone company is making a number of improvements at Rockford, Ill. It recently completed a farmers' line north of the city that extends four or five miles into the country.

Duty of Telephone Companies to Protect Patrons Against Lightning.

The case of Griffith, administrator, against the New England Telephone and Telegraph company was brought to recover for the death of a physician. The evidence tended to show that the physician was killed by lightning while sitting in the library in his house, intently reading, under a telephone instrument owned by the defendant company. The lightning, it was contended, entered the house over the telephone wire, and it was further asserted that the company was negligent in that it did not provide and maintain any appliance to conduct the lightning to the ground, or out of the house, without injury to the inmates therein, by reason of which neglect the physician came to his death.

On the trial of the case the evidence tended to show that the lightning struck one of the company's telephone poles about a quarter of a mile from the house; that it diffused and went to earth by several different routes, and that only a small part of that force went to the physician's house. If the jury found that such were the facts, the Supreme Court of Vermont holds that it was not called upon to find whether any human agency can control the course of a bolt of lightning in its passage from the clouds to the earth, but were only required to find whether the course of such part of a bolt of the lightning as the evidence tended to show went to this house could be controlled when upon a telephone wire. In other words, it says that the question in this case was whether the particular force which the evidence tended to show passed over the telephone line and killed the physician could, by proper ground connections, and by the use of known and approved appliances, have been controlled or diverted so as to have prevented the injury therefrom. The court also holds that, in the absence of any other strokes of lightning at that time in the vicinity than the one that struck the pole referred to, and of any marks about the house that indicated that lightning had entered it in any other way, the jury could properly infer from the facts which the evidence tended to show that the lightning which killed the physician came to and entered the house over the telephone wire. That is to say, it was for the jury to find what force passed over the telephone line to the physician's house, and there killed him, and to find the extent of that force. Then, when the jury had found what the force was and its extent, it was for it to say whether there were known and approved appliances for arresting, diverting and controlling such force so as to prevent injury, and whether the company was negligent in not providing such appliances, and whether the physician came to his death by reason of such neglect.

But the evidence tended to show that no device, as a safeguard or protection against electrical disturbances, was attached to or connected with the telephone instrument in the house, except on top, where there was a device, consisting of two metal plates, which, to be complete, should be furnished with a wire attached to one of the plates and running to the ground, and between the two plates was a plug intended to short-circuit the two plates on the passage of a heavy current. Owing to a defect in the construction of the instrument, the plug did not serve the purpose for which it was intended. Besides, the evidence tended to show that just before the physician was killed, his daughter placed this plug between the plates, but there was no ground connection, and the hole under the plate was too small to receive the plug, and, by reason of these defects, it did not serve the purpose for which it was intended. Considering all the circumstances, which the evidence tended to show were such as to warrant a finding that the physician was doing as a prudent man, under like circumstances, would be very likely to do, the question of whether he was in the exercise of due care being for the jury, the court affirmed a judgment in favor of the plaintiff.

MANUFACTURERS AND DEALERS.

The plant of the Standard Telephone and Electric company in Madison, Wis., was recently damaged by fire to the extent of about $11,000. Friends of the company will be pleased to know that the loss was fully covered by insurance.

The Ericsson Telephone company of New York is in receipt of a letter from the office of the chief signal officer of the United States Army, confirming an order for 200 bridging telephones, to be sent to Manila, and stating that the report on a previous lot of Ericsson instruments shipped to Manila in the early part of 1900 has been favorable.

The D. A. Kusel Telephone and Electric Manufacturing company of St. Louis is about to occupy a four-story building at 1109 Market street. This change is the result of the large amount of orders on hand, it being impossible for the company in its present location to find space enough to carry on its work. The company has recently finished equipping the school board building at St. Louis with a complete telephone system and has also completed an exchange at Watonza, Okla., with a capacity of 200 subscribers.

The Carolina and Virginia Telephone company will build about 200 miles of copper-metallic toll lines to connect its different exchanges to those of the Henderson Telephone company of Henderson, N. C.

Alternating-current Power Work.[1]

By T. P. Gaylord.

Modern polyphase alternating-current apparatus has made possible extensive developments in electric-power transmission and utilization that are both reliable and economical. The early single-phase, high-frequency alternating system gave little promise of success in power work, and the synchronous motors were not generally successful, except in small sizes, owing to difficulties in starting and properly adjusting the field charge under changing loads.

Polyphase generators, according to the nature of the revolving element, are classed as: (1) Revolving-armature generators; (2) revolving-field generators; (3) inductor type generators. The last type is giving way to the other two on account of its poor inherent regulation under trying conditions of power loads, trouble from stray fields, and difficulty in maintaining good insulation and in making repairs. The performance of the first two types is about equal in their respective fields. Collecting rings are unnecessary with a stationary armature, and are only objectionable in generators of low voltage and large current capacity. Better insulation can be maintained on stationary armature coils, making this type suitable for high voltages.

Multiple operation of polyphase generators is very important and indispensable. It may be simply secured with the generating units operated to advantage, if they are designed to be tied, electrically, to one set of bus-bars. The generators should be run in synchronism, have uniform angular velocity and similar electromotive-force curves or wave forms. In steam-driven plants the problem is one for the engine builder, especially concerning flywheel capacity, governors and valve motions. Specifications should be furnished and adhered to in the speed requirements and the permissible variation from uniform angular motion.

Static transformers for power transmission are made in two types, i. e., the oil-insulated or self-cooling, and the air-blast transformer. With the former no blower or auxiliary apparatus is required. Some objections may arise against storing oil in the transformer, in which case the air-blast type may be used.

Alternating current applied to motors meets the general conditions of power work, but special cases arise, as in street-railway work, where the present requirement is for direct-current supply. It must not be inferred that the alternating-current motor is inferior to the direct-current motor, but the conditions of street-railway work make the series motor, with its automatically varying field, exceptionally fitted for that service.

Rotary converters are used where direct current is required, either for a two-wire or a three-wire system, in any polyphase distribution. They serve, however, a variety of useful purposes, delivering alternating or direct current, or both, if driven mechanically, supplying power if operated as a direct-current motor or a synchronous motor, and furnishing alternating when supplied with direct current. The rotary is usually started from the alternating side and brought up to synchronous speed with the generating plant by a small induction motor, mounted on its shaft. Rotaries used inverted to supply alternating from direct current should be excited from a small generator, mounted on the shaft, for without this direct-connected exciter the rotary would have a tendency to speed up abnormally under sudden overloads or short-circuits. The armature of the rotary having but one winding, there is a definite ratio between the alternating and direct-current terminal voltages, which, for an approximate sine-wave form, is 0.71 for two-phase and 0.61 for three-phase machines. Voltage regulation of the direct current is usually effected by an induction potential regulator on the alternating side.

The induction motors of most recent type meet the widest range of exacting requirements in polyphase power transmission. There are no connections of the supply circuit to moving parts and no adjustments to make. In starting it is usual to bring the motor up to speed by applying one-half or two-thirds of the terminal voltage through an auto-converter, which, by a double-throw switch, is thrown out and the motor connected directly across the mains when it reaches normal speed.

The starting torque of an induction motor does not differ materially from that of a direct-current motor. In common motors of small sizes, 2½ times, and in the larger from three to four times, full-load torque is obtained at starting. For workshops, a starting torque is rarely required exceeding full-load torque, and is frequently much less. Ordinarily, the auto-starter is adjusted for the minimum voltage necessary to put the motor in motion, resulting in least current required for starting.

Variable-speed induction motors are of two types, according to the manner of accomplishing the desired result: (1) By varying the voltage applied to the primary or stationary part; (2) by varying the resistance of the secondary or rotating part. Motors of the first type differ from those for constant speed in having greater secondary resistance, resulting in maximum torque at zero speed. The torque of all speeds varies approximately as the square of the voltage applied to the primary, so by applying proper voltage any desired torque from zero to maximum may be obtained.

Variation in speed of induction motors of the

1. Abstract of an illustrated lecture delivered April 30, 1901, before the Engineering College of the University of Illinois.

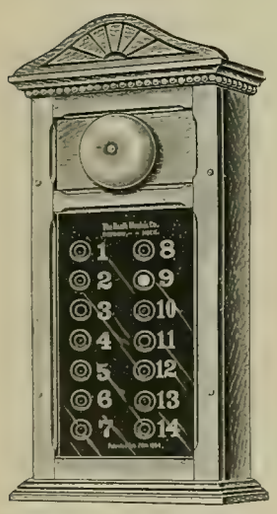
second type is accomplished by their having, instead of the usual "squirrel-cage" winding of the secondary, a regular winding connected up for three-phase star connection with terminals brought out to collector rings. From these rings wires are run to a controller with resistances, by operation of which the speed may be varied at will. The lower speeds are obtained when a large part of the resistance is cut in on the secondary circuit, thus dissipating the heat exterior to the revolving part. This type of variable-speed induction motor is adapted to hoisting and similar work requiring controlled-speed changes, and is largely used in mining localities. Wherever it is desired to obtain only two or three changes of speed, to run continuously at those speeds, it may be effected by a system of series and parallel connections of the primary windings, thus altering the number of poles according to the given speed changes desired. In this way lower speeds are obtained at better efficiencies.

All of the machinery described is equally adapted to two-phase or three-phase working. The particular conditions of any given case will determine which is to be used. The question of frequency is important and motors are designed to operate in frequencies from 3,000 to 7,200 alternations per minute, the lower frequency being somewhat better for power work. Arc lighting requires higher frequencies, but incandescent lighting is successful on frequencies as low as 3,600. The main advantage in selecting low frequencies for power work is that low speeds may then be utilized, and the efficiency and the torque are somewhat increased.

The numerous alternating-current electric-power installations recently made requiring variable speeds have been entirely successful. The most gratifying results have been obtained by the designers, manufacturers and users of this class of apparatus, insuring the commercial adoption of polyphase alternating current for all classes of power work.

Ideal Automatic Annunciator.

The Ideal automatic annunciator, shown in the cut, is intended for use in private dwellings, offices, railroad cars, steamboats, etc. By the automatic feature, one does not have to go to it after each call to reset it. The mechanism is so arranged that when a call is made, only that call is indicated. No confusion can arise regarding the call, as the last call is the only one indicated, as No. 9 in cut. If No. 7 is called next the indication at No. 9 disappears and No. 7 will be indicated, and so on.



IDEAL AUTOMATIC ANNUNCIATOR.

The mechanism is fastened securely to a metal base, rendering it durable. There are but two movable parts, which are easily understood. There is nothing of a complicated character about this annunciator, and it is said that when once properly installed it will remain in perfect order. The design is neat and ornamental, and the material and workmanship are of a high order. These annunciators are manufactured and sold under a guarantee by the Heath Electric company of Detroit, Mich.

Street-railway Feeders to Go Underground.

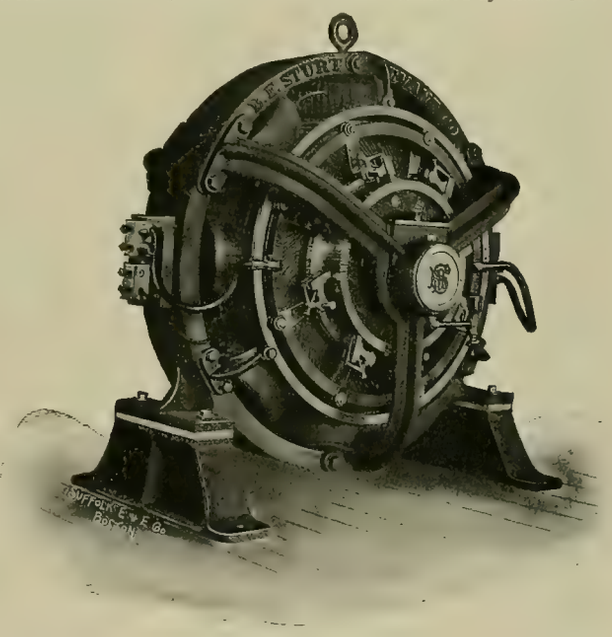
The Chicago City Railway company will soon commence to lay its feed wires underground on all streets where permanent paving improvements are being made. The feed wires are at present, in most cases, carried in cables fastened to the trolley poles. It is understood that the company named has entered into an agreement with the city, the Chicago Telephone company and the Western Union Telegraph company to share the expense of building conduits, and as a beginning six conduits will be laid in Archer avenue, extending from State street to the Chicago River, a distance of two miles, and the same number will be laid in Forty-seventh street, between State and Halsted streets. The plan of building the conduits was explained and illustrated in the Western Electrician of March 16th. This move on the part of the Chicago City Railway company is regarded as of great importance by the city's Department of Electricity.

Motor for Fan Driving.

The eight-pole type of motor lends itself particularly well to adoption for fan driving. Its comparative lightness and its compactness make it a comparatively simple matter to attach it to the side of the ordinary fan. The B. F. Sturtevant company of Boston, Mass., has been developing the electric fan along various lines during the last few years, and as an outcome has produced a type of eight-pole motor, illustrated herewith, which may be either attached directly to the fan side, or, as shown, supported upon feet and used as an independent machine.

The field ring, which also constitutes the frame, is of wrought-iron in the small, of cast-steel in the medium, and of cast-iron in the large size. The field cores are of wrought-iron and the pole shoes of cast-iron, of such peculiar shape and size as to render these machines capable of meeting extreme variations of load without sparking or the necessity of adjustment. The field coils are machine-wound, thoroughly insulated, and of such open construction as to secure the maximum radiation and ventilation. The armature core is built up of laminated slotted disks, which are solidly clamped between two brass rings having corresponding slots. The coils are machine-wound, of uniform size and shape, and thoroughly insulated, the armature being of the drum type.

The commutator is of large diameter, the segments being of fine drop-forged copper. For high voltages or small outputs at low speeds two sets of reaction carbon brushes are usually employed, and from the character of the design require no adjustment. Tripod bearing yokes are provided, as shown, except in the largest machines, which are equipped with special bases and pedestal bearings. The shaft runs in gun-metal sleeves and is lubricated by means of ring oilers. In this style these motors are built in powers ranging from three to 37½ horsepower at normal speed. In larger sizes a pedestal base is provided, giving the motor a still more substantial character. In all sizes these machines are built both as motors and generators.



MOTOR FOR FAN DRIVING.

Trenton Falls Power Plant.

The installation of the power machinery at the Trenton Falls (N. Y.) power plant has been completed and tested. The plant is to supply light and power in Utica, 12½ miles away. It is the plan of the company to develop 5,800 horsepower, which capacity may be doubled. The dam is 60 feet high, 228 feet long, 52 feet wide at the base and tapering to eight feet at the top. Each of the four turbines is of 1,700-horsepower capacity. There are also two turbines of 100-horsepower capacity each. The large turbines operate four 1,000-kilowatt alternators, the current from which is three-phase, at 2,200 volts. The transmission line runs from the plant to Utica over a private right-of-way, and the poles carry three No. 2 wires, forming one three-phase circuit. For transmission purposes the current is raised to 22,000 volts.

Butler, Ohio, has voted to issue $10,000 bonds for the erection of a municipal electric-lighting plant.

Carlisle & Finch Navy Searchlight.

The illustration shows one of the latest type of hand-controlled projectors furnished by the Carlisle & Finch company of Cincinnati for some of the new torpedo-boat destroyers and cruisers of the United States Navy. An 18-inch projector is shown. The specifications of the navy require a much better projector than is necessary for ordinary commercial use. In the first place, no iron or steel is used in the construction unless absolutely necessary, such as in magnet cores, etc., where no other material would answer. The carbon-feeding mechanism must be capable of working in any position and of feeding the carbons the entire length without any apparent difference in the voltage across the arc. The cylinder or the barrel of the projector must be capable of rapid rotation by hand or gradual rotation by means of gearing. A vertical elevation of 70 degrees above the horizontal and 30 degrees below the horizontal is required. Added to these requirements, the entire projector must be constructed in the best possible manner and must be absolutely reliable in its every part.

CARLISLE & FINCH NAVY SEARCHLIGHT.

The projector shown is required to pick out a white object 10 feet by 20 feet at a distance of 4,000 yards. Parabolic mirrors or Mangin mirrors may be used, and the projector is so constructed that either can be inserted in a few minutes. In case of an attack by torpedo boats, the light would be used at close range, and it is required to cover as great an area as possible. To do this, a special front cover is supplied which is fitted with a set of dispersion lenses. These lenses spread the light out horizontally, but not vertically, so that the water is illuminated for a wide range. The mechanism for transmitting vertical motion to the cylinder consists of a worm and wormwheel which may be thrown in or out of mesh like the back gear of a lathe. The trunnions for supporting the cylinder are adjustable.

The Carlisle & Finch company makes searchlights for all classes of sea, lake and river steamers.

Topics to Be Discussed at Niagara Falls.

At the convention of the National Electric Light association, to be held in Niagara Falls on May 21st, 22d and 23d, there will be read a paper on "Storage Batteries in Central Stations," by Augustus Treadwell, Jr. Other papers are promised as follows: "Arc Lighting at the Beginning of the Twentieth Century," by H. W. Hillman; "The Practical Side of the Incandescent Lamp," by F. W. Willcox; "The Foresee (4-C) System of Charging," by Louis R. Wallis; "A Station Load Diagram," by C. R. Van Trump, and "Distribution of Current at High Potential in New York City," by Calvin W. Rice. Reports will be presented by the committees on grounded circuits, rules for electrical construction and operation, standard candlepower of incandescent lamps, photometric values of arc lamps, analysis of flue gases, legislation regarding theft of current, amendments to by-laws, amendments to freight classification of electrical apparatus, legislative policy, and on uniform accounting. The topic, "Steam Heating from Central Stations," will be discussed.

The International Hotel has been entirely reserved for those attending the meeting. The respective passenger associations covering the territory east of the Mississippi River have granted a rate of a fare and one-third, on the certificate plan, for delegates and friends attending this convention, from all points in their territory to Niagara Falls and return.

Mercantile Electric Company of St. Louis.

An evidence of the growth of St. Louis as a distributing center for the large and rich country tributary to it, and also bearing testimony to the rapidly increasing trade in electrical supplies, is the recent incorporation of the Mercantile Electric company of that city.

This company has been started upon a sound financial basis and its officers are men long identified with the electrical trade. It has accepted the exclusive agency for the Western Electric company of Chicago and New York, with which it is closely identified, for the entire southwestern territory.

FIG. 1. MERCANTILE ELECTRIC COMPANY OF ST LOUIS.

The building occupied by the company, which is shown in the accompanying illustration (Fig. 1), is in itself an index of the thorough preparation this new company has made to handle the business in this field. A short description of the group of buildings, of which the illustration shows one, may prove interesting, as it is said that there are probably no other buildings in the country having equal facilities for the rapid transfer and shipment of merchandise.

The buildings are grouped about the mouth of the tunnel and at the terminus of the elevated structure, through and over which all freight from the east must pass that enters the city. The tracks of the western and southern lines extend to the same point, which is known as Cupple's Station. This station has become a feature of St. Louis, and well known throughout the transportation world. The occupants of the buildings comprising the Cupple group have direct access to the tracks of all the roads. Goods arriving in carload lots from any point in the United States are placed at the receiving door of the persons to whom they are consigned, dispensing with all hauling and requiring the goods to be handled but once. Shipping in carload lots is accomplished in like manner; cars are provided and placed at the disposal of the shippers on short notice. Fig. 2 illustrates the system. Small consignments and shipments are handled on a similar plan, except that, instead of a freight car, a hand truck, owned and controlled by the railroad company, is used. The goods are placed by the shippers, properly marked, upon these trucks, which are handled entirely by the employes of the railroad company.

The aggregate daily tonnage at this station is over 2,000 tons, equalling or exceeding that of most of the freight depots of the country.

The workings of this system are always more or less interesting to the business public, and the Mercantile Electric company extends to all an invitation to inspect its building and to see the system in practical operation.

The officers of the company have provided ample quarters for the large stock they intend to carry, embracing everything used in the business of electrical construction, and, aided by their shipping facilities, are in position to give prompt service.

A dispatch from Cumberland, Md., says that the Great Falls Water company has offered the trustees now operating the Chesapeake and Ohio Canal $75,000 for the use of certain water rights at Great Falls. An opposing company has offered, it is said, $100,000 for the water rights, and plans to erect a steel dam across these waters, to furnish power for generating electricity for use in Washington and other points. The opposition plans to generate 10,000 horsepower. James F. McLaughlin of Toronto, Can., is at the head of the syndicate.

Allis-Chalmers Company.

Further details of the combination of the E. P. Allis company of Milwaukee, Fraser & Chalmers and the Gates Iron Works of Chicago and the Dickson Manufacturing company of Scranton, Pa., are now given to the public. The new company is to be known as the Allis-Chalmers company. The valuations of the properties to be combined, made by Julian Kennedy of Pittsburg, are as follows: E. P. Allis company, $5,120,000; Fraser & Chalmers, $3,205,000; Gates Iron Works, $410,000; Dickson Manufacturing company, $1,200,000; total, $9,935,000. The E. P. Allis company says that its business for the fiscal year ended March 31, 1901, amounted to about $5,400,000, and that, owing to inadequate facilities, it was compelled to refuse orders for work in which it has practically no competition for as much more. Fraser & Chalmers say that the amount of work turned out from their Chicago plant amounts to from $2,750,000 to $3,000,000 per annum, and that their profits for the 18 months ended with June 30, 1900, amounted to $476,029.36. At the present time they have orders on hand for work to the value of $1,400,000.

It is proposed to capitalize the new company at $50,000,000—half preferred and half common—of which $16,250,000 preferred stock and $20,000,000 common stock is to be issued. Of the cash capital provided the sum of $2,500,000 is to be expended immediately in doubling the capacity of the Allis works. It is proposed to take over the business of the several companies as of April 1st, under the management of the present officers of the E. P. Allis company and of Fraser & Chalmers. The board of directors will be constituted as follows: Edward D. Adams, New York; Charles Allis, Milwaukee; Mart T. Cox, Orange, N. J.; James H. Eckels, Chicago; Elbert H. Gary, New York; William A. Read, New York; James Stilman, New York; William W. Allis, Milwaukee; Frank G. Bigelow, Milwaukee; W. J. Chalmers, Chicago; William L. Elkins, Philadelphia; Henry W. Hoyt, Chicago; Max Pam, Chicago; Edwin Reynolds, Milwaukee; Cornelius Vanderbilt, New York.

The officers announced for the first year are: Chairman board of directors, William W. Allis; president, Charles Allis; chairman executive committee, W. J. Chalmers; chairman finance committee, William A. Read; treasurer, W. J. Chalmers; general counsel, Max Pam; chief engineer, Edwin Reynolds. The secretary and assistant treasurer and the comptroller are to be designated by the bankers in control of the syndicate.

FIG. 2. MERCANTILE ELECTRIC COMPANY OF ST. LOUIS.—VIEW SHOWING SHIPPING FACILITIES.

Power Plant at Garvin's Falls, N. H.

The Manchester Light and Traction company of Manchester, N. H., has awarded the contract for its new power house at Garvin's Falls, on the Merrimack River, to the Head & Dowst company of that city. The contract calls for a building 75 by 67 feet, one story high, with decorative wire tower surmounting it. The generator room will be 64 by 36 feet, and the wheel room will occupy the remainder of the floor space.

Every vestige of the present plant, except the dam, will be removed, and the entire equipment will be made thoroughly up to date.

The initial installation of machinery will be two 1,000-horsepower, revolving-field, three-phase generators, direct-connected to the waterwheel shaft. The ultimate capacity of the plant will be about 10,000 horsepower, which will be transmitted to Manchester, 16 miles distant, except what is required to light the villages of Pembroke, Suncook and Hooksett, which are situated along the route.

The company operating this plant was formed by a combination of the several lighting and power companies and the electric-railway company of Manchester, under the management of H. Brodie Smith.

C.

Long-distance Transmission of Steam-generated Power.

Work has recently been completed on the power plant of the Cochiti Gold Mining company, near Bland, N. M. The expense of hauling coal to the mines was very great. The company, therefore, built a power plant at a coal mine in Madrid, a distance of 32 miles, connected it with the mines, and now electrical energy is furnished for all the machinery in the mines. Difficulty was experienced in getting water for the generating plant, but that was overcome by going nearly three miles to a river, equipping pumps operated by motors and forcing the water through a four-inch pipe to the power house at the coal mine. Many obstacles were encountered in building the feed line to the mines, it being necessary to cross many "arroyas" and to build through a narrow canyon for several miles. In some places poles had to be hauled several hundred feet up the side of the canyon. Fifty per cent. more work is being done at the gold mine at less than a quarter of the former cost when the old steam plant was used.

Electric and Steam Railroad Crossings.

The commissioner of railroads in the state of Michigan is opposed to the approval of grade crossings of electric and steam roads, and refuses to approve any grade crossings of this nature over the main line of any railroad. While this position has met with some opposition on the part of builders and promoters of electric railways, it is being maintained consistently, it is said, and in the construction of electric lines points are being selected for crossings where a separation of the grades can be accomplished at the least possible expense.

It is asserted by the commissioner that, owing to the great number of projected electric lines in the state, if grade crossings be allowed at all desired points, the high rate of speed so desirable, and even necessary, in first-class passenger traffic will be impossible, as all trains are required to approach crossings at a limited rate of speed and under control. It is also stated that the cost and expense of the construction of either an overhead or undergrade crossing is but little, if any, more than the expense of a first-class interlocking plant, such as is always required at such crossings, and, having once been constructed, the expense of maintenance is very small as compared with the expense of maintenance and operation of the interlocking. Also, that the danger of accident at crossings is avoided by a grade separation, while, no matter how perfect the mechanical appliance may be, there is always some danger at a grade crossing, and without reference to the saving of human life, the expense of one accident may often be enough, from a purely financial viewpoint, to separate the grades upon an entire line

An Extensive Trolley Belt Line.

Work was recently begun at Chesapeake City, Md., upon a trolley belt-line railway, which is to be built in Delaware and Maryland. The company, which is known by the title, Peninsular Traction company, expects to put $5,000,000 into the construction and equipment of the road, which will connect many of the prominent cities and towns in the two states. The road, starting from Wilmington, Del., will be built to North East, Md., on the Chesapeake Bay, a distance of 32 miles, and will run through Newark, Del., Elkton, Md., and Chesapeake City, Md. Another circuit will be built from Wilmington, Del., to Rehoboth Beach, Del., on the Atlantic coast, a distance of 130 miles, and will run through Delaware City, Del., Chesapeake City, Md., Cecilton, Md., Middletown, Del., Bombay Hook, Del., Dover, Del., and Milford, Del. The road is chartered to carry both passengers and freight and is designed to give direct transportation to all farmers in that section. The surveys show that a regular speed of 25 miles an hour can be maintained without difficulty. All the passenger cars will be vestibuled and will have smoking compartments. In addition to the three power houses which supply power to the 45 miles of road now in operation, several others will be built. The moving of freight will be an important item in the business of the road. Delaware will furnish peaches and canned goods, and Maryland, canned tomatoes, grain and oysters. The people interested in the road include prominent Philadelphia capitalists, as well as many from Delaware and Maryland.

Navy Wants an Electrical Expert.

The following advertisement, from a Washington (D. C.) paper, is self-explanatory. It will be seen that the requirements for a position paying at most $2,200 a year are rather exacting.

Wanted—Electrical and mechanical expert. An examination of applicants will be held at the Navy Yard, Washington, D. C., May 17, 1901, for electrical and mechanical expert in the Bureau of Yards and Docks, Navy Department. The pay will be fixed at $7.04 or $6 per diem, as the result of the examination may warrant. The examination will be open only to those who can give evidence of having received a degree in an electrical or mechanical course from an institution of learning in good standing, and who have since then had at least three years' experience in the design, manufacture or supervision, during or after installation, of electrical machinery, including the various types of dynamos and motors and modern methods of electrical distribution of power for industrial purposes, and of steam plants, including engines, boilers, piping, valves, and all accessories, and who are familiar with the requirements and use of other machinery required for navy yard work, including centrifugal pumps, machinery operated by hydraulic power, machinery operated by pneumatic power, plants for heating and ventilation, central electric power and lighting plants, wiring, telephone systems, storage-battery plants, etc. Applications will be addressed to the Commandant, Navy Yard, Washington, D. C., and must be delivered to him on or before Thursday, May 16th. No application received after that date will be considered. Each applicant will state in his application his name, age, residence, citizenship, present occupation and previous employment or work done. The applications will be accompanied by evidence of citizenship, and by certificates, preferably from previous employers, as to character, habits of industry and sobriety, and skill and experience in work of the kind required. F. W. Hackett, Acting Secretary of the Navy.

New York capitalists have been investigating the waterpower of the Delaware River at Foulrift, between Phillipsburg and Belvidere, N. J., with the view of building a plant to convey power to Easton, Phillipsburg, Belvidere and other places. The State Geological Survey places the power available at 1,632 horsepower at the lowest stages of the river, with an average of 5,920 horsepower all the year around. The Delaware River Electric Power company has been incorporated, with a capital stock of $500,000. The following-named officers have been elected: President, A. J. Cooper, New York; secretary, William A. Selby, Buffalo; directors, G. M. Steward, R. G. Williams and I. H. Eckersley.

CORRESPONDENCE.

New York Notes.

New York, May 4.—Telephone and telegraph men were at work nearly all day on April 28th, installing telephones and tickers in the temporary quarters of the Stock Exchange in the Produce Exchange building. A total of 463 telephones was removed from the old exchange and set up in the new quarters before the afternoon was much more than half over. Late in the afternoon the annunciator, a contrivance that summons the brokers to the door or railing when they are called for, was set up. This was a hard piece of work, for the board had to be carried to the new quarters in sections.

At eight o'clock to-night the last car on the Lexington avenue cable line will leave One-hundred-and-fifth street and make a round trip over the line. Service will then be suspended and the system will be changed to the electric conduit system. On May 11th the Columbus avenue line will be changed to electricity, and the Broadway system will be changed on May 18th, which will leave New York without a cable line.

By a decision of the Court of Appeals, the Nassau Electric Railroad company is given the right to construct a two-track railway in Union street, from Hamilton ferry to Ninth avenue, Brooklyn. The question of using Union street for a railway has been in litigation since 1892. The new line will connect with the Ninth avenue line, which will give the residents of South Brooklyn a direct service to the seashore.

Prof. Michael I. Pupin of Columbia University lectured in Carnegie Lyceum on Tuesday evening on the subject of "Electrical Wave Transmission." He gave a series of experiments to illustrate the theory which, applied to submarine telephony, will, in his opinion, enable New York to talk with London and Paris as easily as with Chicago or Cleveland. Professor Pupin said: "There is nothing wonderful in talking across the ocean. It only seems wonderful because we have not done it. It is entirely practicable. It will be done one day and then we will say it is wonderful, but it will be only for a short time."

Energetic methods are being introduced in the operation of the Brooklyn Rapid Transit lines by President Greatsinger. The announcement has been made that a direct line of cars from Williamsburg and Greenpoint to Coney Island will be put in operation at once, doing away with the transfer system. By connecting with several of the ferry lines, the company will draw heavily from the East Side.

The commissioners of the Park Department have adopted a new rule governing the operating of automobiles in Central Park. The new rule is as follows: "No automobile or horseless vehicle shall be driven upon or over a grade at a rate of speed greater than seven miles an hour, and on meeting a horse-drawn vehicle or an equestrian this rate of speed shall be reduced to three and a half miles, until the horse or horse-drawn vehicle shall have passed, except under the provisions of a permit issued by this department." Commissioner Clausen said the rule would be modified as soon as the steam automobile had been here long enough to let the horse become used to it.

Considerable work has been done on part of the East Side branch of the rapid-transit subway. A shaft has been sunk at Central Park West and One-hundred-and-fourth street, and from it about 2,000 feet of tunnel has been excavated, extending to One-hundred-and-thirty-second street and Lenox avenue. More than 550 feet of this distance is in Central Park. Beginnings have been made at One-hundred-and-twelfth street, One-hundred-and-sixteenth street, One-hundred-and-twentieth street and One-hundred-and-twenty-sixth street. The engineer at work on the section estimates that the work actually finished amounts to about one-fifth of the total to be accomplished. G.

New England News.

Boston, May 4.—The transfer of the stock of the Enfield and Longmeadow Electric Railway company to Messrs. Perkins of Hartford, Wilson of Boston and Wagner of New York, is a step in the scheme to form a through trolley line between Hartford, Conn., and Springfield, Mass. The prospective purchasers of this line have secured control of the East Windsor Street Railway company, which was recently organized under a grant from the Connecticut Legislature, and which proposes to build a trolley line to cover the gap of 4½ miles between Warehouse Point and East Windsor Hill. It is stated that the company has made traffic arrangements with the Hartford Street Railway company and the Springfield Street Railway company, whereby its cars can run into both cities. The rights for a through trolley line are thus practically assured.

On April 29th the New England Electric Vehicle Transportation company held a special meeting in Jersey City, N. J., at which it was unanimously voted to cancel the contract with the Electric Vehicle company of New Jersey and dissolve the company. The number of directors was reduced to three—F. R. Hart, president, and C. L. Edgar of this city and James E. Hayes of Jersey City. This board was granted full powers in winding up the affairs of the company. It is expected that a report as to the pro-rata distribution will be ready for the stockholders before June 1st.

Automobilists in this city are talking of going to the Buffalo exposition in their own vehicles. There may be an endurance test arranged in connection with these trips.

Baron Revelstoke, the head of the London banking house of Baring Brothers, and his brother, Cecil Baring, have been in Boston inspecting the Boston elevated road. They are interested in several English electric railways.

One firm in Boston still has faith in the electric delivery automobile. It has used one since March 1, 1899, and it has proved so convenient, expeditious and economical that the firm is planning to have two more built. The one now in use was built by the Pope company from plans drawn by a representative of the firm. It weighs 4,100 pounds, has a capacity of 1,000 pounds, and its battery will carry it 18 miles without recharging. It has done the work of two horse teams. It has carried 2,500 pounds of merchandise and two men without strain. Its designer thinks he can have an automobile constructed that will carry 5,000 pounds. He says the great secret of successful operation is intelligent care of the vehicle. The firm has its own dynamo for lighting and heating its store, and its outlay for power is thus reduced to the minimum.

Wallace D. Lovell, who controls electric-railway companies owning plants costing $1,500,000 to complete, will build an immense power plant at Portsmouth, N. H., which will cost $600,000 and will supply power for all his roads. In some cases the power will be transmitted over 30 miles, but the cheapness of fuel at Portsmouth will more than compensate for the loss of power by transmission.

The Boston Electric Light company has sold its large and valuable corner lot opposite the Southern Terminal station. The lot was formerly occupied by the company's central power station. It has an area of 31,730 square feet.

Mrs. Annie G. Quiner of Marblehead, Mass., has sued George Newcomb of Salem for $15,000. She asserts that, while suffering from an abdominal trouble, Mr. Newcomb subjected her to the X-ray for 50 minutes for the purpose of obtaining a skiagraph. She says that while the ray was being applied she felt a burning sensation, and later a large blister appeared and burst, leaving a sore which has not healed.

Within the last month the managers of several electrical companies in this city have received demands for increases in their linemen's wages. At present linemen receive $2.50 a day of nine hours, and foremen receive $3 a day. The demands were for $3 and $3.50, respectively, for a day of eight hours. A conference took place on Tuesday, and President Bancroft of the Boston Elevated Street Railway company assured the committee that most, if not all, of its demands would be granted. Upon the report of the committee, the Electrical Workers' Union decided to defer a strike until every possible means for amicable settlement had been tried. A conference between the linemen and the New England Telephone and Telegraph company did not result satisfactorily to the linemen. Later, the linemen declared their willingness to accept $3 for a day of nine hours.

On Thursday the eight linemen employed by the Quincy Electric Light and Power company made demands in that city for $3 a day of nine hours. Superintendent Austin refused to increase the wages from $2.50, which the company now pays. This morning a general strike of the linemen was begun. Twenty-eight men in the emergency department of the Boston elevated railway did not go out until noon, but all other men employed by the following-named companies refused to go to work at 7 a. m.: Boston Elevated, 120 men; New England Telephone, 150 men; Cambridge, Brookline, Malden, Somerville, Quincy and Boston electric-light companies, 81 men; Suburban Gas and Electric Light of Beachmont, 15 men. The union will not call out the men employed by police and fire departments, owing to the possible resulting danger to life and property. The companies affected furnish light and power to Woburn, Brockton, Chelsea and intermediate places.

The directors of the Hartford (Conn.) Electric Light company have decided to recommend an increase of $350,000 in the capital stock, which now amounts to $1,050,000. The proceeds of the increase will be used in placing high-tension wires underground and retiring an old issue of six per cent. first-mortgage light and power bonds, amounting to $150,000.

The New York, New Haven and Hartford Railroad company is again about to replace steam with electricity as a motive power on its branch lines between Providence and Bristol, R. I., 14 miles, and between Providence, R. I., and Fall River, Mass., 19 miles. Electricity was substituted for steam on these lines in December, but did not prove a success, and steam was reinstated. B.

New Hampshire.

Concord, N. H., May 4.—The Boston, Concord and Montreal Railroad company (leased to the Boston and Maine railroad) has nearly completed its survey for an electric road from Concord to Nashua, 38 miles, paralleling its steam tracks, part of it on its own right-of-way, but most of it on highways. A line will be built to the state fair grounds.

One of the amusing things in the last Legislature was the petition of Manchester electrical men to change the name of the New Hampshire Typographic association to the Manchester Light, Power and

Traction company. This old charter was granted to Stilson Hutchins and others to build and operate typesetting machines (linotypes), and at several times was amended until, as it stood before the Legislature, it covered all that the Manchester company wanted—electric lighting, street railways and power distribution. No one seems to know why this method of securing a charter was chosen, unless it was to save the charter fees for a new one.

A. H. Albin, the newly elected manager of the Concord street railway, is making extensive improvements. The track will be relaid this season from narrow to broad gauge, and new cars and trucks will be added. Several extensions are contemplated. Mr. Albin is a Concord young man and has been through an exhaustive course in street-railway work, both theoretical and practical, and will bring the road up to modern standards of street-railway practice. C.

Canadian Intelligence.

Ottawa, Ont., May 4.—The Windsor and Chatham Radial Railway company, having secured right-of-way through several townships in Essex County, Ont., will abandon the Talbot road route at Leamington, and run on the middle road to Chatham, as the latter way will reach more inhabitants. The road is 80 miles long, and will cost $800,000 to build and equip it.

The City Council of Vancouver, B. C., has granted an 18-year franchise to the Stave Lake Power company to supply light and power within the city. The company must deposit $25,000 as a guarantee of good faith. It agrees to supply the city with power at a maximum rate to carry on its own lighting system in the event of the city buying out the present lighting company.

The new Montreal Light and Power company is adding to the generator capacity at Chambly power house. The additions are to be Westinghouse apparatus, and the voltage now will be 20,000, stepped up by transformers, and not taken directly off the generators, as was the case with the original S. K. C. generators, current from which was taken off at 10,000 volts. This doubling up of voltage will, of course, give the company greater carrying capacity on its lines, and it is evident that it intends selling electricity on an extended scale. It also shows that it has its present plant well loaded up.

The Metropolitan Power company at Britannia, near Ottawa, has had a large force of men at work all winter, and the gigantic power canal is well on toward completion. Before this canal can be cut through to the river, however, an immense cofferdam will have to be constructed, to hold the river water back while the work of rock cutting is pushed ahead; work on the big power house will be commenced at once. It is expected that water will be let into the canal in September next. At present the rock is being removed at the rate of about 250 carloads per day. Timber is being placed in position for the construction of the permanent cofferdam, and concrete will be manufactured for the piers and power houses. W.

From the Buckeye State.

Columbus, Ohio, May 4.—The outlook for the speedy completion of the Scioto Valley Traction company, which is authorized to build a line from Columbus to Lancaster and another to Chillicothe, is very good. Barney Mahler, the street-railway financier of Cleveland, was in Columbus a few days ago, and he and William Burdell, a Columbus capitalist, drove over the Lancaster route. Mr. Mahler was very well pleased with prospects. Later on he will drive over the Chillicothe and Portsmouth routes also, and the matter of building the lines will then be mapped out.

The Columbus, London and Springfield Railway company will be in position to operate cars on a portion of its line out of Columbus within the next five weeks. The cars will be placed on the Grove City line, which is owned by the same parties, in a few days. They will use the loop.

The work of grading the Columbus, Buckeye Lake and Newark line is progressing nicely, and the company, which is closely allied with the company mentioned in the preceding paragraph, proposes to push the construction as rapidly as possible. This will make three lines out of Columbus that are practically in the hands of the same people, and the fourth one will extend to Delaware and Marion. It will be something like the system of interurbans running out of Cleveland.

The work of construction has commenced on the Canton-Akron Electric Railway company's line about four miles north of Canton.

It is stated that there is a lively contest on between the Everett-Moore syndicate and Richard Palmer as to who shall connect Cleveland and Pittsburg by electric roads. Both have interests that will aid in making the connection, and the prize seems to lie in the possibility of reaching Youngstown early. It is said that the Mahoning Valley lines will make traffic arrangements with the first road that connects that town and Cleveland.

Daniel J. Ryan, counsel for the Miami and Erie Transportation company, says that the electric line along the canal will be completed between Cincinnati and Dayton by January 1st, and that the "electric mule" will then be a reality.

The plans of the Dayton, Fort Wayne and Cincinnati Traction company, incorporated some little time ago, contemplate a big enterprise, which, if successfully carried through, will make it one of the largest electric-railway properties in the central states. The scheme is to build a line 300 miles in length, extending from Dayton, Ohio, to Fort Wayne, through the western and northern part of this state, and from Fort Wayne on to Union City and Decatur, thence back to Cincinnati and Dayton. In addition to this, it is proposed to build several branches, the entire cost of construction and fitting being estimated at $3,000,000. The power house, according to the present plans, will be located at Celina. The company is capitalized at $100,000. It is said that it will be made a freight road as well, the trains to be operated by electric motors.

Dr. Washington Gladden's ordinance providing for the issue of bonds to the amount of $110,000, for the purpose of erecting a municipal light plant in Columbus, has been passed by the council.

The Trumbull county commissioners have granted the Cleveland, Garrettsville and Warren Electric Railway company a franchise to build a line west from Warren to the county line at Phalanx station. This company is an adjunct to the Cleveland and Chagrin Falls road.

The Everett-Moore syndicate a few days ago closed a deal for 50,000 tons of steel rails, or more than enough to build 500 miles of new road, at a cost of more than $1,500,000. The rails will be used on the lines in which the syndicate is interested—the Scioto Valley Traction company, the Detroit and Toledo Shore line, the Columbus, Delaware and Marion, the Dayton and Cincinnati line and others. In all it is estimated that the syndicate now has sufficient material to build 700 miles of electric road, and all this it is proposed to use this summer and fall. Considering that this is one syndicate only, some idea may be obtained as to the great development in this state that is contemplated for the future. There are numerous other smaller enterprises and some large ones that will no doubt prove successful.

The Westinghouse company has awarded the contract for furnishing some of the equipment for its English works to the Niles-Bement-Pond company of Hamilton, Ohio, the amount of the purchase being over $420,000.

It is said that the Everett syndicate has purchased 100 acres of lake beach north of Monroe, Mich., which will be known as Bonnerforce Beach, and will be used during the summer as an outing place for the patrons of the electric railway between Toledo and Detroit.

Superintendent Nichols Hamilton of the Youngstown and Sharon electric road and Miss Alice B. Hayes of Pittsburg were married Monday morning. The young couple are receiving congratulations.

The Lorain Steel company has been awarded the contract for furnishing a large quantity of steel rails by the Dundee corporation, Scotland. The order also included fishplates and other supplies for use in building electric railways.

A report from Canal Dover says that the Canton-Akron Electric Railway company, with Chauncey Eldridge of New York and others, has formed a plan to connect Cleveland and Cincinnati. It is supposed that the proposed Canton-Akron line will be made the basis of the new system.

There is little doubt but that the deal by which the Everett-Moore syndicate gets the Toledo, Fremont and Norwalk line has been closed. Negotiations have been pending for some time, and everything points to a settlement of the matter. It is stated that George S. Stomart will be the general manager.

The Cincinnati Traction company has increased the wages of the employes, and they now stand as follows: Those who have been in the employment of the road six years, 21 cents an hour; those who have served three years, 20 cents an hour; all others, 19 cents an hour. It is said that 350 men are benefited by the increase.

The Niles Car and Manufacturing company of Niles, Ohio, has been incorporated, with a capital stock of $200,000, to manufacture electric cars, motors and other electric-railway supplies. The incorporators are C. P. Souder, B. F. Pew, F. J. Roller, D. J. Finney and George B. Robbins. O. M. C.

Information from Indiana.

Indianapolis, May 6.—The welcome break in the long spell of bad weather that tried the patience of promoters and contractors has improved the electric-railway conditions in this state. Surveying parties are at work on half a dozen electric routes, and much activity is displayed in the securing of private rights-of-way. Rival companies are hurrying to get into Martinsville. J. C. Tarkington of the Indianapolis and Martinsville Traction company and R. E. Field of Cincinnati, representing Cincinnati and New York capitalists, say they have secured $600,000 with which to build their line. Work is to begin as soon as options on right-of-way are secured. The company has abandoned its idea of building on the public highway. Meantime, the preliminary survey for the electric road that C. F. Smith and others intend to build from Indianapolis to Martinsville has been completed. The private right-of-way is being secured, and Mr. Smith says the estimates on which the construction will be let will be ready in a few days. There is much conjecture as to which company will throw the first spadeful of dirt and as to whether the success of one company will put the other out of business. J. E. Lowes of Dayton, Ohio, one of the best known managers of electric roads in the country, is said to be interested in the Tarkington company, and will personally superintend the building of the road.

At Shelbyville the situation is complicated. Several landowners oppose the building of steam and electric railroads across their farms and have planted nitroglycerine in the right-of-way surveyed by order of court. Workmen fear to disturb the earth and refuse to enter these farms. Some of the best people of Shelbyville are involved in these troubles and the entire community is watching the proceedings. Sentiment is pretty evenly divided.

The Richmond Street and Interurban Railway company filed articles of incorporation during the last week. The company succeeds to the property and franchises of the Richmond City Railway company, sold by order of court last week. The new company has a capital of $500,000, with right to increase it to $1,000,000. The directors of the new company are James Murdock, William Wallace, Lafayette; Hugh J. McGowan, Indianapolis; J. M. Lotz, Richmond; Philip Mater, Marion; Perry Freeman, Richmond; J. W. Vandyke, Lima, Ohio, and H. B. Smith of Hartford City. Mr. Smith has been made president, and Mr. Murdock, secretary. This unusual combination of interests of well known electric-railway men is responsible for much speculation as to what the ultimate purpose of the company may be. It is predicted by some that it is the beginning of a consolidation of the most important interurban lines in the state.

The Central Traction company, headed by Frank Maus Fauvre and J. W. Chipman of Indianapolis, has also filed articles of incorporation, with the declared purpose of building an electric line to Richmond. Thus it may be seen that electric-line communication from Indianapolis to surrounding cities is becoming interesting.

The latest traction-railroad project in the gas belt contemplates the construction of an electric line from Shirley to Muncie. Local capitalists stand ready to furnish most of the money. The estimated cost is $1,000,000, and subsidies will be asked. It is probable that a consolidation of interest with the Newcastle-Muncie road will be effected. The proposed line is regarded as important and promising.

F. G. Brownell has sold his proposed electric road from Muncie to Hartford City to S. M. Baxter and S. A. Schoner of Cleveland, who will begin the construction immediately. Brownell retains an interest, and will likely be general manager.

Perry Bradford of Campbell's Station is showing much public spirit and liberality by offering to donate the right-of-way and to build a station costing not less than $1,000, if the electric railway proposed by Charles Finley and others from Bloomington to Martinsville pass through his farm.

The Indianapolis and Rushville Electric Railway company is awaiting with much interest the outcome of the town election this week. The present Town Board is attempting to "hold the company up" in the matter of franchise. It is hopeful that a new board, with more liberal views, will be elected; otherwise the company will survey a route around the town.

A peculiar question has arisen at Anderson. The township assessor has assessed the central power house of the Union Traction company for taxation, and the assessors of adjoining counties through which the trolley wires and current pass insist that it be taxed by the state board as "general rolling stock," so that each county may share the tax. The power house is valued at $700,000, and the company's line at $8,000 per mile. The courts may be called on to decide if the electric current is taxable aside from the power house.

The steam railroads have announced that fares will be reduced 50 per cent. when they come in competition with electric lines. They will issue round-trip tickets good for one person on a round trip or two persons one way, these tickets good for three months. A war between trolley and steam lines is inevitable.

The Bloomington Electric Light company has secured a 50 years' franchise at $85 a lamp. The plant has been rebuilt and equipped in detail.

The Hammond Illuminating company has been incorporated, with a capital of $350,000. The company proposes to supply gas and electric light to the city and citizens of Hammond. The board of directors is headed by ex-State Senator W. H. Gostlin.

The L. B. Root company of Terre Haute is constructing an independent electric-light plant of sufficient capacity for lighting its own store and other buildings in the vicinity.

The Lake Erie and Western railroad has appealed from a fine of $50, imposed by the city of Alexandria, for failure to maintain arc lights at street crossings. The validity of the law and ordinance will be tested in the courts. If decided in favor of the city, other cities in the state will pass similar ordinances.

James F. Shuman of Angolia has been elected secretary of the electric-railway company that is building a line from Angolia to Goshen, by way of Orland and LaGrange.

Municipal electric lighting is contemplated by Freemont and Brazil. The former will build its own plant and the latter proposes to purchase a plant on the installment plan, at a price not to exceed the amount now paid for light. The Brazil Electric Light company's contract expires next January.

There is much opposition to the plan of the Indianapolis Board of Public Works to let the new public electric-lighting contract. It is charged that the two local companies have pooled their interests.

The present contract does not expire until two years from next July. The board's excuse is that it desires the successful bidder to have time to erect a plant, if necessary. F.

PERSONAL.

Mr. Harry Rolfe of the International Correspondence Schools, Scranton, Pa., has accepted an important position in the mechanical-engineering department of the Westinghouse Electric and Manufacturing company, Pittsburg, Pa.

Dwight B. Cheever, who for the last four years has been first assistant to Robert H. Parkinson in the practice of law, announces that he has opened an office at 1612 Monadnock building, Chicago. As heretofore, he will give special attention to patent law.

E. M. Deems of New York has been appointed western agent for the Gordon Battery company, to succeed George W. Patterson. His office will be at 358 Dearborn street, Chicago. William C. Banks, electrician for the company, was in Chicago to consummate the change.

Frederick H. Chamberlain of the General Electric company will sail from San Francisco some time this month, to superintend the installation of a plant at Sydney, N. S. W., for the Australian Tram company, for the equipment of which the General Electric company has the contract.

Owing to the determination of the United States Steel corporation to concentrate all the operating departments of the constituent plants at Pittsburg, Charles M. Jarvis, vice-president, in charge of the operating department of the American Bridge company, has resigned, as he does not care to change his residence from New England.

Edward B. Pillsbury, New England superintendent of the Postal Telegraph-cable company, sailed for Antwerp from New York on the steamer Zealand on May 1st. A number of Postal officials were at the dock to wish their colleague a pleasant voyage. Mr. Pillsbury will go from Antwerp to Vienna, thence to London. He will return to this country the latter part of June. During his absence Assistant Superintendent Charles E. Bagley will be acting superintendent in New England.

Frank Stevens, for 20 years chief operator in the main office of the Western Union Telegraph company in Boston, died at his home in Chelsea, Mass., on April 28th. He was born in Laconia, N. H., April 25, 1845, and entered the telegraph service in September, 1859, as a messenger for the Bain company in Concord, N. H. He was operator for the American Telegraph company in Concord at the time of that company's consolidation with the Western Union company in 1866, when he was transferred to the Boston office.

Frank H. Clark, well known throughout the country as an electrical sales manager, has accepted the position of western manager of the Helios-Upton company, with headquarters in Chicago. Mr. Clark will have charge of the Chicago factory of the company, as well as the supervision of the selling end of the business in the West. His wide experience and extended acquaintance among electrical men cannot fail to make his services of great value to the company with which he is connected.

The Methodist Episcopal Church at St. Marys, Pa., on Tuesday evening, April 30th, was the scene of a beautiful wedding, that of Mr. J. S. Speer to Miss Helen Mann Fryling, daughter of Mr. and Mrs. Henry Y. Fryling. After the ceremony there was a reception at the residence of Mr. Fryling from 8 until 9:30 p. m., when the bridal couple left for the East. Mr. J. S. Speer is well known to all consumers of carbon in its various forms throughout the United States, and his marriage will doubtless be somewhat of a surprise to his host of friends. He is general manager of the Speer Carbon company. Miss Fryling is a handsome and charming young lady, prominent in St. Marys' social, literary and church circles; in fact, she is the leader of the select set which dominates society in that pretty little town. At the present time Mr. and Mrs. Speer are at the Imperial, New York, where they are being entertained by their many eastern friends. The newly wedded pair will return to St. Marys after a short stay in Buffalo to visit the Pan-American Exposition. The Western Electrician joins with other friends in extending hearty congratulations.

ELECTRIC LIGHTING.

An electric-light plant will soon be built at Collins, Miss.

An electric-light plant is being erected at Knightstown, Ind.

The Belt Line railway of Bristol, Tenn., will install an electric-lighting plant.

Starke, Fla., will issue $18,000 of bonds for the erection of an electric-light plant.

Baker City, Ore., has voted to issue bonds for the erection of an electric-light plant.

The Compton Land, Water and Electric company, Los Angeles, Cal., has been incorporated, with an authorized capital of $500,000. J. R. Compton, G. W. Cox and G. D. Sanford are the incorporators.

The Hastings Electric Light and Power company, Hastings, Mich., capitalized at $60,000, is in process of formation, and electric-lighting service will be furnished Hastings, Middleville, Nashville, Caledonia and Lake Odessa.

The Hudson River Electric company, Albany, N. Y., has been incorporated, with $1,000,000 capital stock. The object of the company is to furnish light, heat and power. The incorporators are C. H. Peddrick, J. M. Warren and F. G. Baker.

A dispatch from Amsterdam says that the Dutch government has granted a 30-year concession to Messrs. H. R. der Mosch and H. Jul Joostenz of Batavia, Java, for the erection of electric-light and power plants in the cities of Padang and Djokjakarta in Dutch East Indies. Padang is the largest city on the west coast of Sumatra, having a population of 35,000. Djokjakarta contains 85,000 and is on the north coast of Java.

ELECTRIC RAILWAYS.

The Jackson and Suburban Traction company of Jackson, Mich., will soon erect a new power house.

Work on the grade of the Aurora, Wheaton and Chicago electric railroad has begun at Maywood, Ill.

The Sharon Street Railway company and the Greenville Street Railway company have applied for franchises in the village of Greenville, Pa.

I. A. Blackburn and G. W. Taylor, representing the Cleveland-Chagrin Falls consolidated companies, have applied for a franchise for an electric railway from Warren, Ohio, to the Portage county line, by way of Leavittsburg and Phalanx.

The Buffalo, East Otto and Cattaraugus Railway company, Buffalo, N. Y., has been incorporated, with $800,000 capital stock, and proposes to construct and operate an electric railway from Cattaraugus to Hamburg or to Buffalo, a distance of 35 miles.

The Chagrin Falls and Cleveland Railway company of Akron, Ohio, has been incorporated, with $10,000 capital stock, by C. W. French, V. A. Dehnee, C. D. Crouch and others. The purpose is to construct an electric line from Cleveland via Chagrin Falls to Youngstown.

The electric street railway between Charleston and Mattoon, Ill., will soon be built. At a meeting of the directors in Charleston it was decided to increase the capital stock from $125,000 to $200,000. The Charleston-Mattoon line will be 12 miles long. F. Bolton of Huntington, Va., is president of the company. C. Fairbanks of Terre Haute and M. R. Williams of Indianapolis are also interested.

Lee County (Ill.) farmers are promoting an electric railroad to run from Steward, in the eastern party of the county, to Dixon, by way of Lee Center and Amboy. The farmers are doing everything they can to make the road a success, and will provide free right-of-way next to the highway. It is thought that there will be no difficulty in raising the money for the building and equipment of the road.

PUBLICATIONS.

The Kuhlman Electric company of Elkhart, Ind., has issued a pamphlet descriptive of its oil transformers, which it builds in sizes from 10 to 500 lights.

The Peru Electric Manufacturing company of Peru, Ind., has just issued a series of six booklets on various articles which it manufactures. The latest is one on a porcelain handle and porcelain cross-bar baby knife switch, that is approved by the National Board of Underwriters. The booklets are sent upon application, free of expense.

SOCIETIES AND SCHOOLS.

At a recent meeting of the executive committee of the International Association of Municipal Electricians in Niagara Falls, N. Y., it was decided to hold the annual convention in that city on September 2d, 3d and 4th. A committee, consisting of Morris W. Mead, F. C. Mason and J. W. Aydon, was appointed to select topics for the papers to be read at the meeting. The new convention hall of the Natural Fruit company was selected as the place in which to hold the sessions. After the meeting of the committee the members visited the Pan-American Exposition grounds and buildings.

The next regular meeting of the American Society of Mechanical Engineers will be held at the Plankinton House, Milwaukee, Wis., on May 28th to 31st. Among the papers scheduled to be presented at the meeting are the following: "Method of Filing and Indexing Engineering Literature," by George H. Marr; "Rules for Drawing Office," by A. W. Robinson; "Requirements of Electricity in Manufacturing Work," by W. S. Aldrich; "Blueprinting by Electric Light," by H. G. Reist; "Drafting Room and Shop Systems," by F. O. and F. H. Ball; "A Few Instruments of Precision at the Paris Exposition of 1900," by William E. Reed; "Efficiency Tests of a 125-horsepower Gas Engine," by C. H. Robertson.

MISCELLANEOUS.

An ordinance was presented to the Pittsburg City Council on April 29th which provides for the burial of all electric wires by November 15, 1903. A penalty clause provides for a fine from $50 to $100 a day for each pole left standing after that day. A reserve clause exempts electric railways from these provisions.

The Westinghouse Machine company of East Pittsburg has just completed the largest stationary engine that has ever been built in America. This engine is one of eight 6,000-horsepower engines ordered by the New York Gas, Electric Light, Heat and Power company. When occasion demands, these engines are capable of delivering 10,500 horsepower each. The whole engine weighs more than 1,500,000 pounds and stands 37 feet high. The flywheel is 23 feet in diameter, and the main shaft weighs 136,000 pounds and is 26 to 29½ inches in diameter.

TRADE NEWS.

The Davis & Stitt company, Marinette, Wis., states that it recently disposed of its entire stock, consisting of 80,000 poles and 300,000 posts, to the Lindsley Brothers company of Menominee, Mich.

The United States Carbon company of Cleveland was involved in the recent suspension of the Cuyahoga Savings and Banking company of the same city. Walter D. Sayle has been appointed receiver of the Carbon company.

Bids for the installation of a conduit and wiring system for the United States postoffice at Beaumont, Texas, will be opened at the office of the supervising architect in the Treasury Department at Washington, D. C., on June 10th. Copies of the drawings and specifications may be obtained at the office of the supervising architect or at the office of the superintendent of construction at Beaumont, Texas.

On account of increasing business, the Siegrist Lubricator company has purchased the property at the northeast corner of Second and Vine streets, St. Louis, with a frontage of 44½ feet on the east side of Second street, a depth of 138 feet on the north line of Vine street and a frontage on the west line of the alley of 63 feet. A four-story brick structure, to cover the entire lot, is to be erected, and will be used as a factory for the manufacture of lubricators.

At the annual meeting of the stockholders of the Joseph Dixon Crucible company, held in Jersey City, N. J., on April 15th, the following-named directors were re-elected: Edward F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Edward L. Young and Joseph T. Bedle. The board re-elected officers as follows: President, E. F. C. Young; vice-president and treasurer, John A. Walker; secretary, George E. Long. Judge Joseph T. Bedle was also re-elected counsel of the company.

In a series of articles in the Iron Age on Japan as a commercial rival of the United States, Alexander Hume Ford says: "While Japan is now a large purchaser of our electrical goods, having fully equipped trolley lines in her larger cities and electric-light plants in even small villages, she hopes before long to manufacture her own supplies. Small electric factories, springing up all over the country, encourage this hope. However, it will probably be some time before Japan will be able to compete with us in this, our specialty, in Asia."

The Bernstein "Lowatt" lamp is the novel product of the Bernstein Electric Manufacturing company of Boston, Mass., that is described in a recently issued catalogue. This lamp has a complete metal reflector entirely within the bulb and directly behind a multi-coiled carbon filament, both in proper relation to each other and utilizing all reflecting surfaces in a scientific manner. The reflectors are either concave, to concentrate the light, or convex, to spread it. The lamps are made in standard voltages from 45 to 130 volts, and for the standard sockets.

The New England Electric Manufacturing company was organized under the laws of the state of Massachusetts on May 2d, with an authorized and paid-in capital of $30,000. George O. Proctor is president of the company, Guy H. Proctor vice-president and manager, and Charles A. Haskell treasurer. This company succeeds to the business of the Anchor Electric company, with which Guy H. Proctor has been connected for five years, and will continue to manufacture the Anchor specialties at the factory at Somerville. President George O. Proctor is a prominent grain merchant of Boston and Mr. Haskell has heretofore been connected with the leather trade. The new company starts out under very favorable auspices. The business experience and financial standing of the members of the company are of the best, and the company will doubtless receive its full share of patronage.

The Stanley Electric Manufacturing company of Pittsfield, Mass., has issued a bulletin descriptive of the S. K. C. indicating wattmeter and S. K. C. phase indicator. These instruments depend upon the dynamometer principle, and are of the spherical-coil type. No allowance has to be made in the reading of the wattmeter, as it is not affected by a leading or a lagging load of any power factor. It indicates power directly, or, in other words, tells what

the engine is doing. The phase indicator facilitates the counteracting of leading or lagging-load disturbances on a line by indicating the proper variation of the excitation of the synchronous motors connected thereto. At a glance it tells the condition of phase relation of current and electromotive force. Where motors and lights are supplied by the same machines this instrument is of great value. By its indications the regulation of the whole system may be materially increased.

The Bunnell Telegraphic and Electric company, 110-120 Beekman street, New York city, well known throughout the electrical field, has recently purchased the plant and business of the National Electric and Manufacturing company of Milford, Conn., and has assumed control of the plant and apparatus of that company. It is the intention of the Bunnell company to remodel the interior of the factory, install more modern machinery and extend the present facilities for output, and while the present force of hands will be employed, a large number of skilled workmen will be added to it. The Bunnell company has also recently made several large additions to its supply house and factory in New York, having bought and equipped throughout the building located at Nos. 118 and 120 Beekman street. The New York establishment, with this recent extension, now numbers from 110 to 120 Beekman street, occupying nearly the entire front of that block, where the company will retain its office and salesroom. The company has thus greatly increased its facilities for manufacturing general electric, street-railway, telephone and telegraph supplies. It is adding valuable improvements to the district, burglar and fire-alarm call boxes and registers manufactured by the National company. It has just issued a complete catalogue of 220 pages, which describes many new features in the company's line.

BUSINESS.

The Electric Appliance company of Chicago says that it is shipping the A.-B. arc lamp by hundreds.

The Pencoyd plant of the American Bridge company shipped during March 7,339 tons of material. It is believed that this is the largest shipment ever made by any bridge shop in the world.

The Manhattan Electrical Supply company of New York and Chicago reports heavy sales of its own specialties, as well as of the general line of supplies. All who have not written for the company's general catalogue are requested to do so at once, so as to receive a copy as soon as the book is off the press.

The G. F. Brunt Porcelain Works of East Liverpool, Ohio, are calling attention to their latest improved regulating socket for 15-candlepower incandescent lamps. They are adapted to direct or alternating current, for any voltage between 50 and 118 and for T.-H., Edison or Westinghouse bases. The lamp regulates between two and 16 candlepower, and, it is claimed, will save 40 per cent. of the current when turned down.

Charles H. Besly & Co. of Chicago report that their general business is very good and that they are making large shipments of their Helmet oil, Bonanza cups and their new Badger oil cups, in which Helmet oil is used. At the Besly factory at Beloit, Wis., the firm is running 22 hours a day in its oil-cup department. Besly & Co. have just made shipment of an entire carload of Gardner disk grinders on orders for delivery in New York, Pennsylvania and New England.

The St. Louis Electrical Supply company of St. Louis, Mo., has recently moved to a new address at 911 Market street, its old building not being large enough to carry on the business. The company now occupies its own four-story building. Mr. Doxsie, secretary of the company, reports business very good, the company having recently completed a municipal plant at Coffeyville, Kan., with two belted 60-kilowatt, alternating-current Westinghouse generators. In all there will be 3,000 lights furnished by the plant.

An important contract was recently awarded to the Stanley Electric Manufacturing company of Pittsfield, Mass., by the Castner Electrolytic Alkali company of Niagara Falls, N. Y., for eight S. K. C. motor-generators, each set having a direct-current output of 500 kilowatts. These machines will take the current from the Niagara Falls Power company, at 2,200 volts, 25 cycles, converting it into direct current of 245 volts for electrolytic work. The contract includes a complete switchboard equipment for handling the 8,500 kilowatts.

The Star Brass Works, 67-69 South Canal street, Chicago, call attention to their whitewash and painting machine, which can be used with great saving and convenience at this time of the year in painting or whitewashing factories, barns, central stations, etc. This machine is made for hard and long service, and it is estimated that by its use two men can do the work of 25 men with brushes. The Star Brass Works are also dealers in a cold-water, fireproof paint, which is used for inside work only, and has been extensively used throughout the country. Orders received for machines and paint the last two months have been large, and have not only been from nearly all parts of the United States, but also from foreign countries.

The B. F. Sturtevant company of Boston, Mass., is rapidly recovering from the effects of the fire of April 14th, which affected only the engine and electrical departments. With only a day's delay incident to the renewal of belts, the remainder of the plant has been running as usual. Already a complete new equipment of improved machine tools is nearly installed in other buildings. As the Sturtevant company employs electric transmission for the driving of a considerable portion of its tools, this work of installation has been a comparatively simple matter. Further delay in shipment of engine and electrical work is unlikely, for no patterns or drawings were destroyed, and the foundry, with a large stock of castings, is intact.

The Western Electrical Supply company of St. Louis reports that its spring business has opened up in a most gratifying manner and that every department of its business is rushed with orders. It states that it is meeting with success in the introduction of the new J. M. standard junction boxes, and that all contractors who have used the box say that it is the most economical and best arranged box that they have ever used. This box is so built that it has a slate-lined wiring pocket back of the tablet, so that the entering wires can be brought in from any direction through the sides or back without difficulty. The tablet board can be easily removed without disturbing the box, and is not placed in position until all the building operations are completed. The boxes are made in two general types, one for surface work and one for concealed work. The company has a special bulletin covering these boxes which it mails on application.

Elmer A. Willyoung of New York city reports brisk and promising business. He has recently moved into a new office and laboratory at 11 Frankfort street. The equipment of this laboratory has been completely overhauled and much added to, and is now said to be for accurate electrical standardizing one of the very best in the country. Many of the instruments are new, having been specially designed for his own work by Mr. Willyoung. For resistance work there is a complete set of standards by Woolf of Berlin, certified by the Reichsanstalt. These standards range from one ohm down to 0.0001 ohm, and carry current from one to 1,000 amperes. For low-resistance comparison is provided a special Carey-Foster bridge, and for the resistance work of higher value a series-multiple bridge. For quick approximate work a special half-meter slide bridge is used. For condenser testing is used a faradmeter on the Varley slide principle and utilizing an alternating current, while for ballistic tests a pendulum is employed. The Willyoung X-ray machines are said to be finding increasing favor. They are now made for either battery or power circuits of practically any voltage and for either direct or alternating current. A new line of portable coils has just been brought out by Mr. Willyoung.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued April 30, 1901.

672,913. Electrolytic Current Rectifier and Condenser. Charles Pollak, Frankfort-on-the-Main, Germany. Application filed March 7, 1899.

This device consists of an electrolytic transforming or condensing cell having an electrolyte containing a free organic acid of the aromatic class.

672,936. Control of Electric Motors. Frank W. Garrett, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed August 28, 1900.

In a system of series-parallel control for two electric motors, this patent covers the method of shifting the motors from a circuit relation wherein their fields are in parallel and their armatures in series to a full parallel relation. The method consists in connecting the field coils of both motors and the armature of one motor in series, and the armature of the other motor in shunt with the first-named motor.

672,942. System of Automatic Telephone Exchange. Alexander E. Keith, John Erickson and Charles J. Erickson, Chicago, Ill., assignors to the Automatic Telephone Exchange company, Baltimore, Md. Application filed June 23, 1897.

A series of circuits from distant stations is combined with a series of selectors, one for each station, these selectors being arranged consecutively in groups. There is also a series of connectors arranged in groups. The connectors of each group form means of communication with each other and independent circuits are placed between the selectors and the connectors. The groups of connectors are arranged consecutively to correspond with the consecutive arrangement of the selectors, and the circuits from each group of connectors form means of communication with their corresponding selectors, while the circuits from each group of selectors form means of communication with their corresponding connectors. (See cut, next page.)

672,950. Electric Motor. Frank A. Merrick and Joseph D. Forrer, Johnstown, Pa., assignors to the Lorain Steel company of Pennsylvania. Application filed August 16, 1900.

In the armature are combined a non-threaded shaft having an enlarged portion, a head seated on the enlarged portion, an opposite head seated against the shoulder formed by one end of the enlarged portion, and a laminated body between the heads. Clamping bolts pass through the body and heads, and there is a locking device removably secured to the shaft to prevent endwise movement through the body and heads.

672,951. Electric-railway Motor. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed August 21, 1900.

The field-magnet frame is constructed in upper and lower sections, armature-shaft bearings being seated partially in each section. Adjustable hinges connect the sections at one edge, and removable bolts connect the sections at the ends. Rings or straps engage the projecting ends of the shaft bearings and are removably secured to both upper and lower sections.

672,952. Electric-railway Motor. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed August 21, 1900.

The motor frame is formed in two main sections, which are connected by hinges at one edge and have bolts for holding the sections together. Bearing-supporting members are seated in cut-away portions of the sections and have laterally extending arms or projections. Bolts are seated in the upper frame section and engage the arms or projections, the lower ends of the bolts being secured with nuts.

672,959. Electrical Connector. Harry E. Norris, Northeast, Pa. Application filed July 20, 1900.

This device consists of a connector terminal comprising a terminal portion and a tapered protuberance having a base of less diameter than the terminal portion. This protuberance extends from the end of the terminal.

672,967. Telephone-exchange Mechanism. Harlen P. Snow, Erie, Pa., assignor of one-half to Frederick C. Jarecki, Erie, Pa. Application filed September 28, 1899.

There are 120 claims in this patent. One of them describes a series of incoming and outgoing line wires to which a series of groups of telephones is connected. Each group utilizes in common one wire of one of the series of wires for one side of their circuits, and a different wire of the other series for each telephone of the group, each series of wires containing a common wire for a group. A series of bars is connected with the outgoing wires and a series of bars is connected with the incoming wires. An inductive repeater is provided which is normally out of the line of circuit. Means for connecting the two circuits of the coil with any of the circuits formed by the outgoing and incoming wires and a reciprocating mechanism are provided, also a controlling mechanism, one for each line wire and connected bar. There are also means controlled by the controlling mechanism for coupling the brushes with the reciprocating means and for uncoupling the brushes from the reciprocating means with the brush of the bar corresponding to the actuated controlling mechanism.

672,989. Transformer. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Gustave P. Gehring, Philadelphia, Pa. Application filed February 12, 1901.

This transformer comprises an induction coil having two electrical circuits in connection with the primary winding. A spring lever makes connection with each of the circuits, one at a time. A revolving ratchet wheel operates the lever to make the connection, thus producing an alternating or intermittent current, as desired.

672,992. Controller for Electric Motors. Emmett W. Stull, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Original application filed June 8, 1900. Divided and this application filed July 25, 1900.

The motor controller described comprises two controller drums, each of which is provided with contacts and connections for controlling one pair of motors. A reversing switch is arranged to reverse the direction of the motors, and also to cut out either pair without entirely cutting out of circuit the contacts of the corresponding controller drum.

673,020. Electric Pendulum Clock. Frederick Haenichen and Otto A. Haenichen, Paterson, N. J. Application filed January 10, 1900.

This device involves the combination of a pendulum, a crutch connected with the pendulum, a current reverser partly supported on the crutch, an electromagnet and a balanced armature actuated by the electromagnet. An impulse mechanism is intermittently actuated by the armature for imparting an impulse to the pendulum, and a beat-regulating device operates in conjunction with the current reverser to restore to the pendulum a beat of predetermined length at regular intervals of time.

673,039. Telephone System and Apparatus Therefor. Arthur T. M. Thomson, East Dulwich, England. Application filed October 9, 1899.

This system combines with an electric circuit and a distant indicator or signal included in the circuit a semi-automatic latent signaling switch for actuating and controlling the indicator or signal. This switch consists of a frame in electrical connection with one terminal of the circuit, movable contact plates, a contact piece on the frame and an externally screw-threaded spindle rotatably mounted in but insulated from the frame. Means are provided for rotating the spindle in one direction, a traveling nut block is mounted on the spindle, and a contact is carried by the nut block in electrical connection with the other terminal of the circuit, and is adapted to brush the contacts on the plates and frame.

673,072. Telephone Meter. Donald M. Bliss, Lowell, Mass., assignor to the Automatic Telephone Meter company, Orange, N. J. Application filed October 1, 1900.

This device is located at the instrument and includes a circuit containing electromagnets to operate the meter. This circuit is bridged across the line conductors and is independent of the other circuits at the instrument. Means are provided for closing the circuit in response to the outgoing signaling currents; also means for breaking the circuit in response to the incoming signaling currents.

673,085. Safety Synchronizer for Coupling into Parallel Alternating-current Machines. John Pearson, St. Paul, Minn. Application filed February 19, 1901.

A rotary converter having direct-current leads and alternating-current leads is combined with an automatic or self-closing switch in the alternating-current leads and an automatic circuit-breaker in the direct-current leads. Electric trips for the switch and the circuit-breaker have their magnets connected into a common trip circuit. There is a hand switch for controlling the trip circuit. (See cut, next page.)

673,106. Electric Arc Lamp. Samuel H. Anderson, Pasadena, Cal. Application filed May 23, 1900.

A magnet is energized by the current which operates the lamp, while a hollow, movable armature operated by the magnet and arranged to receive the upper carbon is fur

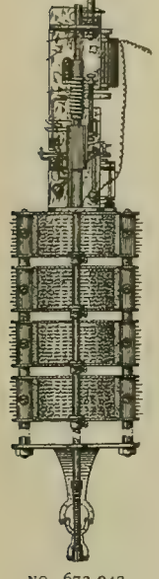
nished with a projecting arm. A member connected with one side of the circuit and sliding on the hollow armature is arranged to contact with the carbon. A lever pivoted to the sliding member is arranged to engage the carbon to force it into contact with the sliding member. There are means provided to limit the movement of the sliding member, and a connection unites the arm with the lever to operate the same.

673,108. Rheostat. Arthur W. Berresford, Westfield, N. J. Application filed June 12, 1900.

In this construction there is a circular base of insulating material with a hole in the center. There is a depressed portion in the base concentric with the hole, and also a concentric row of teeth. Between the periphery of the base and the row of teeth there is a shallow annular groove.

673,139. Portable Electric Fan. Edward R. Post and Frederick Wright, Newburgh, N. Y. Application filed May 26, 1900.

The field frame of this motor is provided with a stationary, longitudinally arranged supporting spindle, having an extended stem and an intermediate bearing shoulder. There is a sleeve shaft for the armature mounted upon the extended stem of the spindle and co-operating with the shoulder of it. This sleeve shaft carries the commutator. A cross-bar is mounted on the supporting spindle at one side of the bearing shoulder, and the brush-holders are carried by the cross-bar.



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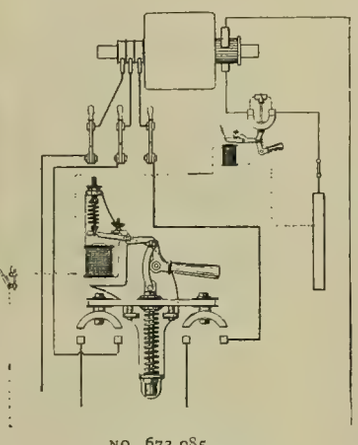


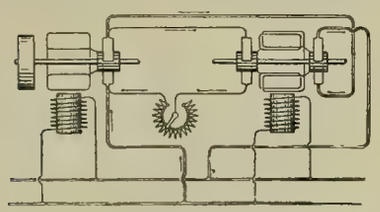
NO. 673,085.

673,169. Electric Elevator. Nils O. Lindstrom, New York, N. Y., assignor to Alonzo B. See and Walter L. Tyler, New York, N. Y. Application filed February 4, 1901.

The counterweight is in excess of the weight of the car, whereby the actuating electric machine will at times be a motor and at other times a generator. Operation of the switch in the car to change the speed of the machine will effect the desired result whether the machine be running as a motor or as a generator. (See cut.)

673,176. Clamp for Trolley Wires. James W. Perry, Philadelphia, Pa., assignor to H. W. Johns Manufacturing company of New Jersey. Application filed March 28, 1901.

In a trolley crossing or switch structure the free end of the arm is jointed to a laterally movable clamping jaw. The arm is adapted to grasp the trolley wire and means are provided for clamping the jaw upon the wire and moving it toward the arm.



NO. 673,345.

673,209. Brake. Frank J. Lingemann, Detroit, Mich. Application filed July 13, 1900.

This mechanism consists of a frame, an axle, a brake wheel mounted on the axle, a flexible brake shoe for controlling the wheel having one end secured to the frame and the other engaging the armature of an electromagnet or solenoid. A rack is pivoted to the free end of the brake shoe. A fixed rack is secured in the frame and there are means for bringing the swinging rack into engagement with the fixed rack.

673,211. Telephone Appliance. Myer London, McKeesport, Pa. Application filed October 31, 1900.

This appliance consists of an arm pivotally secured at its base to permit vertical adjustment. A projection extends from the arm to engage the switch hook of the telephone and a receiver is rotatably mounted upon the upper end of the arm. Means are provided whereby the receiver is caused to be adjusted from its vertical or normal position to a horizontal position when the arm is lowered.

673,219. Double-relay Crossing Signal. Bert. N. Parrish, Jackson, Mich. Application filed June 30, 1900.

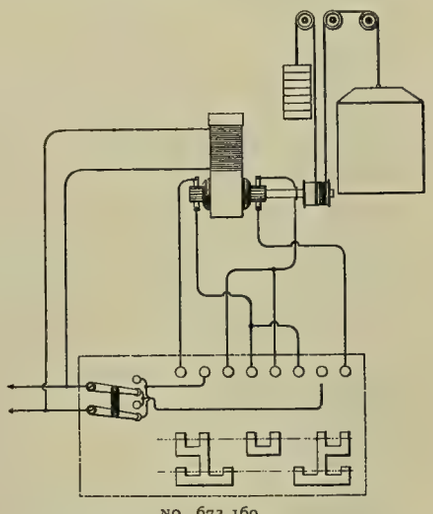
An electromagnet is in normally closed circuit with two short block sections in one of the rails of a railway track and a long block section in the other rail. The magnet holds an upright pivoted armature which constitutes one terminal of an open-relay circuit. A second electromagnet has a horizontally pivoted armature which constitutes the other terminal of the relay signal circuit. The second magnet is in open circuit with the long block section and also with an intermediate insulated block section located between the two short block sections. An open signal circuit is closed by the contact of the upright armature with the horizontal armature when a car short-circuits the normally closed circuit.

673,222. Storage Battery. Arvid Reuterdahl, Providence, R. I., assignor to the Reuterdahl Electric company, Saco, Me. Application filed August 9, 1900.

The jar has oppositely arranged parallel grooves and a composite plate, consisting of a flexible and perforated sheet, which is inserted in and supported by the grooves. This plate is of a material which is a non-conductor of electricity, bent into U shape. A mass of active material is contained in the bent sheet and there is an embedded conducting plate having the entire superficial area of its embedded portion in contact with the active material. This material is held against the conducting plate by means of the insertion of the ends of the bent sheet in the grooves.

673,238. Electric Signal. Hiram M. Buck and John H. Love, Baltimore, Md. Application filed June 11, 1900.

This signal consists of a relay with spaced electromagnets, a pivoted armature for each magnet, an arm carried by each armature, the arms being disposed for movement in a common plane. A contact is adapted for engagement by one of the arms when moved under the influence of its electromagnet, while the opposite arm is adapted to lie out of contact with the contact and in the path of movement of the first arm. There are also means for connecting the contact point and the first arm in a circuit to be closed.



NO. 673,169.

673,249. Base for Battery Cells. George T. Eyanson and Albert J. Shinn, Philadelphia, Pa., assignors to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed December 4, 1900.

This device has sides that form a dish-shaped receptacle. There are recesses in the sides for the attachment of a cell casing and a channel in the base communicating with the interior.

673,266. Booster-regulating System for Storage-battery Circuits. Albert S. Hubbard, Belleville, N. J., assignor to the Gould Storage Battery company, New York, N. Y. Application filed March 2, 1901.

This system consists of a storage battery and a work circuit in combination with a booster having its armature in series with the storage battery and an auxiliary generator connected to excite the field magnet of the booster.

673,274. Electric-circuit Controller. Harry W. Leonard, New York, N. Y. Application filed March 27, 1899.

Two independently movable switch levers are shown, with an electroresponsive device for controlling one of the levers, which, in responding to failure or abnormal decrease of current, releases the lever. Means are provided for moving the lever when released to affect the circuit. An electroresponsive device for controlling the other lever in responding to abnormal increases of current releases the second lever. Means are provided for moving the second lever when released to affect the circuit.

673,277. Incandescent Electric Lamp. Jules E. de Marçay, Paris, France. Application filed November 8, 1898.

A lamp is shown which comprises a base adapted to be fitted in a socket. A central reflecting piece is carried by the base, and there are a number of tubes containing filaments arranged around the reflecting piece.

673,286. Electromechanical Emergency Brake for Tram Cars. Emanuel von Planta, Lucerne, Switzerland, assignor to the Gesellschaft für Patentverwertung der Elektro-Mechanischen Notbremse, Basle, Switzerland. Application filed January 10, 1901.

In this device an electric circuit, with a source of electrical energy and an electromagnet contained therein, is combined with an armature disposed in operative proximity to the electromagnet. A skid which is adapted to be engaged by one of the wheels of a vehicle to stop the latter rests on one of the rails, and a train of mechanism carries the skid and is normally engaged by the armature to maintain the skid elevated. The source of electrical energy operates through the circuit as a means for braking the vehicle and simultaneously actuating the armature.

673,287. Storage Battery. Arvid Reuterdahl, Providence, R. I. Application filed October 10, 1900.

In this battery a composite plate consists of two parallel and perforated sheets provided with apertures. A strip is inserted between the parallel sheets along the bottom. An electrode comprising a top bar as wide as the strip is inserted between the sheets at the top of the same and lead-ribbon strips extend from the top bar. These constitute the active material and pass between the sheets in contact therewith. Rods, screw-threaded at their ends, pass through the apertures of the two sheets and nuts engage the ends of the rods, the sheets and bottom strip. The rods and nuts are made of a material which is not a conductor of electricity.

673,289. Supporting Frame for Relay Magnets. Ulysses G. Rogers, New York, N. Y. Application filed February 28, 1901.

This frame consists of an armature-contact-supporting yoke on the front end of the top, and has hind-end and front-end top-supporting legs located between the magnet spools at their ends, respectively. The hind side of the hind leg is practically flush with the ends of the spools.

673,315. Printing Telegraph. George A. Cardwell, New York, N. Y., assignor to Joseph E. Heimerdinger, New York, N. Y. Application filed November 18, 1899. Renewed November 14, 1900.

This apparatus comprises a number of working circuits or branches, each including a working magnet and having at least three breaks or gaps. Controllable magnets, each responding to a characteristic kind of impulse, operate sets of switches. Each set closes breaks in different working circuits, but not all the breaks in any one working circuit. The operation of particular sets of switches in a certain order of three at the least closes all the breaks of a particular working circuit.

673,317. Automatic Reverse Cut-out for Electric Traveling and Hoisting Cranes. Jacob S. Cole and George E. Swartz, Homestead, Pa. Application filed August 14, 1900.

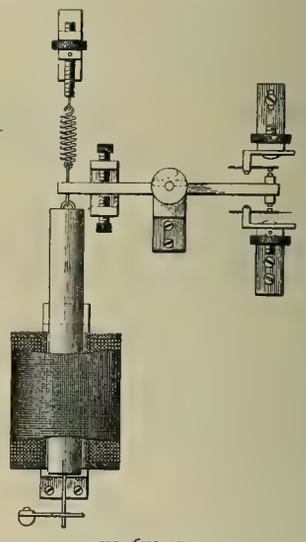
The trolley of an electrically operated crane is combined with a cut-out supported from the trolley and comprising an insulated disk, which has contact segments mounted on the inner and on the outer face and connected together. Contact bars are carried by the disk and provided with contacts to engage the segments on the inner face of the disk. A pair of adjusting levers are shown, together with means on the trolley for engagement with the levers whereby the contacts of the contact bars are shifted from engagement with the segments on the inner face of the disk, and the electrical circuit is thus broken.

673,344. Telephone Switch and Cut-out. Peter J. Wendell, Opheim, Ill. Application filed April 18, 1900.

A number of telephones and a line wire common to all of them are combined with means for grounding the line wire on one side of a given telephone, means for completing the circuit through the telephone and the line wire on the other side, and means for shunting the telephone and connecting the line wires on opposite sides thereof.

673,345. Regulation of Dynamo-electrical Machinery. Schuyler S. Wheeler, New York, N. Y., assignor to Harry Ward Leonard, East Orange, N. J. Application filed September 24, 1894.

This device provides for a shunt-wound working motor and a shunt-wound regulating motor, the armatures of which are connected in series to the feed circuit, and means for controlling the counter-electromotive force of the regulating-motor to regulate the working motor. (See cut.)



NO. 673,372.

673,350. Telephone Transmitter. Charlton E. Yocom, New York, N. Y., assignor of one-half to James G. McFadyean, Pittsburg, Pa. Application filed February 4, 1901.

Several diaphragms each has a carbon element associated therewith. An insulating support separates the outer and inner diaphragms. A granular electrode is interposed between the carbon elements on the opposing surfaces of all the diaphragms, and non-conducting flexible material surrounds the electrodes and confines the same about the centers of the diaphragms.

673,368. Trolley Stand. Frank Pfent, Conners Creek, Mich., assignor of one-half to Gilbert M. Moran, Detroit, and Louis A. Moran, Grossepointe, Mich. Application filed June 27, 1900.

A suitable frame of a trolley-pole is pivoted in a trolley stand. The lower end of the pole extends beyond the point of the pivot. A spring-actuated arm is hinged in the frame and a link is jointedly connected with the free end of the arm and with the lower end of the pole.

673,372. Voltage Regulator. Phill S. Tirrill, Groveton, N. H., assignor of one-half to Charles E. Bellows, Groveton, N. H. Application filed June 27, 1900.

A solenoid coil which is connected in multiple arc to the supply wires is provided with a core and sustaining spring. A double-contact lever for which a torsion spring forms the fulcrum mount is connected with the core and the sustaining spring. This lever moves between two contacts, one of which is connected to one portion and the other to a second portion of a double solenoid coil. In the operation of the lever each portion of the solenoid coil is thrown alternately into the circuit of the supply wires, and an automatic rheostat connected in the circuit of the dynamo field magnet is operated thereby. (See cut).

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Niagara Falls Power Development and the Pan-American Exposition.

By Orrin E. Dunlap.

Seldom, if ever before, have the members of the National Electric Light association approached the occasion of their annual meeting with such rich promise of instruction and pleasure as that which greets them at this time, when they are preparing to attend their twenty-fourth convention, which is to be held at Niagara Falls next week. The Power City has very much with which to entertain such a notable gathering of men interested in the advancement of electrical science, while it is also rich in beautiful scenic features that give joy to the hearts of those who attend conventions for the sake of getting a brief respite from the toil of everyday duties.

It is recognized that conventions are not all business, and it is perhaps well that it is so. Humanity is better for having its playtime, and men of the ability of the members of the National Electric Light association may well be trusted to attend to the proper work of the convention and enjoy the recesses offered for their pleasure. Twice before (in 1889 and in 1897) the association has visited the Falls, and it has been found that the enjoyment of the scenic features has not been exhausted. The great work of restoring the locality about the Falls to a primeval state has been carried on under able financial support of the government of the Empire State, and gradually a new beauty has been given to the lands immediately surrounding the great waterfalls.

The month of May is delightful in the Niagara region, and this year vegetation is advanced to that stage where the unfolding of the natural beauty gives rest and vigor to enjoy better the wonderful work man has wrought at the Falls. The very atmosphere is charged with inspiration. To be at Niagara is invigorating, for here one stands in the presence of the most wonderful electrical development. Those who have not visited the Falls within a few years will marvel at the manner in which the great power installations have been carried toward completion, while those who have been comparatively recent visitors in the vicinity will find much that is new to command their attention.

Of itself, Niagara has more than enough in the way of new things to entertain for a much longer period than the members of the National Electric Light association will spend there, but added to this the convention is held within sight of the Pan-American Exposition and its portrayal of the marvelous progress of a century. It will be strange indeed if the inspection of the Niagara power development and the features of the exposition by men of careful research is not prolific of some good.

Virtually, Niagara Falls is one part of the Pan-American Exposition, and the grouping of buildings in Buffalo is another, both thoroughly interesting. That the exposition should have been held in such close proximity to the cataract is a matter on which all concerned are to be congratulated. Millions of dollars have been judiciously expended to gather exhibits and create effects which, possibly, are of greater interest to the members of the association than to any other class. Electricity and its applications are predominating features of the exposition. Never before has such homage been paid to the subtle current, and the members of the convention may feel a just pride in their association with Luther Stieringer and Henry Rustin, two men who have given to the world the most attractive electrical display ever made.

Niagara Falls Power Plant.

Since the members of the National Electric Light association last assembled in a body at Niagara, the initial 50,000-horsepower installation in the first power station has been brought to completion, and the Niagara Falls Power company now has 10 generators, each of 5,000 horsepower, in use. The installation is thoroughly beautiful, and the line of 10 generators is a sight that none should miss. There are two switchboard structures in the station, and on each of these apparatus is installed for controlling five of the generators. In the transformer station new transformers have been placed in order that the demands for the company's product may be met. This station will have particular interest from the fact of the recent change of the voltage on the Niagara-Buffalo transmission line from 11,000 to 22,000 volts.

The new aluminum transmission line between the Falls and Buffalo will also come in for its share of attention. This line follows the route of the old line to the south boundary of the village of Tonawanda and then diverges to a new route which is three miles shorter. The route of the new line is plainly visible from the trains of the New York Central.

New Power Wheel-pit.

The convention will be held at an advantageous time for the members to inspect the great work of building the new wheel-pit, which is now in a most interesting stage. The depth is now about 160 feet out of a total approximate depth of 180 feet. The pit will be found to be a wonderful slot. The manner in which the various castings are placed in the side walls, the placing of the penstock mouthpieces and the construction of the masonry about the top of the pit should all come in for inspection. The work that the Niagara Falls Power company is also doing beyond the wheel-pit out in the river to govern the flow of water and ice will also be of some moment to various members who have to do with waterpower development.

Utilization of Electric Power.

It will be found that the large spaces which existed between factories on the lands of the Niagara Falls Power company when the association was last at the Falls have been pretty well closed up. In fact, a marvelous growth will be apparent. Nearly every factory with which the members are familiar will be found to have changed its dimensions as the demand for its product necessitated enlargements. Right here will come a full conviction of the remarkable popularity of the electric power of Niagara. Look where you will, almost in every quarter of the possessions of the Niagara Falls Power company it will be found that the full force of the development is far from being spent. Foundations for new plants of magnitude have been laid; others are about to be put down, and more new industries are about to spring up to enjoy the benefits of the constant and wonderful power supply and service. That everything is carried to completion in the most substantial manner is impressive of the fact that the Niagara construction is destined to last for ages. There is nothing temporary about any feature of it.

Some of the Niagara industries using electric power have always been gracious in the reception of members of the association, while others recognize the advisability of hanging the "No Admittance" sign on the outer walls. Members of the convention who are desirous of going from the hotels to the manufacturing district of the Niagara Falls Power company should take the trolley car marked "Power House," or the yellow cars of the Buffalo line.

Canal Power Development.

The power station of the Niagara Falls Hydraulic Power and Manufacturing company, located at the water's edge in the gorge, has been materially increased in its output capacity within a few months, and the installation there is full of interest. In all there are 15 turbines with their connected generators in operation, with more being installed, and the entire installation has an attractiveness that is instructive in many ways. The turbines are fed by three huge penstocks extending from a forebay to the station, the equipment of the third section of which is now being installed. This power house is but a short distance from the hotel where the convention is to be held, and the descent of the cliff is made by means of an inclined elevator in the Cliff paper mill, passes on which should be obtained at the office of Chief Engineer Jones. An inspection of the canal will show that the company is hard at work enlarging its plant in order that a larger amount of water may flow from the upper river to the basin and forebay. In this enlargement and the extensions and improvements to the power station are to be found still further signs of the force behind Niagara. Mr. Frank G. Lott, electrical superintendent and manager of the company, will be pleased to show members of the association every courtesy.

Canadian Power Development.

So recent has been the announcement that the Niagara Falls Power company will develop the power of the Horseshoe Fall under the charter of the Canadian Niagara Power company that all the members will be alert, no doubt, to familiarize themselves with the site of this latest projected development of the power of Niagara. To reach the spot members should cross the upper steel arch bridge, on foot or by trolley, and go to the island vicinity of

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PAN-AMERICAN EXPOSITION.—NIGHT SCENE IN COURT OF HONOR, LOOKING NORTH ACROSS MIRROR LAKE.

Victoria Park above Table Rock. At the head of Cedar Island the preliminary steps will be visible.

Natural Food Company's Plant.

The Natural Food company is one of the latest and greatest industries to locate at Niagara Falls. The site selected for the plant is right in the heart of what was the finest residence section of the city, but which has thus been doomed to changes as a result of the industrial growth. The food conservatory, or factory, is well advanced, and it is well worth a visit in order that the full scope of the company's intentions may be understood. This plant is to be really impressive, H. D. Perky, president of the company, carrying out an idea of his own as to what a manufacturing establishment should be. The company has contracted for 2,500 electrical horsepower.

The Pan-American Exposition.

When the rush of travel is on the New York Central will run trains at frequent intervals from Niagara Falls to the exposition grounds and from the exposition to the Falls, while the International Traction company will run its yellow cars direct from the Falls to the grounds and return. It is not at this writing certain whether this service will be in operation by convention time, but if not passengers over the New York Central going from the Falls to the exposition should alight from the train at Black Rock and from that station take the belt-line trains to the exposition grounds. Passengers on the yellow cars, in going from the Falls to the exposition, should transfer at Hertel avenue. In returning to the Falls the same route may be followed, or the trains or trolleys may be taken into the city and the return journey to the Falls commenced there. Those desiring to travel by the New York Central will find the Terrace station but two blocks from Main street. The West Amherst street gate is the most desirable for entrance from the city or trunk-line trolleys, as the Service building, the Electricity building, Electric Tower. Machinery and Transportation building are not far distant from the gate. The Elmwood avenue entrance is nearest to the electric fountain in North Bay. The New York Central trains land one on the north side of the exposition grounds convenient for all features.

Electrical Display.

The success of an exposition lies not in the size of the exhibits, and this point has not been forgotten in what has been done in Buffalo. The exhibits are not of the warehouse kind or class, but, on the contrary, close attention and effort have been given and made to have working exhibits so far as possible.

Unlike the Paris Exposition, the Pan-American features will be continuous. In other words, special hours will not be set aside for special illuminations or fountain effects, but these will be visible at all periods, when they are designed to entertain and instruct. The nearness of the exposition to Niagara has placed a bountiful supply of electric energy at the command of the men having the electrical features in charge, and for the first time an exposition has been opened where the quantity of current did not have to be considered.

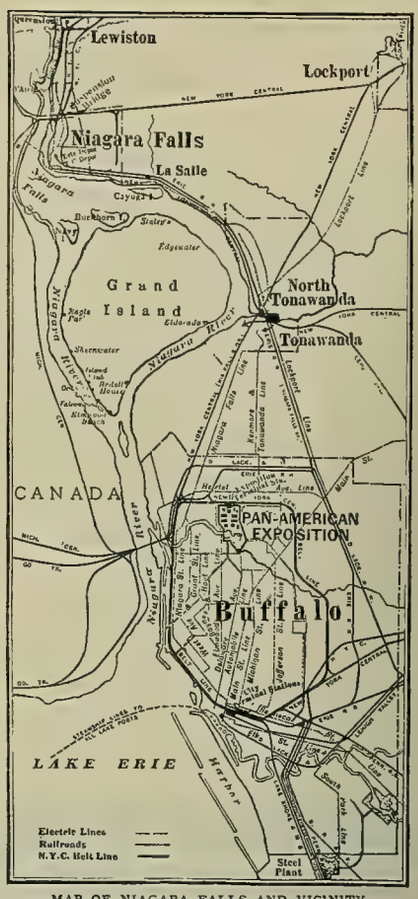
Transmission of the Power.

Naturally, all will be interested to see the evidences of the Niagara transmission, and will visit the Niagara transformer plant in the northwest corner of the Electricity building. To be clear, it should be remembered that the current in use on the exposition grounds is generated at Niagara Falls at a voltage of 2,200, two-phase, passed through the transformer station at the Falls, where its voltage is raised to 22,000 for transmission over the copper and aluminum cable lines to the transformer station on Niagara street, Buffalo, where the voltage is reduced to 11,000, at which it passes over a special transmission line of six cables to the exposition grounds. Reaching the exposition at a point on Elmwood avenue, near Groat street, just north of the West Amherst street gate, the cables drop into a building erected on posts, and it is here the rheostat is located. The rheostat has been doing admirable work, and Superintendent Rustin pronounces it the best thing of the kind he has seen.

This birdseye view shows (1) the inlet of the Niagara Falls Power company, (2) the inlet of the Niagara Falls Hydraulic Power and Manufacturing company, and (3) the embankment that is being thrown out in the Niagara River, above the inlet of the Niagara Falls Power company, to divert ice.

NIAGARA FALLS POWER DEVELOPMENT.—THE BEGINNINGS OF IT ALL.

It consists of three tanks, each three feet wide, three feet deep and seven feet long, holding about 1,420 gallons of water. A one-half-horsepower motor operates a worm gear which puts in motion a shaft around which is wound a rope attached to hinged knife blades six feet long. These blades make contact with the water, and as the blades are lowered



MAP OF NIAGARA FALLS AND VICINITY.

the resistance is gradually diminished to full metallic contact.

Passing from the rheostat the cables converge into three and pass underground to the transformer station in the Electricity building, where the voltage is reduced from 11,000 to 1,800 for distribution about the grounds, where, at various points, it is still further reduced to 104 volts for use at the lamps. This transformer station is a portion of the exhibit of the General Electric company, and it is thoroughly complete.

Some Special Features.

Members of the association who visit the exposition will quickly realize that all the results of the work of the many months are hardly to be seen. They will have in mind the miles and miles of wire concealed from the view of the spectators in order that it may not obtrude on the picture of the elaborate

NIAGARA FALLS POWER DEVELOPMENT.—LATEST PICTURE OF THE TEN 5,000-HORSEPOWER GENERATORS AT THE FALLS.

setting. They will think of the miles of ducts for various purposes placed out of sight, but when they come to make a study of the Pan-American they will find that there is nothing in the electrical art but what is to be found in some section of the exposition plot. Direct and alternating current will be found in use in all forms in connection with single, two and three-phase work. In wiring there are single, two and three-phase circuits and three-phase, four-wire secondaries.

In the matter of telephones the exposition grounds have been equipped with an excellent service by the Stromberg-Carlson Telephone Manufacturing company of Chicago, which company has installed a system of central-energy telephones which gives service to the Pan-American officials. In this system as employed on the exposition grounds there are about 72 instruments in service for 24 hours. This work was in charge of Paul M. Krahmer.

In the matter of police signals the Municipal Signal company of Chicago has installed the Cregier system. In this installation there are 75 police boxes divided into three stations, each station having 25 boxes. Each station is equipped with a switchboard, and each station has a trunk line one to the other.

The Nernst lamps exhibited by the Westinghouse people in the dome of the Electricity building over their exhibit space will command much attention. At the Pan-American these lamps will be shown to much better advantage than they were in Paris. The Westinghouse company will also show interesting combinations of gas engines and electrical generators.

The Gould single-cell storage battery of 16,000 ampere-hours' capacity, said to be the largest in the world, will be among the exhibits.

Later on, possibly in June, it is expected that the new storage battery of Thomas A. Edison will be shown in the Edison space. However, Manager Martgraf will have several novelties to interest the members.

Electricity Building.

Prof. George Sever has labored most industriously to have the exhibits in the Electricity building far surpass anything of the kind that has been presented for the inspection of the public, and in this he has succeeded. At this writing many of the exhibits are in course of installation, but the work so far accomplished justifies the statement that the Electricity building in its every feature will be worthy of the closest inspection. Members should expect to devote considerable time to the Electricity building.

This building is lighted by the General Electric company's series alternating enclosed arc-lighting system, about 70 series enclosed-arc lamps being located in three rows over the main aisles of the

PAN-AMERICAN EXPOSITION.—RHEOSTAT HOUSE, WHERE NIAGARA FALLS TRANSMISSION LINE ENTERS GROUNDS.

building. In the operation of this installation the transmitted Niagara energy is taken from the transformer plant in the company's space and used to operate a synchronous motor belted to a 100-kilowatt, revolving-field, alternating-current generator and exciter combined. It is this generator that supplies current for the standard 75-light, constant-current transformer which operates the two lighting circuits. All of the apparatus in this operative exhibit is open to inspection and the operation may be followed and studied by all interested. To afford opportunity for study of the constant-current transformer a five-light machine is shown, the sides of which have glass panels through which it is possible to observe the movement of the coils.

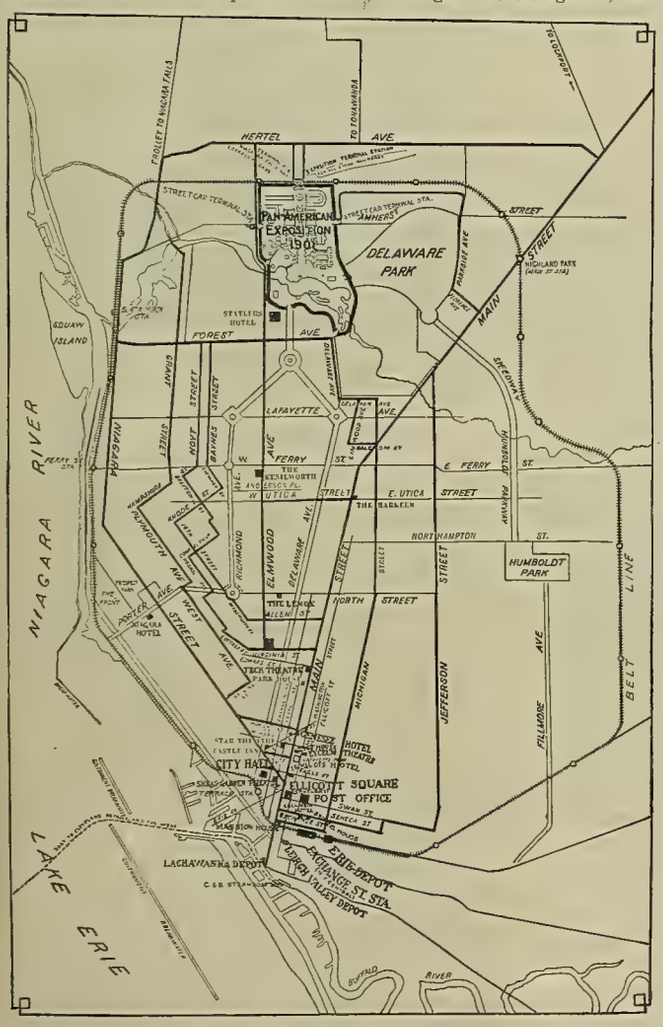
Machinery Building.

In the Machinery and Transportation building a very instructive exhibit of automobiles has been arranged and placed. The general line of exhibits in this building is worthy considerable attention, which no doubt it will receive.

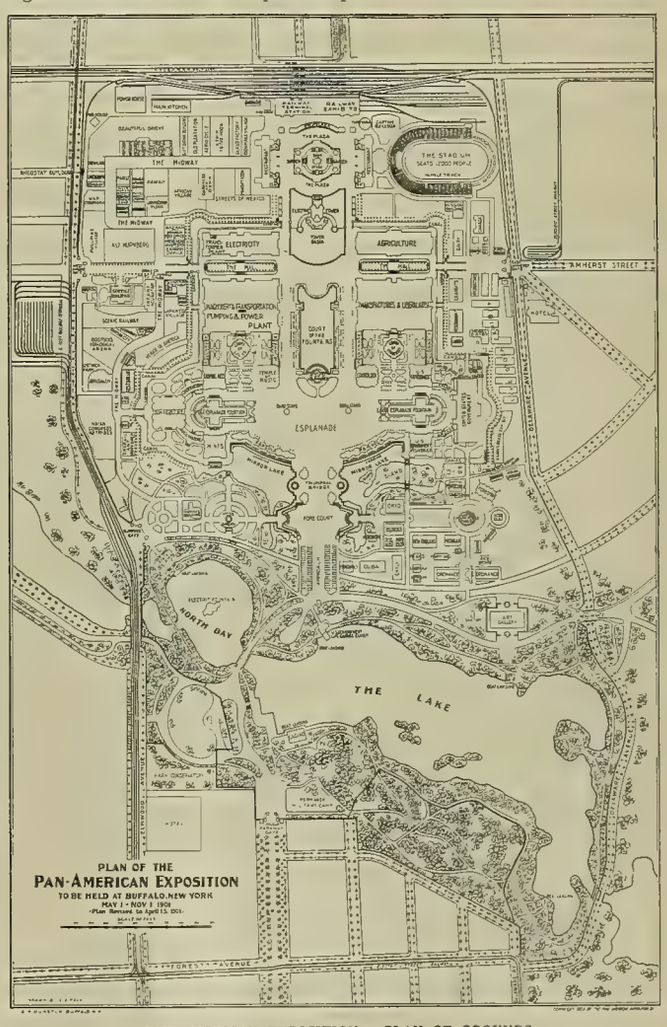
Illuminating Effects.

So much has been said about the beauty of the illumination of the exposition buildings and grounds that the expectations of all have been raised to a high point. Numerous sketches and drawings have from time to time been presented, depicting to what extent the artist comprehended what the illumination was to be, but all visitors find that the effects are beyond being described by word or depicted by the most skilful artist. Many have seen all the efforts at illuminating great expositions, and have marveled with the world at each succeeding step marking a notable advance in the art, for art it is and must be so recognized. The day has passed when there can be any question of the merit of keeping a great exposition open at night, for, after looking upon the surpassing beauty of the Pan-American night effects, it is safe to say that any exposition or similar event that does not strive to equal, no matter how hopeless the effort, the Pan-American illumination will be lacking in the energy that means success.

Never have people had opportunity of viewing such a beautiful night scene as that of the Pan-American Exposition. As the dying day gives intimation of the coming night, the expectations of all are aroused and all are alert for the very faintest glow in the lamps to indicate that the very heart-throb of old Niagara is pulsating through the miles of cables between the exposition grounds and the Falls, and that the transmitted energy of the "Thunder of Waters" is flowing along the wires within the exposition plot. You seem to have an uncertainty about this building or that building going to respond to the advance of the current. You fasten your eyes on the magnificent electric tower, the highest point to which the transmitted energy from the Falls flows within the grounds, and you think of the mighty turbines 179 feet down in the pit 26 miles away. The lamps grow brighter, but it seems so long ere the brilliancy is pronounced. Is anything the matter? Isn't there enough electricity to go around? Are you to be disappointed in witnessing



OUTLINE MAP OF BUFFALO.



PAN-AMERICAN EXPOSITION.—PLAN OF GROUNDS.

PAN-AMERICAN EXPOSITION.—ELECTRICITY BUILDING.

the climax of the exposition glory? You look from building to building, and then back to the electric tower. The brightness is increasing. It is all right. It appears to come with a rush now. Every lamp of the hundreds of thousands within your view is in full brilliancy. No matter what you have seen in electric illumination, no matter what you have imagined it to be, you are overawed at the beauty of this night scene which has the inky sky of night for a background. Foolish would be the artist who would try to paint it. No spoken or printed words will ever tell the truth about it, for it is beyond all this. It may be called the City of Golden Light.

The lamp that creates all the glory is the lamp which Edison says "is still my pet." Truly the light from the incandescent lamp is beautifully displayed at every available point through the grounds and about the buildings and electric tower. The beauty in every part of the illumination arouses the thought: Could Stieringer and Rustin have foreseen the beauty of it all, or have they builded better than they knew? But we consider the promises early given, that the Pan-American Exposition illumination would be superb, and we know then that they built after a well-conceived and carefully arranged plan, and they built to perfection.

At this writing little can be said of the electric fountain in the North Bay, as it has not yet been in operation. However, the members of the association are likely to be among the first to behold its effects and their beauty, and there is little doubt but what it will be an eye-feast that will be memorable.

In Buffalo.

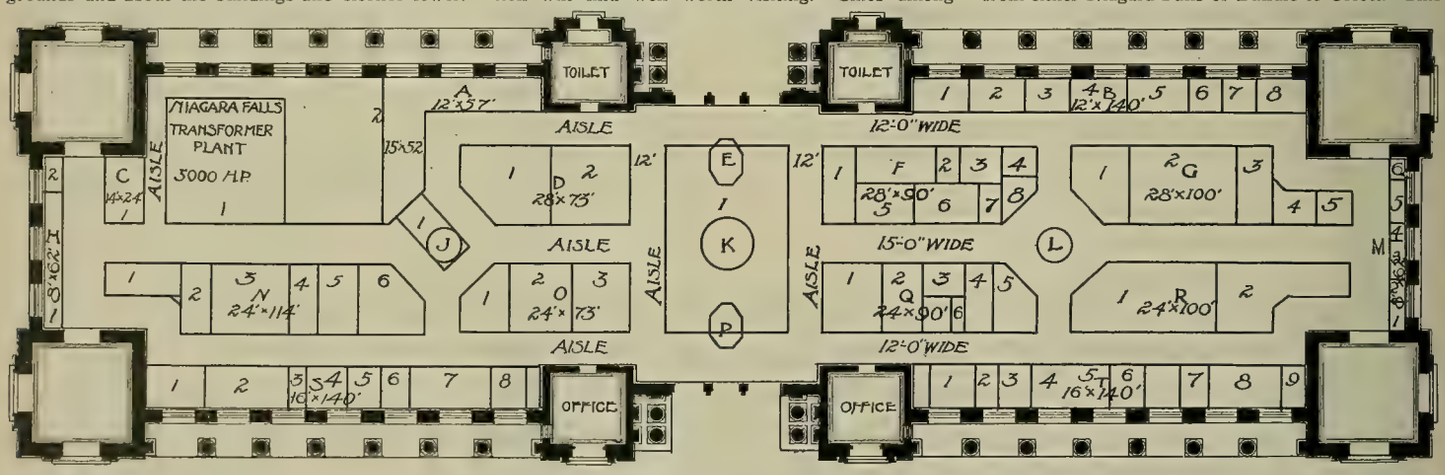
Within the boundaries of the city of Buffalo there are several points that the members of the association will find well worth visiting. Chief among these is the central station of the Buffalo General Electric company on Wilkeson street, reached on a Niagara street trolley. The installation is in every particular modern, and an inspection is instructive. The Niagara street terminal station of the Niagara Falls Power company has been recently equipped with new apparatus, and it is there the transmitted power from the Falls has its voltage reduced to 11,000 volts. It is from this station that the special transmission line runs to the exposition grounds, and where the Niagara current is received over the copper and aluminum transmission lines. This terminal station can be reached by a Niagara street car, or, by leaving the New York Central trains at Black Rock, visitors will find themselves within a few minutes' walk of the station. In fact, should there be any wait for a belt-line train at Black Rock, it might be well to pass the interval at the station, which is near by. The Ohio street transformer station can be reached by an Elk street car. It is through this station that the elevator district of

PAN-AMERICAN EXPOSITION.—TEMPLE OF MUSIC ILLUMINATED.

Buffalo is supplied with Niagara power. The Niagara street power house of the International Traction company is one of the points of interest in the city, the Niagara street trolleys running right to it.

Trolley Rides.

In electric-railway enterprise the International Traction company this year presents a delightful ride from either Niagara Falls or Buffalo to Olcott. This



Section A—
1. Niagara Falls transformer plant.
2. General Electric company, Schenectady, N. Y.

Section E—
1. Morris Electric company, New York.
2. H. B. Camp company, Akron, Ohio.
3. Bossert Electric Construction company, Utica, N. Y.
4. National Carbon company, Cleveland.
5. American Vitrified Conduit company, New York.
6. Peru Electric Manufacturing company, Peru, Ind.
7. McGraw Publishing company, New York.
8. The O. C. White company, Worcester, Mass.

Section C—
1. General Electric company, Schenectady, N. Y.

Section D—
1. Edison Manufacturing company, New York.
2. Bullock Electric Manufacturing company, Cincinnati.

Section F—
1. Buckeye and Jandus Electric companies, Cleveland.
2. Western Electrician, Chicago.
3. M. R. Hutchison, New York.
4. McRoy Clay Works, Brazil, Ind.
5. Cutler-Hammer Manufacturing company, Milwaukee.
6. Warren Electric Manufacturing company, Sandusky, Ohio.
7. Hazard Manufacturing company, Wilkesbarre, Pa.
8. Standard Underground Cable company, Pittsburg.

Section G—
1. American Electric Telephone company, Chicago
2. Stromberg-Carlson Telephone Manufacturing company, Chicago.
3. Wilhelm Telephone Manufacturing company, Buffalo.
4. National Automatic Telephone company, Chicago.
5. Clark Automatic Telephone company, Providence, R. I.

Section H—
1. Historical exhibits.
2. 500-volt service switchboard.

Section J—
1. General Electric company, Schenectady, N. Y.

Section K—
1. Westinghouse Electric and Manufacturing company, Pittsburg.

Section M—
1. F. C. Perkins, Buffalo, and D. & W. Fuse company, Providence, R. I.
2. C. B. Rowell.
3. Waite & Bartlett Manufacturing company, New York
4. B. & E. Hanfeld.
5. R. V. Wagner & Co.
6. Incandescent Electric Light Manipulator company, Boston.

Section N—
1. Gould Storage Battery company, New York.
2. Onondaga Dynamo company, Syracuse, N. Y.
3. Niagara Falls power station models.
4. Stanley Instrument company, Pittsfield, Mass.
5. Northern Electrical Manufacturing company, Madison, Wis.
6. Stanley Electric Manufacturing company, Pittsfield, Mass.

Section O—
1. Electric Storage Battery company, Philadelphia.
2. Holophane Glass company, New York.
3. Crocker-Wheeler company, New York.

Section Q—
1. Brown Optical company.
2. Buffalo Concessions company.
3. Kate Fearn's silk loom.
4. Lea Electric Manufacturing company, Elwood, Ind.
5. Safety Insulated Wire and Cable company, New York.
6. Eureka Tempered Copper Works, Northeast, Pa.

Section R—
1. Kellogg Switchboard and Supply company, Chicago.
2. Western Electric and Bell Telephone companies, Chicago and New York.

Section S—
1. Arnold Electric Power Station company, Chicago.
2. Collective exhibits.
3. Buchheit Badge company.
4. Submerged Electric Motor company, Menomonie, Wis.
5. Mann Bros., Chicago.
6. Robbins & Myers company, Springfield, Ohio.
7. S. S. McClure company.
8. Buffalo Concessions company.

Section T—
1. P. B. Delany, South Orange, N. J.
2. A. W. Hall.
3. S. Lubin.
4. Buffalo Candy company.
5. Bettini Phonograph company, New York.
6. E. R. Johnson, Philadelphia.
7. National Gramophone company.
8. American Clock company.
9. Mason Monogram company.

A list of the names of the exhibitors in the space of the Electric Specialty Exhibiting company is as follows: Charles J. Bogue, New York; Edison-Johnson Electric Manufacturing company, New York; Dunn-Martin Electric company, New York; Thomson Electric Welding company, Lynn, Mass.; H. C. Cushing, Jr., New York; Prentiss Clock company, New York; Speer Carbon company, St. Marys, Pa.; F. B. Sage & Bro., New York; Diamond Arc Lamp company, Mt. Vernon, N. Y.; Harold P. Brown, New York; Emil F. Tardie, New York; H. P. Cameron Electric Manufacturing company, Syracuse, N. Y.; William Roche, New York; Percell & Weed, New York; Electric Contract company, New York; Hart Manufacturing company, Hartford, Conn.; E. W. Hazazer, New York; H. Krantz, Brooklyn; Queen & Co., Philadelphia; Standard Welding company, Cleveland, Ohio; Pyle National Electric Headlight company, Chicago; Stow Manufacturing company, Binghamton, N. Y.; W. C. Vosburgh Manufacturing company, Brooklyn, N. Y.; P. H. Gilbert, Scranton, Pa.; Ericsson Telephone company, New York; Utica Drop Forge and Tool company, New York.

Frank C. Perkins of Buffalo represents the American Brass and Lamp company of Trenton, N. J., and the Pianophone company of Orange, N. J.

PAN-AMERICAN EXPOSITION.—PLAN OF ELECTRICITY BUILDING AND LIST OF EXHIBITORS.

new point of interest is located on Lake Ontario, about 12 miles from Lockport. It is a most delightful spot, where the company has made large expenditure in opening and improving a new lakeside resort. The time from Buffalo is about an hour and 35 minutes, and the same from Niagara Falls. Passengers from the Falls take the yellow cars to North Tonawanda, where connection is made with cars on the Lockport line. The trip carries one through Lockport, the county seat of Niagara County, and then through a beautiful fruit section, which at this time is in blossom. From North Tonawanda to Lockport it is interesting to study the success met in transforming a former branch of the Erie railroad to an electric line.

Western Electrician at the Pan-American Exposition.

The Western Electrician and other books and publications of the Electrician Publishing company of Chicago are on exhibition in Section F 2 of the Electricity building at the Pan-American Exposition in Buffalo. Visitors to the exposition, including members of the National Electric Light association, the Independent Telephone association and other technical societies holding their

PAN-AMERICAN EXPOSITION.—ELECTRIC TOWER ILLUMINATED.

meetings in Buffalo and vicinity, are cordially invited to visit the exhibit. A representative of this journal is in attendance and will be glad to see all who are interested in electrical journalism or electrical books.

Chicago Trains to Convention.

There is no official train designated to convey the Chicago and western visitors to the Niagara Falls convention of the National Electric Light association next week. Some of the gentlemen will go on the Wabash road, leaving either on Sunday or Monday, May 19th or 20th, at 3:15 p. m., arriving in Niagara Falls, N. Y., at 6:48 a. m. on the succeeding day. A larger party, in charge of Jesse Scribner, will go on the Michigan Central, leaving Chicago at 3 p. m. on Sunday and probably going through to Buffalo, where the train is due to arrive at 7:14 a. m. on Monday. After visiting the Pan-American Exposition the delegates will return to Niagara Falls in time for the opening of the convention on Tuesday morning.

General Strike of Machinists Threatened.

A general strike, to embrace all the machinists throughout the country, is predicted to commence on May 20th unless the employers meet the demands of the International Association of Machinists, which call for a nine-hour day and an increase of 12½ per cent. in wages. A number of firms not now complying with the arrangement entered into between the machinists and the association of employers as to a nine-hour day have recently signed the agreement, and it is predicted that a large number will have signed by May 20th. It is believed that the strike will affect at least 100,000 men directly and over that number of allied mechanics indirectly.

The stockholders of the Albert Lea Electric company of Albert Lea, Minn., have voted to increase the capital stock from $100,000 to $200,000.

National Electric Light Association.

The official programme for the twenty-fourth convention of the National Electric Light association, as prepared by Secretary George F. Porter, is given below. The convention opens on the morning of Tuesday, May 21st, in Niagara Falls, the sessions being held at the International Hotel, the headquarters of the association. The programme is as follows:

TUESDAY MORNING, MAY 21ST.

9 a. m. Meeting of the executive committee, secretary's office, International Hotel.

10 a. m. Morning session in the convention hall of the International Hotel.

Address of President Cahoon.

Paper—"A Station Load Diagram," C. R. Van Trump, Wilmington, Del.

TUESDAY AFTERNOON.

Paper (2 p. m.)—"The Practical Side of the Incandescent Lamp," Francis W. Willcox, Harrison, N. J.

Report of committee on standard candlepower of incandescent lamps.—Dr. Louis Bell, chairman.

Report of committee on amendments to freight classification of electrical apparatus.—James I. Ayer, chairman.

WEDNESDAY MORNING.

Paper (10 a. m.)—"Arc Lighting at the Beginning of the Twentieth Century," H. W. Hillman, Schenectady, N. Y.

Report of committee on photometric value of arc lamps.—Henry L. Doherty, chairman.

WEDNESDAY AFTERNOON.

Paper (2:30 p. m.)—"The Foresee (4-C) System of Charging," Louis R. Wallis, Woburn, Mass.

Report of committee on uniform accounting.—G. E. Tripp, chairman.

Report of committee on analysis of flue gases.—Henry L. Doherty, chairman.

Executive session.

Report of committee on legislative policy.—Samuel Insull, chairman.

THURSDAY MORNING.

Paper (10 a. m.)—"Storage Batteries in Central-station Work," Augustus Treadwell, Jr., New York, N. Y.

Report of committee on rules for electrical construction and operation.—Captain William Brophy, chairman.

Topic—"Steam Heating from Central Stations."

THURSDAY AFTERNOON.

Paper (2:30 p. m.)—"Distribution of Current at High Potential in New York City," Calvin W. Rice, New York, N. Y.

Report of committee on amendments to by-laws.—Samuel Insull, chairman.

Executive session.

Reports of the secretary and treasurer and the executive committee.

Election of officers for the ensuing year.

OFFICERS AND COMMITTEES.

The officers and committees of the association for the year ending with the convention are as follows:

President—James Blake Cahoon, New York city.

First vice-president— Louis A. Ferguson, Chicago, Ill.

Second vice-president—W. Worth Bean, St. Joseph, Mich.

Secretary and treasurer—George F. Porter, New York city.

Master of transportation—C. O. Baker, Jr., Newark, N. J.

Executive committee—Henry L. Doherty, Denver, Colo.; Samuel Insull, Chicago, Ill.; Charles B. Hunt, London, Ont.; Samuel Scovil, Cleveland, Ohio; Ernest H. Davis, Williamsport, Pa.; Charles E. Scott, Bristol, Pa.; H. M. Atkinson, Atlanta, Ga.; William M. Brock, Paterson, N. J.; E. F. Peck, Brooklyn, N. Y.

The officers, members, committees and guests will be distinguished during the convention by the following insignia: Officers, red bow; executive committee, blue bow; active members, brown ribbon; associate members, turquoise-blue ribbon; reception committee, yellow ribbon; guests, rose ribbon; honorary members, white ribbon; press, olive-green ribbon.

Linemen's Strike in New England.

[From the Boston correspondent of the Western Electrician.]

Boston, May 11.—The strike of linemen to which I referred in my letter of a week ago is growing. The strikers have obtained assurances of co-operation from the linemen in Worcester, Lawrence, Haverhill, Newburyport, Salem, Lynn, Springfield and Lowell, Mass. The corporations have not acceded to the demands of the men and show no disposition to yield. Work has been resumed on the State street elevated station of the Boston Elevated Railway company, after a suspension of two days, caused by the strike of housesmiths, who are still out. The Electrical Workers' Union is considering the advisability of calling out workers in other trades. The housesmiths working on the other stations were satisfied with their wages—28 and 33½ cents an hour. Those on the State street station were hired at 22½ and 25 cents an hour. On Wednesday, May 8th, electric-light wires were cut in Brighton district and in Brookline, Mass., but the strikers claim that it was not done by any of them. The police will investigate the matter. The cutting in Brookline caused darkness for several hours in the neighborhood of Chestnut Street avenue.

The Boston Elevated Railway company says that it was not given sufficient time to consider the demands of the linemen, as the latter struck before the directors could meet. The company says that it received a stereotyped copy of a circular in April, but that there was nothing in it to show that its own employes had anything to do with it, and no company was mentioned, so the circular received no consideration.

The New Bedford (Mass.) linemen met Wednesday night, but took no action relative to a strike.

Boston, May 13.—At the meeting of the Building Trades Council of this city, yesterday, it was voted to indorse the linemen's strike. In future union men attached to the council will refuse to work where non-union linemen are employed.

The Electrical Workers' Union of Springfield, Mass., yesterday voted to strike to-day because of the New England Telephone and Telegraph company's refusal to sign an agreement to pay $3.50 a day to foremen and $3 a day to linemen—the day to be eight hours, and time and a half to be paid for overtime. The strike involves 100 linemen, and affects all cities and towns between Spencer, Mass., Bellows Falls, Vt., and the New York and Connecticut state lines.

Two of the 13 linemen at Fitchburg, Mass., and 50 linemen employed on trunk lines at Ayer Junction, Mass., have struck.

The Housesmiths' Union yesterday decided to call out all its members employed by G. W. & F. Smith of this city. This firm is constructing the State street station of the Boston elevated road, and the men working on that station are now on strike for more pay.

The New England Telephone company's linemen at Lowell, Mass., struck Saturday morning. These

PAN-AMERICAN EXPOSITION.—MACHINERY AND TRANSPORTATION BUILDING.

men cover a large and important district of small t wns.

The striking linemen expect help from the International Brotherhood of Electrical Workers, with which the local union is affiliated. B.

Chicago Edison and Commonwealth Reports.

The annual financial statement of the Chicago Edison company issued last week shows much the largest earnings in the history of the company. For the fiscal year ended March 31, 1901, the net surplus, after paying all expenses and fixed charges, amounted to 10¼ per cent. on the amount of the capital stock outstanding. The net earnings for the year were $902,959, and a balance was carried to surplus after paying interest and dividends of $145,479. The following shows the earnings and balance sheet, compared with the preceding year:

Year ended March 31st:	1901.	1900.	Increase.
Gross income from electric current and merchandise sales	$2,517,219	$2,123,827	$383,392
Operating, repairs and renewals and general expense	1,614,260	1,321,437	292,823
Net income from all sources	$ 902,959	$ 812,390	$ 90,569
Bond interest	279,792	265,243	14,549
Balance for stock	$ 623,167	$ 547,147	$ 76,020
Dividends paid	477,688	398,072	79,616
Balance	$ 145,479	$ 149,075	*$ 3,596

*Decrease.

BALANCE SHEET, MARCH 31, 1901.

ASSETS.

	1901.	1900.	Increase.
Plants, real estate and franchises	$11,392,971	$10,817,676	$575,295
Material and unfinished work	241,542	236,484	5,058
Accounts and notes receivable	563,984	435,920	128,064
Cash	156,455	65,261	91,224
	$12,354,982	$11,555,341	$799,641

LIABILITIES.

Capital stock	$ 6,000,000	$ 5,971,100	$ 28,900
Funded debt	5,508,000	4,808,000	700,000
Accounts and notes payable	70,896	160,016	*89,120
Open accounts	53,884	39,452	14,382
Surplus	250,252	182,773	67,479
Depreciation reserve	420,000	350,000	70,000
Insurance fund	52,000	44,000	8,000
	$12,354,982	$11,555,341	$799,641

*Decrease.

Gross and net earnings for a term of years have been:

	Gross.	Net.		Gross.	Net.
1900-01	$2,517,219	$901,959	1896-97	$1,548,608	$599,674
1899-1900	2,133,827	812,380	1895-96	1,461,084	562,567
1898-99	1,954,877	740,256	1894-95	1,437,042	483,605
1897-98	1,661,863	676,525	*1893-94	2,141,779	680,677

*Includes 15 months from January 1, 1893, to March 31, 1894.

At the forthcoming annual meeting, to be held on June 10th, a proposition to increase the authorized capital stock to $10,000,000 (the amount now authorized being $6,000,000) will be voted upon and, without doubt, carried. Of the authorized increase about $900,000 will be put out in August. Additional issues will be put out from time to time, as the business expands, in the discretion of the directors.

The statement of the Commonwealth Electric company for the fiscal year ended March 31, 1901, being the third year of the company's existence, shows an increase of $112,000 in gross receipts as compared with the year before, the amount being nearly double what it was in the first year. The capital investment is represented by an increased bond issue, being due, partly, to power-house construction, which will result in cheaper operation as compared with the first year. Earnings and balance sheet compare as follows:

Year ended March 31st:	1901.	1900.	1899.
Gross income from current and merchandise sales	$629,047	$517,151	$390,065
Operating expenses, repairs, renewals and general expense	410,176	349,169	260,999
Net income	$218,871	$177,961	$129,065
Bond interest	137,770	124,592	103,911
Balance for stock	$ 81,101	$ 52,969	$ 25,155

BALANCE SHEET, MARCH 31, 1901.

ASSETS.

	1901.	1900.	Increase.
Plants, real estate and franchises	$8,353,584	$7,643,682	$709,902
Material and unfinished work	78,193	46,961	31,237
Accounts and notes receivable	129,926	80,350	49,576
Cash	33,501	17,543	15,958
Other accounts	2,823	.....	2,823
Total	$8,598,032	$7,788,536	$809,496

LIABILITIES.

Capital stock	$5,000,000	$5,000,000	.....
Bonds	3,114,000	2,500,000	$614,000
Accounts payable	324,806	199,178	125,628
Open accounts	.....	11,233	*11,233
Surplus account	159,226	78,125	81,101
Total	$8,598,032	$7,778,536	$809,496

*Decrease.

G. W. Baumgoff, former general manager of the St. Louis Transit company, is one of the incorporators of a new company that will operate an electric line from Las Vegas, N. M., to Hot Springs, N. M. V. O. Saunders of St. Louis is also interested.

General Meeting of the Institute.

A preliminary programme has been prepared for the general or summer meeting of the American Institute of Electrical Engineers, to be held at Buffalo, N. Y., during the Pan-American Exposition. It is proposed to begin the programme by a meeting of the members of the Institute and their European guests for formal welcome and reception on Wednesday, August 14th, at the house of one of the engineering societies in New York city, as found most convenient and as arranged later. A collation will be served after the meeting, and there will be a steamboat excursion in the afternoon. On the two following days technical visits will be made to important works and installations in New York city and vicinity. A banquet will take place on one of these evenings, and arrangements may be made later for a reception or some entertainment on the other evening. No special assignment is made for Saturday, in order to enable visitors to make their own arrangements for sightseeing and recreation.

The council committee has under consideration for Sunday, August 18th, a daylight trip up the Hudson River to some convenient point, thence by rail to Albany, where the party will stop over night, leaving early on Monday, August 19th, for a visit to the works of the General Electric company at Schenectady. From Schenectady the party will go by special train to Buffalo. On Tuesday morning, August 20th, the general meeting of the Institute will open at Buffalo in the Temple of Music with addresses by the exposition and municipal officials. A preliminary visit will be made to the exposition in the afternoon. On the three following days there will be sessions for the reading and discussion of papers in the forenoons, and perhaps on some of the afternoons. The director-general has designated August 22d as "Electrical Day."

The programme contemplates the allotment of an entire day, if possible, for an excursion to Niagara Falls and the various electrical features to be seen at that place. Visits will also be made to various sub-stations in Buffalo. The closing meeting will probably be held on Saturday, August 24th. Entertainments and receptions may be provided for some of the late afternoons or evenings. Visitors desiring to include other large American cities in their tour will be able to obtain all information desired from the secretary of the Institute, at 26 Cortlandt street, New York city, and also from members residing in these cities who will be in attendance at the meeting both in New York and Buffalo. Local committees of the American Institute of Electrical Engineers will be appointed in some of the larger cities to cooperate with the council committee for the purpose of facilitating the arrangements which the visitors may desire to make for visiting various places of interest.

The Chicago and Desplaines Electric Railway company is having a difficult time in securing the right-of-way for a portion of its line between Chicago and Joliet. The desired right-of-way lies through the property of the National Stone company at Sag Bridge, and it is said that dynamite has been planted in this property and that the railway company fears to enter the property. Condemnation proceedings are talked of.

New Central Station at Cologne, Germany.

BY FRANK C. PERKINS.

In the city of Cologne, Germany, a new central station has recently been completed which may be considered a typical example of electrical power-station work in Europe. The plant was installed by the Helios company of Cologne and Ehrenfeld, together with Siemens & Halske of Berlin and Schuckert & Co. of Nuremberg.

The old central station consists of two main rooms, the boiler room and the engine and generator room. The switchboard and controlling apparatus is placed in a gallery, and there is an electrically operated crane. The station represented the best central-station practice at the time of construction, but it can hardly compare with the new station.

In the boiler house there are 10 water-tube boilers of the Steinmuller type, each having a heating surface of 212 cubic meters and designed to operate at a pressure of 10 atmospheres. Each boiler has 140 water tubes of five meters' length. The boiler furnaces are supplied with fuel consisting of coal and coke. In the engine room of the old plant there are four units installed. The engines are of the horizontal, compound, condensing type, and were installed by the Sulzer Brothers of Winterthur. Each of the engines has a capacity of 600 effective horsepower, while working at a speed of 85 revolutions per minute, the steam pressure being six atmospheres. The high-pressure and low-pressure cylinders have a diameter of 650 and 900 millimeters, respectively, while the stroke is 1,250 millimeters. The alternators are directly connected to the engines and are of the revolving-field type. The field acts as a flywheel for the engine and has a diameter of 4,300 millimeters and is built with 72 poles. The armature is stationary, and the current generated has a potential of 2,000 volts and a frequency of 6,120 alternations per minute, or 51 periods per second. The exciting dynamo is built on the same shaft, and consists of an eight-pole, direct-current generator, next to the revolving-field magnet. Each of the alternators has a capacity of from 360 to 400 kilowatts at 2,000 volts. The electric crane has a capacity of 30,000 kilograms.

FIG. 1. NEW CENTRAL STATION AT COLOGNE, GERMANY.

The machines and feeder circuits are controlled from the switchboard by levers placed convenient for the operator. The contacts and switches are placed out of reach of the operator, to avoid the danger of contact, while the measuring instruments are always under his eye and the levers within reach.

The new plant, a portion of which is shown in Fig. 1, is equipped with units of more than double the capacity of those in the old station. Six direct-connected generators are to be used in this station, each having a capacity of 1,200 kilowatts and supplying a polyphase current of 2,000 volts' potential. The frequency of these machines is 6,120 alternations per minute, or 51 periods per second, the speed of the revolving field being 85 revolutions per minute. The steam engines are of the triple-expansion type, using condensers, and were designed and constructed by the Sulzer Brothers.

The revolving-field magnets of these polyphase

machines are not excited by direct-current machines operated on the same shaft as the alternators, as in the old station. Instead of this arrangement, motor-generators are provided, as seen in Fig. 1. Each direct-current generator has a capacity of 120 kilowatts and is operated by a synchronous single-phase motor, directly connected, and driving the generator at a speed of 500 revolutions per minute.

In order that there may always be exciting current at hand, a storage-battery plant has been provided. It consists of accumulators having a capacity of 2,176 ampere-hours, with a total potential of 110 volts. An additional charging outfit has been provided for this accumulator plant, consisting of a

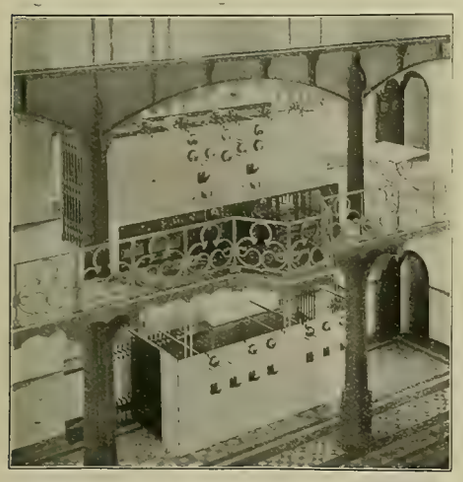


FIG. 2. NEW CENTRAL STATION AT COLOGNE, GERMANY.—SWITCHBOARD.

30-horsepower, asynchronous, alternating-current motor, directly coupled to a direct-current dynamo, having a capacity of 420 amperes at 50 volts, with a speed of 950 revolutions per minute. The neatness of the switchboards, as seen in the illustration, Fig. 2, as well as the general appearance of the station, is particularly worthy of note.

The distribution is entirely by underground cables, of which there are more than 80 kilometers in use. One of the sub-stations, or switch and transformer houses, is seen in Fig. 3, on one of the streets of the city of Cologne. Each of these stations is equipped with telephones for communicating with the central station and with other similar sub-stations.

A Canadian View of International Power Development.

The Toronto World takes a pessimistic view of the Canadian development of the Niagara Falls Power company and thinks that the development of electric power on the Canadian side is causing greater satisfaction on the American side of the river than in Canada. It adds: "It was a serious blunder on the part of the government to allow the company to transmit the power developed in Canada across the river. We may rest assured that the development company, whose directors are Americans, and whose interests are all in the United States, will concentrate its efforts in getting new factories for New York instead of for Ontario. If Ontario had reserved for itself all the power produced on this side of the river, the price for electric current would have been lower, and it would have been distributed over a much larger area than will be the case under the present arrangement. Mr. Rankine refers, with satisfaction, to the recent successful transmission of electric power in California, for a distance of 140 miles. It is said the loss of current was only five per cent. If such is the case, then the distribution of Niagara Falls power throughout all western Ontario would be an easy and profitable undertaking. The Ontario government's deal with the United States electric monopoly was an egregious blunder, and a storm of indignation will sweep over the country as soon as the people realize that their rich heritage has been squandered for a mess of pottage."

Mr. Fish Succeeds Mr. Edison.

At the annual meeting of the stockholders of the General Electric company held at Schenectady, N. Y., on May 14th, Frederick P. Fisk of Boston, the retiring general counsel of the company, was elected a member of the board of directors, to succeed Thomas A. Edison. The remaining 12 directors were re-elected as follows: Gordon Abbott, Oliver Ames, C. A. Coffin, T. Jefferson Coolidge, Jr., George P. Gardner, Eugene Griffin, Henry L. Higginson, J. Pierpont Morgan, J. P. Ord, Robert Treat Paine, 2d, George Foster Peabody and Charles Steele. Only routine business was transacted at the meeting.

National Municipal League.

The annual convention of the National Municipal League was held at Rochester, N. Y., May 8th, 9th and 10th. Delegates from many of the principal cities in the United States were present, and topics of municipal interest were discussed. A paper on the street-railway outlook in Chicago was given by William Ritchie, said to represent an organization called the Chicago Citizens' Union. Mr. Ritchie, as reported, made some curious statements in his paper, such as the assertion that the Chicago Union Traction company had gradually absorbed all competing lines until to-day it controls the entire street-railway business of Chicago, and the further allegation that the company controls the state Legislature of Illinois. Considerable attention was given to the subject of municipal accounting.

The following-named officers were elected for the ensuing year:

President, James C. Carter of New York; first vice-president, Charles Richardson of Philadelphia; second vice-president, Samuel B. Capen of Boston; third vice-president, Thomas N. Strong of Portland, Ore.; fourth vice-president, H. Dickson Bruns of New Orleans; fifth vice-president, Edmund J. James of Chicago; secretary, Clinton Rogers Woodruff of Philadelphia; treasurer, George Burnham, Jr., of Philadelphia.

Executive Committee—Charles J. Bonaparte, chairman, of Baltimore, George W. Guthrie of Pittsburg, George W. Ochs of Chattanooga, Hector McIntosh of Philadelphia, Joseph A. Miller of Providence, Oliver McClintock of Pittsburg, W. P. Bancroft of Wilmington, Del., Harry A. Garfield of Cleveland, William G. Low of Brooklyn, Dudley Tibbits of Troy, Frank N. Hartwell of Louisville, John A. Butler of Milwaukee, M. Thresher of Dayton, Ohio, and Joseph T. Alling of Rochester.

The convention closed without a meeting place being decided on for next year.

New England Street Railway Club.

The New England Street Railway Club met in Boston last week, with 180 members present, including the following-named officers: President, H. E. Bradford, superintendent of the Worcester Consoli-

FIG. 3. STREET TRANSFORMER SUB-STATION AT COLOGNE GERMANY.

dated; vice-president, L. H. McLain, inspector for the railroad commissioners; second vice-president, C. A. Bradwell, superintendent of the Sanford (Me.) street railway; third vice-president, W. G. Meloon, general manager of the street railway of Portsmouth, N. H.; fourth vice-president, F. G. Daniels, electrical engineer of the Fairhaven and Westville street railway of New Haven, Conn.; secretary and treasurer, F. W. Teele of Boston. At the invitation of the Boston Elevated Railway company, the members of the club took a trip over the Charlestown section of the elevated road and visited the shops and "Kindergarten" for the elevated employes. They also visited the company's power house at Lincoln wharf. The business meeting acted upon 85 applications for admission to the club. There were 250 persons at the annual dinner, at which President Bradford made an address of welcome and President W. A. Bancroft of the Boston Elevated Railway company explained the elevated system.

L. H. McLain resigned the first vice-presidency and E. L. Spring was elected to succeed him. The club voted its thanks to the management of the Boston Elevated Railway company for courtesies received.

Albany Street-railway Strike.

Employes of the Union Traction company, which operates in Albany, Troy, Watervliet, Rensselaer and Cohoes, N. Y., have gone on strike. The strike, according to the men, has been brought about by the refusal of the company to accede to two demands—that the company employ none but members of a branch of the Amalgamated Association of Street Railway Employes of America, and that eight non-union men employed be discharged or compelled to join the union, and that all "night-car" men and "extra" men, who now get 18½ cents per hour, be paid 20 cents, the compensation of regular day men.

The situation at Albany and Troy assumed a serious aspect this week, and the strikers resorted to violence when the street-railway company made efforts to run its cars with non-union men. One man was killed and some 20 or 30 injured. The state militia has been called upon to help quell the riots and a thousand men are under arms awaiting orders. The Twenty-third Regiment of Brooklyn has been ordered to Albany, and three companies of the Tenth Battalion are on guard there.

Electric Railway between Baltimore and Washington.

By the incorporation of the Baltimore and Washington Electric Railway company, another project has been added to the long list of important electric-railway projects now under consideration. The company proposes to build a line that will extend from the national capital to Baltimore, and a branch will be built to Annapolis. The air-line distance between Washington and Baltimore is about 33 miles, but the railway will undoubtedly be considerably longer. The company was incorporated in the state of Maryland, with an authorized capital stock of $1,500,000, and the promoters of the railway have elected the following-named officers for the company: President, James Christy, Jr., of Akron, Ohio; treasurer, Otto Miller; secretary, Frank M. Wilcox. A franchise has already been secured.

Mail Carried by Automobiles.

Experiments were made in Chicago on Monday, May 13th, by the officers of the postoffice, to find some way to facilitate the delivery of mail. A business firm in the city loaned Postmaster Coyne two electric automobiles with which to make the experiments. One vehicle, in charge of Superintendent McArthur, left the main postoffice at 6:30 o'clock with six letter carriers and 500 pounds of mail. It made the run to South Water street and Fifth avenue, a distance of about a mile, dropping off men at various points, and back to the office in 12 minutes. As a result of this trip the carriers were relieved of their heavy burdens and the business houses received their mail from five to nine minutes earlier. Postmaster Coyne regards the experiment as a success and will try to secure vehicles for permanent use in this way.

D. P. Jones.

The chief engineer of the Niagara Falls Hydraulic Power and Manufacturing company is D. P. Jones, and he is a gentleman whom many of the members of the National Electric Light association will meet while at Niagara next week. Mr. Jones is an alumnus of the Chandler Scientific School of Dartmouth College, having graduated in 1890. From 1890 to 1894 he was in the employ of D. H. & A. B. Tower of Holyoke, Mass., as engineer in charge of the construction of paper and pulp mills and the development of waterpowers. He is familiar with important hydraulic works in several states of the Union. He was connected with the construction of the Kimberley & Clark mills in the Fox River Valley and with the big paper mill now owned by the International Paper company at Niagara Falls. In 1894 he became

D. P. JONES.

assistant engineer in charge of construction of the Niagara Falls Power company, with which company he remained until October, 1900, when he was appointed to his present position.

The power development of which Mr. Jones has charge is that of the surface canal, the station being at the water's edge in the gorge. The third section of this station is now nearly ready for operation, and members of the association will find it well worth their while to visit it, many improvements having been made there since their last visit to the Falls.

The Fort Wayne and Southwestern Traction company is building an electric railway between Fort Wayne and Huntington, Ind., a distance of 25 miles.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK

CIRCULATION, 20,000.

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Visitors to the Pan-American Exposition will find the Western Electrician's space in Section F 2 in the Electricity building, where they will be cordially welcomed.

There appears to be an immediate opening in Sweden for Professor Pupin's invention to increase the efficiency of long submarine telephone cables by the attachment of inductance coils at calculated intervals. The Swedish government is considering a project for laying a telephone cable between the mainland and the island of Gothland in the Baltic. Many objections are being raised to the carrying out of this enterprise, however, as the problem of long-distance submarine telephony is considered by the Swedish engineers to be still unsolved.

The Swedish telegraph administration and the owner of the Pupin patents might find it of mutual advantage to open negotiations for the equipment of the proposed Gothland cable. A new cable from 62 to 93 miles long built and laid for telephone service would give an admirable opportunity to test the advantages claimed for Professor Pupin's invention.

In a recent communication to a scientific contemporary Mr. F. H. Bigelow concludes, from a theory based upon Ebert's and Pupin's experiments on the behavior of a conducting body placed in a vacuum and subjected to magnetic force, that the photosphere of the sun is the seat of powerful electric discharges which ionize portions of its material, or, at least, set free minute particles of matter charged with electricity. According to this interesting conception, the particles are repelled outward in a coronoidal radiation, and give the forms seen in the disorganized streamers. This nucleus of the sun may be the seat of a powerful magnetic field whose axis is near that of the sun's axis of rotation, and whose action upon the ions repels them from the polar zones in accordance with Ebert's experiments. The equatorial regions of the sun usually show that there is a tendency to form a trumpet-shaped extension along the ecliptic, widening in proportion to the distance from the sun. This is taken to be another evidence of the fact of mutual electrical repulsion between the charged ions of like sign.

It is interesting to observe the attitude of submarine-cable owners toward wireless telegraphy, as the latter seems to be meeting its greatest success in transmitting messages over water. This attitude appears to be rather patronizing and not antagonistic, if we are to judge by the presidential address of the Marquis of Tweeddale at the half-yearly meeting of the Eastern Extension, Australasia and China Telegraph company in London last month. "You will probably remember," said the noble lord, "that when addressing you on former occasions I have referred to Signor Marconi's interesting experiments in connection with wireless telegraphy, and the probable effect of this remarkable system on submarine telegraphy. It is now nearly six years since Signor Marconi first startled the world with his discoveries, and during that period considerable progress has been made in communicating with lightships, exchanging messages between passing ships and speaking across the channel, etc., the longest distance now reported to have been attained being nearly 124 nautical miles. For such purposes as those I have indicated wireless telegraphy undoubtedly meets a long-felt want; but the sensational reports appearing in the newspapers from time to time as to wireless telegraphy being used for communicating across the Atlantic, between England and Australia, and even with the planet Mars, must not be taken seriously. If it were possible to use the wireless system for long-distance submarine telegraphy, the British and Colonial governments would hardly have entered into the contract for bridging the Pacific Ocean at a cost of £2,000,000 sterling, when their object might have been attained at a trifling expenditure. The fact is, gentlemen, that Marconi's system will, no doubt, as I said, I think, some two or three years ago, prove a feeder to this system." This seems to dispose of the possible competition of space telegraphy very comfortably for the stockholders of the cable companies. It does seem that the new method of communication is making rather slow progress when compared with the introduction of the telephone, for instance, but nevertheless some progress is being made, and it may be that the ethereal telegraph may eventually prove a more formidable rival for established systems than those interested in the latter are now disposed to admit.

Agitation for the general adoption of the metric system of weights and measures does not cease. Just at the close of the Fifty-sixth Congress the committee on coinage, weights and measures recommended the passage of a bill providing for the adoption of the standards of the metric system as the standard weights and measures of this country. But the committee report came too late. However, the metric-system bill will probably be a live question in the Fifty-seventh Congress, and it devolves upon all friends of progress to recognize the fact and endeavor to assist in securing the passage of the bill. The bill which was reported to the Fifty-sixth Congress provided that the adoption of the system should go into effect on January 1, 1903. The bill which will be introduced next winter probably will give more time in which to permit manufacturers to change their machinery and citizens to become accustomed to the new units of measurement. Of course, the change, if accomplished, will be a radical one in ordinary business transactions. But it will be worth all it will cost, and more, in its beneficial effect on the export trade of the United States alone. England is our only important customer in the family of nations that does not use the metric system, and it is a fair assumption that if the United States does away with feet and inches, pounds and quarts, Great Britain will not be long in following suit. We know the advantage of the decimal system by the experience with our coinage, and it is probable that the sole objection to the metric units—the expense and confusion of making the change—has been overrated. Of course, it goes without saying that the scientific and technical interests of the country are almost unanimous in favor of the metric system, which is to some extent already in use in the United States.

In this issue of the Western Electrician advantage is taken of the convention of the National Electric Light association to be held in Niagara Falls, N. Y., next week (May 21st to 23d) to present a well-illustrated preliminary description of the electrical features of the Pan-American Exposition and of the use of electrical power in the Niagara Falls region, particularly in its relation to the exposition. The combination is a most interesting one, and we have no hesitation in saying that Mr. Dunlap's article in this number gives the best account of what may be seen, electrically speaking, at the Pan-American Exposition, and of the intimate relation of the whole to the hydro-electric development at Niagara Falls, that has yet appeared. The article, with the accompanying maps and illustrations, will be particularly useful to the members of the association, assisting them to appreciate and understand what they shall have time to see in a few days' visit in Niagara Falls and Buffalo, but it will also possess much interest to the general reader, as it is comprehensive as well as concise and gives an excellent idea of the electrical features of the Pan-American Exposition as they are now to be seen. For one thing, the beautiful night pictures give foundation for the belief that the enthusiastic descriptions of the electric-lighting effects are not overdrawn, for, of course, no night photograph of decorative lighting can convey more than an indication of the effect of the original on the eye. It is probable that the Buffalo exposition will be best remembered by its marvelous illumination. Already it is called the City of Golden Light.

But the visitors to the electric-light convention must not forget their allegiance to the gathering at Niagara Falls. President Cahoon and Secretary Porter have prepared a programme of many attractive features, with six papers by Messrs. Hillman, Willcox, Wallis, Van Trump, Rice and Treadwell, and several important committee reports. There will be no evening sessions of the convention, and it is hoped that the attendance at the morning and afternoon meetings may be large, so that a valuable discussion may be had on the many interesting topics presented for discussion. The gathering will be held amid surroundings which will be a constant provocation for absenteeism, but delegates should steel themselves against temptation in advance and remain loyal to the association during the hours of the convention sessions.

Mr. Abbott's High-frequency Experiments.

Mr. A. V. Abbott, chief engineer of the Chicago Telephone company, gave a lecture, illustrated by experiments, on "High-frequency Electrical Oscillations," before the Western Society of Engineers on Wednesday evening, May 8th. The experiments were numerous and well chosen and were arranged in such sequence that each step of the lecture was clearly illustrated. Some striking comparisons between electrical and mechanical phenomena were made. The apparatus used in making these experiments consisted of a rotary transformer, condensers, an oscillator and a large Tesla transformer, immersed in oil.

The experiments served to show the analogy existing between inductance in a conductor and mechanical resistance and between the capacity of a conductor and mechanical elasticity. A number of the more familiar Tesla effects were produced; vacuum tubes were lighted; the effect of the high-frequency discharge on pieces of wood was shown; glass and mica plates were perforated, and a brush discharge was caused to exist between two conductors run parallel to each other and a few inches apart, down the aisle of the lecture room.

The rate of oscillation varied from 218,000 to 400,000 per second and the potential ran up to 200,000 volts, while the capacity of the condensers was 0.05 of a microfarad. A unique feature in the construction of the condenser was the dielectric between the plates. This consisted of sheets of micanite paper saturated with oil and pressed together in oil, it having been found that the dielectric strength of this combination was greater than that of glass. The oscillator also comprised some new features. It consisted of five balls of aluminum. These balls were carried on two supports, three alternate ones being carried on one support and the remaining two being placed on the other. The adjustment of the spark gap was obtained in this arrangement by causing one set or system of balls to approach or recede from the other. By means of this series arrangement the number of spark gaps remained constant; only the spark length changed, and the total dielectric strength of the gap was increased.

One of the most striking experiments was the lighting of an ordinary incandescent lamp by Mr. Abbott, by means of high-frequency current transmitted through his body. This transmission, he said, was attended by no disagreeable sensations other than a slight twitching in the wrists. In performing this experiment, Mr. Abbott stood on an insulated base and extended a metal rod, which he held in one hand, to one of the discharge terminals of a transformer, between which a discharge probably a foot in length was passing. With a metal rod held in the other hand he touched one coil of a second Tesla transformer, to the other coil of which an ordinary incandescent lamp was connected. As the rod was approached to the discharge terminal a torrent of sparks passed into it, through the coil, and the lamp was brightly lighted.

The ability of these high-frequency oscillations to perform work was further illustrated by means of a small static motor. This consisted of two revolving vanes, the pivot supporting which was connected to one terminal of the Tesla transformer; from the other terminal a wire was led to an insulated disk held above and close to the movable vanes. The electro-static attraction between the disk and the vanes caused the latter to revolve slowly. After the lecture Mr. Abbott connected an X-ray tube with the Tesla transformer and by means of a fluoroscope demonstrated the ability of these high-frequency oscillations to produce the familiar X-ray effects. Mr. Abbott was assisted in his experiments by Mr. M. A. Edson of the Chicago Telephone company.

Navy Board Favors Wireless Telegraphy.

The board of naval officers, headed by Captain Chadwick, appointed to make a full investigation and report on wireless telegraphy, has completed its work and submitted its report to Admiral Bradford, chief of the naval bureau of equipment, having charge of this subject. It had been expected that the inquiry would last through the summer, and the Navy Department has been somewhat surprised at the promptness with which the board has been able to reach its conclusions. Although the findings are not made public, it is believed that the board recommends that wireless telegraphy be adopted and that the present system of using carrier pigeons for messages between naval points be abandoned.

With the report the board submits the results of an extended conference with Mr. Marconi concerning the general subject. It is understood that Marconi made no proposition regarding his own system, and that the board secured his views as an expert on the general subject. There is no finding in favor of any particular system, but a general treatment of all systems. The board has no doubt, it is said, that wireless telegraphy will prove a valuable adjunct for the navy.

Southwestern Gas, Electric and Street Railway Association.

The third annual meeting of the Southwestern Gas, Electric and Street Railway association was held in Houston, Texas, from April 19th to 22d. On the opening day the meeting was called to order by the president of the association, J. F. Strickland of Waxahachie, Texas. An address of welcome was made by Hon. L. J. Fuffly, acting for Mayor Woolford. After a brief response President Strickland delivered his annual address. He spoke briefly of the work of the association, its committees and officers, and then reviewed the different topics to be presented at the meeting in the form of papers by the members. He recalled the fact that the first meeting of the interests represented by the association had been held in Houston in 1895.

T. D. Miller called attention to the important part taken by the gas men in inaugurating the work of the association, and among other things said the wonderful development of oil at Beaumont was sufficient guarantee of the future of the gas business in Texas, as there was no purpose for which the Beaumont oil was so well adapted as the manufacture of gas.

Secretary T. H. Stuart of Waco, Texas, then submitted his report, which showed that the finances of the association were in a good condition.

At the afternoon session a paper was read by T. D. Miller, manager of the Dallas Gas and Fuel company, on "Municipal Ownership versus Private Corporations." The paper was accompanied with some general statements on the subject of municipal ownership and a number of quotations from different authorities showing the results of operation in the United States and abroad. The next paper was on "Water Power for Small Plants," by F. R. Starr, superintendent of the Gonzales (Texas) Electric Light company. H. F. MacGregor, president of the Houston Street Railway company, then read a paper on "The Corporation and Its Employes." Other papers presented at the meeting were: "Station Work," by George H. Cushman of San Antonio, Texas; "What Are We Here For?" by E. L. Wells, Jr., of Marshall, Texas; "Inspection," by W. S. Rathell, Waco, Texas; "Electrical Potpourri," by John G. Boyd, Terrell, Texas; "Cheap Fuel and How to Use It Economically," by L. T. Fuller, Calvert, Texas.

The officers elected for the ensuing year were as follows: President, H. F. MacGregor, Houston Electric Street Railway company; first vice-president, E. H. Jenkins, San Antonio Gas company and San Antonio Street Railway company; second vice-president, C. F. Yeager, Laredo Electric and Railway company; third vice-president, J. R. Cullinane, Denison Electric Light and Gas company; secretary, T. H. Stuart, Waco Gas company; treasurer, Thomas D. Miller, Dallas Gas and Fuel company; directors, H. F. MacGregor, Houston, Texas; E. H. Jenkins, San Antonio, Texas; C. F. Yeager, Laredo, Texas; J. R. Cullinane, Denison, Texas; J. F. Strickland, Waxahachie, Texas; R. B. Baer, Galveston, Texas; Thomas D. Miller, Dallas, Texas; E. Dysterud, Monterey, Mex.; J. B. Ward, Beaumont, Texas; F. R. Starr, Gonzales, Texas; A. E. Judge, Tyler, Texas.

Following is given a list of the names of those in attendance at the sessions of the convention. Where the state is omitted from the address, it is to be understood that the cities are located in Texas:

Barden, E. T. ..... Houston
Bennett, F. J., Jr., Galveston City Railway company ..... Galveston
Bitgood, F. C. .....
Bonner, B. F. ..... Houston
Bonner, J. S. ..... Houston
Bonner, J. A. ..... Houston
Brooke, W. M., Electric Appliance company ..... Dallas
Brown, C. H. .....
Buck, C. H., Detroit Stove Works ..... Chicago, Ill.
Buescher, E. .....
Collier, G. A., Galveston City Railway company ..... Galveston
Cooley, D. D., Houston Electric Street Railway company ..... Houston
Cramer, Albert ..... Houston
Cushman, George, San Antonio Traction company ..... San Antonio
Davis, C. W. ..... Palestine
Ellis, E. S., Houston Electric Street Railway company ..... Houston
Ford, Charles W., Galveston City Railway company ..... Galveston
Fuller, L. H. ..... Bryan
Fuller, L. T. ..... Calvert
Gerhard, Harry H. ..... Austin
Gilchrist, J. A. ..... Gatesville
Gimper, John, Galveston Gas company ..... Galveston
Greenhill, W. L., Merchants' Electric Light and Power company ..... Gainesville
Guldlin, O. N. ..... Ft. Wayne, Ind.
Hayward, A. H. ..... Houston
Henderson, R. D. .....
Hobson, C. W., Waco Electric Supply company ..... Waco
Hobson, Sam, Waco Electric Supply company ..... Waco
Irving, Tom ..... Chickasha, I. T.
Jenkins, E. H. ..... San Antonio
Johnson, J. E., Westinghouse Electric and Manufacturing company ..... Dallas
Judge, A. E., Tyler Electric Light and Power company ..... Tyler
Kingston, W. W., Lorain Steel company ..... Atlanta, Ga.
Knight, Frank B. ..... Houston
Kuhlman, E. ..... Elkhart, Ind.
Lee, John G. ..... Brownwood
Lee, R. H., Jr. ..... Pittsburg, Pa.
Lehman, J. S. ..... St. Louis, Mo.
MacGregor, H. F., Houston Electric Street Railway company ..... Houston
McVea, J. C. ..... Flatonia
Miller, T. D. ..... Dallas
Monroe, H. L., General Electric company ..... Dallas
Moore, Al, Waco Electric Supply company ..... Waco
Newning, C. A. ..... Houston
Patterson, H. C. ..... Austin
Payne, J. T., Galveston City Railway company. Galveston
Payne, J. W., Houston Electric Street Railway company ..... Houston
Pletzker, E. J., American Steel and Wire company .. .. Chicago, Ill.
Raggio, V. E. ..... Dallas
Rathburne, H. E., Victoria Ice, Light and Power company ..... Victoria
Reed, W. W., Columbia Incandescent Lamp company ..... St. Louis, Mo.
Reed, Warren B., Safety Electric and Manufacturing company ..... New Orleans, La.
Richards, Charles M., City Electric Light and Water Works ..... Ladonia
Roberts, C. W. ..... Abilene
Rosenthal, A. R. ..... Houston
Sanders, H. J. ..... Brenham
Scovill, Frank E. ..... Austin
Smith, J. S. ..... Brenham
Smith, W. R. ..... Belton
Spranley, W. T., Newman-Spranley company, Ltd.. ..... New Orleans, La.
Starr, F. R. ..... Gonzales
Storie, H. C. ..... Ennis
Strickland, J. F. ..... Waxahachie
Stuart, T. H., Citizens' Railway company ..... Waco
Ward, J. C. ..... Beaumont
Whipple, T. H. Bailey, Buckeye company ..... Cleveland, Ohio
Wier, R. W. ..... Houston

Affairs of the United States Carbon Company.

The statement has been made that the assets of the United States Carbon company of Cleveland, Ohio, which was recently embarrassed by the failure of the Cuyahoga Savings and Banking company, are $200,000, and that the liabilities are $181,000. Much of the paper was held or indorsed by the Cuyahoga company, of which R. N. Pollock, who committed suicide in Seattle, Wash., last week, was president. Mr. Pollock was also treasurer of the Carbon company, but he is said to have left the finances of the latter concern in good condition. The Carbon company, it is asserted, is now making money, and all the paper out would have been redeemed in time, although it is believed that it would not have been taken up when due. The company had just gotten on its feet, and through a more rapid process of baking, it had greatly cheapened the manufacture of the goods. Mr. Pollock was the promoter of this company and was greatly interested in it, but it is not now believed that the financial condition of either this company or the bank caused him to take his life, but rather disappointment in not being placed at the head of a new financial concern which has been in the process of formation in Cleveland. Manager W. E. Saunders of the Carbon company is said to be confident that the embarrassment of his institution would be only temporary. It was running double time, he is quoted as saying, and was behind with its orders. Temporary lack of funds to meet pressing obligations, he said, had cramped it, but he was positive these would be met if the company is given time to turn itself.

Following the embarrassment of the Cuyahoga and Carbon companies comes the announcement that the Horix Manufacturing company of Cleveland has had a receiver appointed for it. Mr. Pollock was also largely interested in this company and Mr. Saunders was its manager. It is said that the assets of the company are $25,000 and the liabilities $28,500.

Professor Kintner on Wireless Telegraphy.

(From the Indianapolis correspondent of the Western Electrician.)

Professor S. M. Kintner, formerly of Shelbyville, Ind., now professor of electrical engineering in the Western University of Pennsylvania, who is now visiting at Shelbyville, has attracted much attention by his work in wireless telegraphy. Professor Kintner was born on a farm near Corydon 29 years ago. He graduated from the New Albany public schools, and from Purdue University, Lafayette, in 1893, winning honors in electricity and mathematics. He came to Shelbyville and served as electrician for the Home Telephone company while the plant was being built. He then took service with the Bell Telephone company, but was soon called to the Western University of Pennsylvania, to work with Professor Reginald Fessenden, then with that institution. Professors Fessenden and Kintner made a receiver for wireless telegraphy. Professor Kintner says that wireless telegraphy will never supplant the system now in use, but that it will remain valuable for signaling ships at sea, sending messages from rapidly moving trains, and in the explosion of mines, torpedoes, etc.

Consul Warner of Leipzig urges the introduction there of American electric street-car heaters, the three electric roads in and near that city not having a single car which is heated, even in the coldest winter weather. He adds that, in order to meet with success, it will be necessary, first of all, to convince the authorities of the fact that the health of the general public is greatly endangered by riding in unheated cars during the winter months.

DEVELOPMENT OF THE TELEPHONE FIELD.

Independent Growth in Mississippi.

In Mississippi there are a number of prosperous Independent telephone exchanges which are growing rapidly. Among these exchanges are those located at the following-named towns: Booneville, Aberdeen, Lexington, Pontotoc, West Point, Yazoo City, Oxford, Columbus, Meridian, Water Valley, Starkville, Ellisville, Okolona, Ackerman, Laurel, Houston, Kosciusko, Hattiesburg, Amory, Greenwood and McComb City.

The manager of the Amory exchange has recently put in a 100-drop improved switchboard and a current generator. His switchboard capacity is now full, and will have to be enlarged to accommodate new subscribers. The Aberdeen exchange has a 200-drop board which is filled to its uttermost capacity, and will have to be enlarged to supply additional subscribers. The Columbus exchange, which has been recently equipped with a new 300-drop switchboard and new cables, is about full and will also have to be enlarged at an early date. At the last-named place the Cumberland (Bell) Telephone company has for several years been an active competitor of the Citizens' Long-distance Telephone company, which owns the Aberdeen and Columbus exchanges and a number of toll lines entering them. The Cumberland company is reported to have only 140 subscribers there, while the Independents have 300 subscribers.

At West Point there is a good exchange of 140 subscribers, and it is well equipped in the matter of poles, switchboard and office furniture. The exchange at Starkville has been newly equipped with a 200-drop switchboard and a current generator and has a list of 150 subscribers. At Kosciusko the Independents have an exchange of 150 subscribers and are doing well, while the Cumberland company, which has been operating there for a year, has only 20 subscribers. At Lexington the Independent exchange is in a prosperous condition, while the Cumberland company has only a pay station and has been refused a franchise.

At Hattiesburg, where an Independent exchange was established six months ago, with a 100-drop switchboard, the system has grown beyond its capacity and a new 200-drop board has been ordered. The 100-drop board to be displaced will be used to establish an exchange at Laurel. An Independent company and the Cumberland company both applied for a franchise at Ellisville to put in an exchange. The municipal authorities refused to grant both franchises and referred the matter to a popular petition of its citizens as to which should have the franchise. The vote resulted almost unanimously in favor of the Independent company. Lexington has a new 100-drop switchboard and is in a prosperous condition. The McComb City Independent exchange has 400 subscribers, while the Cumberland company practically has no subscribers, only bare poles and wires. The Yazoo City Mutual company (Independent) has 300 subscribers, while the Cumberland company has 60 or 70.

This shows the recent growth of some of the Independent exchanges in Mississippi. There are many good toll lines connecting the various exchanges, and the building of many more is in contemplation.

Independent Telephone Convention.

The local Buffalo committee having in charge the arrangements for the annual convention of the Independent Telephone Association of the United States of America, which is to be held in Buffalo on June 11th, 12th and 13th, has engaged the banquet room of Convention Hall for the sessions. This hall is located at the corner of Virginia street and Elmwood avenue. The headquarters of the convention will be at the Iroquois Hotel, where the exhibits made by the manufacturers will be placed. Application for space should be made to the committee or to C. L. Ingham, Ellicott Square, Buffalo, N. Y. It is announced that the hotel accommodations are ample and that the rates are favorable. The programme for the meeting will shortly be given out.

Gray Magneto Patent Held to Be Invalid.

On May 7th Judges Lurton, Day and Severens, comprising the United States Circuit Court of Appeals for the Sixth Circuit, at Cincinnati, ordered dismissal of bill in the suit brought by the Western Electric company against the Williams-Abbott Electric company of Cleveland for infringement of the patent. Decision was announced in favor of the defendant.

The patent in question covers an automatic shunting device for magnetos. It is well known to telephone men and has been in litigation several years. It will expire next December. The late Elisha Gray realized a large sum of money in royalties on this patent, which at one time was considered a formidable weapon of the Bell telephone interests.

Telephone News from the Northwest.

The Zenith City Telephone company of Duluth, Minn., plans to extend toll lines freely and looks forward to a line to Minneapolis and St. Paul soon.

A resolution is before the council of St. Paul directing the city engineer to prevent the Twin City Telephone company from prosecuting further work. The reason is that the original franchise of the Mississippi Valley Telephone company had a clause in which it is forbidden to transfer to any other company without the consent of the council. The new company has neglected to secure this permission. The new company is working vigorously in St. Paul, and expects to have an exchange of 3,000 connections talking by August 1st. Contracts are being considered for the new sub-exchange to be erected at Hague avenue and Dale street.

The Western Electric Telephone company will proceed to build a line through Tabor, S. D.

The Iron Range and Electric Telephone company has been incorporated, with headquarters at Wadena, Minn. The officers are: President, A. B. Kerlin of Park Rapids; vice-president, W. R. Baumbach of Park Rapids; secretary, C. W. Baumbach of Wadena. The capital is $50,000.

J. A. Steninger will establish a local exchange at Hurley, S. D.

The Pierce County Telephone company has received materials and will start work at once building new lines in the vicinity of Ellsworth, Wis.

The telephone exchange at St. Peter, Minn., is to be extended to cover Le Sueur County, Minn.

A telephone line is projected from Cameron to Tony, Wis., and a local exchange at Bruce, Wis., by the Barron County Telephone company.

The Hutchinson (Minn.) Telephone Exchange company will build a toll line to Bear Lake.

The People's Telephone company of Chatfield, Minn., has declared a dividend of two per cent. on all outstanding stock.

The Fairmont Telephone company is building a new line from Sherburn, Minn., to Estherville, Iowa.

The Minnesota Rural Telephone company of Princeton, Minn., has been incorporated, with $50,000 capital stock.

The Gary Telephone company will extend its line from Rindal to Fertile, Minn.

The Northwestern Telephone Exchange company will extend its line from Langdon, N. D., to Hannah, it is understood.

The Board of Fire Commissioners of St. Paul thinks that, as the telephone company uses its poles for stringing wires to the engine houses and the telephones are only connected with private lines, that the cost of service should be reduced. The company thinks that, as the department uses its poles for carrying fire-alarm wires, the honors are even on the pole use.

The Police Commission of St. Paul has refused to pay a bill of $1,635 for telephone service from the Northwestern Telephone Exchange company for the last five years.

The Crookston (Minn.) Telephone company has transferred its system and franchises to the new Iron Range Telephone company, which has its headquarters at Wadena, Minn. The new owners will use Crookston as a base of supplies and build long-distance lines to Duluth along the Great Northern railway. The company has also secured territory in Norman and Cass counties, and will cover the towns in that section.

The Iowa Telephone company has cleared a site at Davenport, Iowa, for the erection of its new exchange building. The company has just finished a copper-metallic circuit line from Davenport to Iowa City, and is building one from Iowa City to Cedar Rapids, thence to Vinton. After these are completed a line will be constructed from Des Moines to Boone. A line is also to be constructed from Iowa City to Des Moines, by way of Marengo, Grinnell and Newton.

The Cedar Rapids and Marion Telephone company announces 154 new toll connections recently made over the line of the Johnson County Telephone company. The stations are located in eastern Iowa and western Illinois.

The automatic company has received a carload of instruments for its new exchange for Seattle, Wash. The work of installing them will be begun at once.

Musson Bros. of Atlantic, Iowa, have bought the Atlantic, Mount Etna and Corning Telephone company's lines between Massena and Atlantic.

Robinson & Wilson have connected their exchange at Washington, Iowa, with the toll system in southeastern Iowa, operated by J. C. Hubinger.

The Kellerton Central Telephone company has been formed at Kellerton, Iowa, by the owners of the farm lines converging there.

The Johnson County Telephone company of Iowa City, Iowa, is about to rebuild some of its lines. A line is being constructed to Oxford, Holbrook and Parnell.

The Sumner Telephone company, which was granted a local franchise at Oelwein, Iowa, has failed to install the exchange, and the people there are disappointed.

The City Council of Des Moines, Iowa, will investigate the matter of the Mutual Telephone company's alleged failure to keep its contract with the city. It is charged that the company has agreed to pay a gross earnings tax of one per cent., but has failed to do so. The council has hung up a bill of the company's for $110, pending an investigation.

The Chamber of Commerce of Seattle, Wash., has waged a fight against the measured-service system, recently introduced by the Sunset Telephone company, until the company has agreed to recommend to the head office that the requests of the Chamber of Commerce be granted, with reference to a return to a flat-rate system.

John Deffenbaugh has been appointed assistant superintendent of the Bell Telephone company at Helena, Mont., being promoted from Missoula, Mont.

The Rural Telephone company of Anita, Iowa, has filed articles of incorporation, with $10,000 capital stock. R.

Ohio Telephone Notes.

The United States Telephone company has inaugurated a one-minute service between Columbus and Cleveland at a rate of 40 cents for the first minute and 15 cents a minute after that. The old rate was 70 cents for the first three minutes and 15 cents for each additional minute. The same arrangement has also been made between Columbus and a number of other towns in the state, with corresponding tolls.

The Springfield Citizens' Telephone company, Springfield, Ohio, has been incorporated, with a capital stock of $10,000, to build a local exchange in that town. The incorporators are George W. Dun, Paul Jones, W. D. Garst, Edward Denmead and H. C. Park.

Incorporation papers were filed with the secretary of state last week by the Home Telephone company of Plattsburg, the capital stock being placed at $10,000. The company proposes to build an exchange at Plattsburg and toll lines to Xenia, Urbana, London, Dayton, Washington Court House and other points. E. E. Hodge, J. L. Price, Carlton Henry, F. S. Wilson, D. H. Campbell, C. A. Snyder and J. C. McMillan are the incorporators.

The Garl Electric company of Akron has been incorporated, with a capital stock of $25,000, the incorporators being F. H. Lyder, J. W. Lyder, J. W. Lyder, Jr., G. W. Clemmer and A. J. Rowley. The company will manufacture telephones, hotel telephone systems and portable telephones for use on electric cars. The systems are the inventions of M. Garl, but the patents have been purchased by F. H. Lyder.

The Merchants' Telephone company has been granted a franchise to build an exchange at Dresden. The company owns several toll lines in Muskingum, Coshocton, Holmes and Wayne counties. It is stated that the Zanesville Telephone and Telegraph company will also build a line into that town. The Central Union already has an exchange there.

The new offices and quarters of the Sandusky Telephone company, in the Kingbury building, that city, have been completed, and it must be said they are among the best in the state. The operators' room has a switchboard sufficient for 2,400 subscribers, with 1,000 lines in active operation. At the farther end of this room is the terminal room, presided over by the wire chief. Both the operating room and the terminal room are finished in enamel and have hardwood floors. The power room across the hall contains four motor-generators, the current being furnished by the light plant. The shops are on the floor above. The equipment was all furnished by the North Electric company of Cleveland, and the office is up-to-date in every particular.

I. B. Ballmer has been elected president of the Weston Mutual Telephone company of Weston.

The United States Telephone company is reported to have purchased the new Cumberland exchange of the Phœnix Telephone company.

The United States Telephone company will erect an exchange building at Thompson's Corners, Cuyahoga County.

The Akron People's Telephone company will establish an exchange at Clinton.

The United States Telephone company will build a line from Detroit to Pontiac, Mich. O. M. C.

Indiana Telephone Items.

An Independent telephone company was organized at Redkey on the 8th inst. The stockholders comprise the business men of the community, $3,500 being subscribed in $25 shares.

It is reported that the rivalry at Terre Haute is taking on a serious aspect. The Central Union Telephone company is cutting rates to a mere trifle, in competition with the Independent company.

The United Telephone company at Huntington is experiencing much difficulty in securing workmen. The company had 15 men stringing wires. Manager Hassion discharged one of them for violating a rule and the others struck. The work is at a standstill because workmen refuse to take the men's places.

The city authorities of Indianapolis have had several inquiries recently about the franchises of the two

telephone companies operating in the city. They replied that each company received a 20-year franchise, of which 16 is yet to run, and that each pays the city an annual fee of $6,000.

Dayton Harter, cashier of the Bank of North Manchester, and Lewis Signs, ex-postmaster at North Manchester, have obtained from the Wabash county commissioners a franchise covering the highways of the entire county for telephone toll lines. They are interested in an exchange at North Manchester, and it is believed it is intended to make it a nucleus for an extensive county system.

Three telephone companies are competing for business in Spencer. The Spencer Telephone company has long-distance connections with the Central Union, the Citizens' company is connected with the New company at Indianapolis, and the Farmers' Co-operative company has an exchange. Each of the above-named companies has 100 subscribers or more, and there are 600 telephones in the county connected with them. Spencer business houses are using three telephones and declare the manifold plan annoying. Each company is seeking more business at low rates. The Farmers' Co-operative company has had a rapid growth in the country districts, owing to the cheapness of its service to members and the mutual plan of constructing the lines by its own labor. The rivalry between these companies is growing, and the people are wondering what the outcome will be.

A chess tournament is being conducted in Indianapolis by telephone. There is an uptown club and a downtown club, and there are three tables at each place. A conductor announces the moves made by the players. These games will, it is said, lead to a permanent chess organization in Indianapolis.

F.

Competition in Toronto Proposed.

Alderman Urquhart of Toronto announces that he has a proposition for the establishment of Independent telephone service in Toronto. The company, which is to be incorporated as the Ontario Telephone company, is said to be an offshoot of a successful United States company, operating exchanges in Wilkesbarre and Scranton, Pa. Local capital will be interested in the new enterprise. The new concern offers to give an efficient modern service for $36 for business houses and $25 for house telephones, or $50 for both to the same subscriber. The number of Bell subscribers in Canada is as follows: In Ontario, 23,000; in Quebec, 22,000; in Manitoba, 2,000, and in the territories, 302 subscribers.

Bell Telephone Output.

The following is a comparative statement of the output of instruments by the American Telephone and Telegraph company for the month ended April 20th and from December 21st:

April:	1901.	1900.	1899.	1898.
Gross output	72,396	53,190	61,481	29,254
Returned	33,177	20,077	13,079	13,139
Net output	39,219	33,113	48,402	16,125
December 21st to April 20th:				
Gross Output	288,505	236,193	224,325	109,921
Returned	122,604	83,121	54,804	51,697
Net output	165,901	153,072	169,521	58,224
Outstanding April 20th	2,118,717	1,733,577	1,294,767	977,345

NEW COMPANIES.

The Adair Telephone company, Adair, Iowa, has been incorporated, with $10,000 capital stock.

B. W. McHerry, W. P. Graham and A. B. Sheadle have incorporated the Independent County Telephone company at Polo, Ill., with $20,000 capital stock.

The Versailles Telephone company of Versailles, Mo., has been incorporated, with a capital stock of $5,000, by William E. Straus, A. Popper and others.

The People's Telephone company, Chillicothe, Ill., has been incorporated, with a capital stock of $4,000. B. F. Zinzer, Howard L. Pettet and W. D. Kelley are the incorporators.

The Tennessee Telephone company has been incorporated at Kingston, Tenn., with a capital stock of $10,000, by H. M. Carr, George M. Chandler, S. C. Brown and others.

The People's Telephone Exchange has been incorporated at Yates City, Ill., with a capital of $2,000. The incorporators are W. G. Lehman, O. B. West and L. D. Fletcher.

The Daniels Telephone company of Iuka, Ill., has been incorporated, with a capital stock of $10,000. The incorporators are George E. Daniels, Porter E. Daniels and Jordan W. Harrison.

The Saratoga Telephone and Telegraph company has been incorporated at Saratoga Springs, N. Y., with an authorized capital stock of $125,000. It is the purpose of the company to operate in Saratoga Springs, Ballston Spa, Mechanicsville, Stillwater, Waterford, Troy, Schuylerville, Glens Falls, Schenectady, and in the various cities, towns and villages of Saratoga, Fulton, Warren and Schenectady counties. The directors of the company are F. K. H. Beach, Stephen C. Medbury, J. W. Wiswall, Herbert C. Westcott, Charles W. Coal, W. L. Burke and William P. Burtley.

GENERAL TELEPHONE NEWS.

The Spottsylvania (Va.) Telephone company will extend its lines to Belmont and Chilesburg, Va.

The Belvidere (Ill.) Telephone company has increased its capital stock from $25,000 to $50,000.

The Overton Telephone company of Livingston, Tenn., has been reorganized, increasing its capital stock from $5,000 to $25,000, and it will install an exchange and construct 300 miles of line.

The Rochester (N. Y.) Telephone company observed the first anniversary of its opening on Monday, May 13th, by throwing open its exchange for inspection by subscribers and citizens of Rochester.

The Mansfield (Ohio) Telephone company is making a strong bid for business, and E. C. Bickel, the general manager, is sending out a number of circulars, explaining the advantages to be had by connection with his company.

The Citizens' Telephone company of Columbus, Ind., has just finished the installation of about 12,000 feet of aerial cable. The Co-operative Telephone Construction company of Chicago did the work. The Citizens' company has now one of the best cable systems in the state of Indiana.

M. C. Watts, general manager and superintendent of the long-distance telephone system in Virginia, is quoted as saying that the system is now about two-thirds completed. Charlottesville, Richmond, Lexington, Staunton and other cities have been connected. Other connections will be completed about July 1st.

It is announced that the Pennsylvania Railroad company will soon have its own wires for long-distance telephone transmission all the way from Philadelphia to Pittsburg. The company already has a circuit throughout the length of the middle division of the road, Harrisburg to Altoona, 132 miles, and there are a number of stretches on the division west of Altoona. The division east of Harrisburg has telephone wires for much more than half its length already.

The Peninsular Telephone company of Florida has been organized at Tampa, Fla., by William G. Brorine, Jacob F. Brorine, Guy Hufman, James W. Barwick and James J. Lunsford. The capital stock is placed at $300,000, at $100 a share. A charter has been applied for. The company has placed the price of business telephones at $2.75 a month and residence telephones at $1.50. Several hundred subscribers have already been secured. It is the intention of this company to erect systems in Lakeland, Bartow, Fort Meade, Plant City, Fort Myers, Arcadia and Palmetto at once, and they will all be connected.

TELEPHONE MEN.

E. W. White, manager of the St. Paul office of the Twin City Telephone company, has resigned, and will take a position with the Western Supply company.

Mr. Sabin, the recently elected president of the Central Union Telephone company, arrived in Chicago on May 9th, and at a meeting of the directors of the Chicago Telephone company was officially installed as president of the company. John M. Clark, the retiring president, was made chairman of the board of directors.

Hugh Campbell, president of the Mississippi Independent Telephone association and general manager of the Citizens' Long-distance Telephone company of Aberdeen and Columbus, Miss., died at Bosberg, Miss., on April 28th. Mr. Campbell was one of the pioneer Independent telephone men of Mississippi, and a strong advocate of and zealous worker for Independent telephony. Mr. Richmond, who has recently been in the employment of the Cumberland Telephone company, at Canton, has resigned his position and accepted the position of general manager of the Citizens' Long-distance Telephone company, to fill the vacancy caused by Mr. Campbell's death. Mr. Richmond is an electrician of considerable ability.

MANUFACTURERS AND DEALERS.

The Couch & Seeley company of Boston, Mass., has recently issued a circular, illustrating and briefly describing some of its telephone instruments and sets and telephone parts.

The Century Telephone Construction company of Cleveland, Ohio, manufacturer of telephones, switchboards, apparatus, etc., is making a central-battery, lamp-signal, multiple switchboard.

The address of the D. A. Kusel Telephone and Electric Manufacturing company of St. Louis, which recently moved into a four-story building, to accommodate its increasing business, is 1119 Pine street, St. Louis, Mo.

The recent fire in the plant of the Standard Telephone and Electric company, Madison, Wis., damaged only a part of the company's stock, and did not in any way delay its work. In fact, the machinery stopped only long enough to allow the adjustment of loss from damage due to fire and water. Only a very small portion of the company's large stock of instruments, transmitters and auxiliary apparatus was damaged, and orders have not been delayed in consequence.

The Corporation and Its Employes.[1]

By H. F. MacGregor.

The relation of corporations to their employes has become one of the perplexing questions that affect corporate management and service. Originally, skill, in connection with supply and demand, regulated prices, and employer and employes were free agents, with the largest liberty of action; then corporations were treated the same as other employers of labor. The creation of corporations was authorized, based on the co-operative principle, with limited individual liability, that people might compass great undertakings which would otherwise be impracticable. The benefits therefrom in the way of development have been marvelous and almost beyond computation, the conveniences and comforts of life have been greatly augmented, and the cost of production reduced, so that the luxuries of a few years ago are now necessities, by force of habit. Combined effort brought about an increase of power for good or evil. Among the evil results may be mentioned the demagogue that has been abroad in the land, forcing corporate influence into politics to some extent in self-defense; there has come the destruction of individual effort, the closing of the field of competition and the formation of trusts. Trailing in the wake of the organization of capital there has come a kindred process of the organization of labor, and with kindred results to labor, viz., an apparent great benefit and improvement in conditions, followed by a leveling of mankind to a dependent human machine, the creation of a quasi-political organization and a tendency toward monopoly. The fruit of these hostile, instead of mutual, relations between corporations and their employes has been the exhausting of the resources of the corporations and a constant tax on employes to maintain organization and support the hostile army in conflicts arising here and there, but too frequently, and a total loss of wages at the point of action. By gradual process the goose that lays the golden egg is being killed. The weaker corporation and the weaker labor organization lose. To remedy this condition, the federation of capital goes on and the federation of labor follows—both seeking unfair advantage, wrong in principle and pernicious in results. These conditions must, possibly, of necessity, continue longer, but will eventually result in a collision of forces, sometime, somewhere—a convulsion that will read like history repeating itself in the horrors of the French commune, with such added horrors as the destructive agencies of the present day permit.

The two trusts, capital and labor, allied together, now control many branches of the productive field, with almost every day rumblings of a probable rupture between the allied forces, which at any time may get beyond the bounds of compromise or conciliation and become an issue of absolute control. If capital wins, we will have an era of autocratic or imperialistic conditions; if labor wins, anarchy and chaos.

Every active manager of a corporation knows that he is the intervening force between two aggressive forces that require but little provocation to bring about the "Kilkenny" process of attempting to destroy each other. The inquiry naturally follows, Where is the remedy for these unnatural conditions? Sound discretion, uniformity of purpose and unvarying justness on the part of the management will, in most instances, prevent serious results, though labor troubles are frequently epidemic and beyond all rule or reason.

Arbitration of the differences between corporations and employes has been suggested, and it would seem to be the ideal method, as the principle of arbitration is sound, but its administration evidences a fatal weakness, as it is impossible to find unbiased arbitrators. I know of no remedy that would meet with popular approval, under the trend of prevailing thought, and no remedy can succeed that is not based on simple principles that require little or no machinery to enforce. The wage-earner should be relieved of these constant assessments to maintain drones and hostile camps. The simplest system of protection to the wage-earner would be the establishing by the state of a labor bureau to gather statistics for the use of the Legislature, and in adopting a standard wage system for different vocations, somewhat on the principle of the legal rate of interest. The writer believes there should be three classes—a standard rate, a higher rate for superior skill and a lower rate for incompetents. This system would not please labor leaders, as they would have to return to work, but the actual workers would be relieved of a large amount of unnecessary expense and frequent serious losses, and the progress and prosperity of the country would be relieved of the constant menace of threatened trouble. Capital is satisfied with a small return, though it reaches out after big results when opportunity offers. These opportunities should be open only to individual effort, which, by natural laws, would be redistributed. Corporations should have limited powers, but a safe field of investment. Originally, the purpose of labor was to maintain rates of wages; now it teaches socialism; that the savings of others are stealings from the working classes; that the management of capital should be supervised and controlled by the labor organizations; that the hiring and dis-

1. Read before the Southwestern Gas, Electric and Street Railway association at Houston Texas on April 19, 1901. Mr. MacGregor is president of the Houston (Texas) Electric Street Railway company.

charging of employes should be by, and with, the consent of the other employes only, and that the man who saves must surrender the control of his savings to the man who never saves—propositions that are offensive and savor of the principles of despotic force.

The golden rule covers, in a short way, the correct relations between employer and employe, though that rule has some flexibility administered by a selfish person. A better guide for the management of corporations that are entrusted with the interests of both capital and labor would be to "do what is right." The management, from the nature of its duties, occupies the position of every-day arbitrator, and should weigh both sides carefully.

The writer, in handling corporations entrusted to his care, has handled the question of the corporation and the employe on the basis of first principles, making it a question of efficiency and mutual interest, and that policy has not been changed. Principles that were not sound have not been subscribed to.

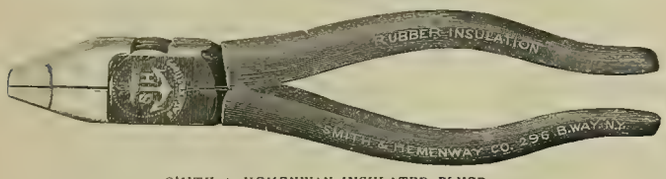
Believing, personally, that the success of the present demands of labor would be the greatest calamity that could happen to the wage-earner, as what is would soon be absorbed and destroyed, and the methods they advocate could not create. I have preferred to stand on principle rather than sentiment or expediency. Some issues are better met than avoided. The corporation has gone through several periods of attempted compulsory education in the anarchist school, only to confirm previous opinions, though at great cost.

The writer believes the experience the employes obtained therefrom brought about a better understanding of the limitations of labor organizations, that confiscation of capital does not benefit the individual, and that many of the demands of labor are impracticable. There is a better understanding of the disposition of our corporations toward their employes.

Our relations are conducted more on business principles—rules as clearly defined as possible—and some leniency shown toward the employe in their enforcement, dissolving of doubts in favor of the employe. These principles and policies we believe are sound. Considerable extra labor and patience are required to make careful investigations, but in the end it is better for the corporation and just to the employes.

Smith & Hemenway Insulated Plyer.

An insulated plyer, such as is illustrated herewith, which is used by a large number of linemen, electricians and others having use for a tool of this description, is being marketed by the Smith & Hemenway company, 296 Broadway, New York city. This plyer is said to have given satisfaction wher-

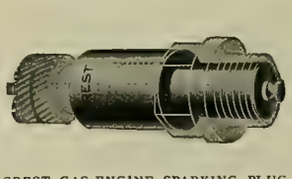


SMITH & HEMENWAY INSULATED PLYER.

ever used. The handles being insulated, it is impossible for anyone using it to receive an electrical shock. Having round edges, it is convenient to carry in the pocket without injury to the clothes, which is an added advantage, as the users find. Another plyer, for the use of telephone manufacturers, machinists, electricians, engineers, jewelers and opticians, is the No. 622, made by the same company, which comes only in one size, six-inch, black, with polished nose. The nose being pointed and long, is of great use when working in deep and narrow places.

Crest Gas-engine Sparking Plug.

The Crest Manufacturing company, Cambridgeport, Mass., is putting on the market what it calls a special indestructible sparking plug, having either the French metric thread or the standard 16-thread, to adapt it to American taps. This plug, as will be seen in the illustration, consists of a shell of steel, having a thread at one end to screw into the orifice of the chamber of the motor. Through this shell is a tapered hole, in which the insulating cone is inserted, making a perfect gas-tight joint. Above the shell and fitting around the upper part of the cone is a cup of insulating material. A nut on the metallic stem, which passes through the cone, holds the several parts of the sparking plug together. A nut on the metallic stem screws on to a metallic washer, which takes care of the difference of expansion between the insulating material and the metallic stem. On this shell is a binding nut which is partially split, as shown in the cut, having a small extra binding screw, which has a special locking device to prevent the nut loosening. This sparking plug, on account of its peculiarity of construction and the material used, is unaffected by expansion and the intense heat of the motor.

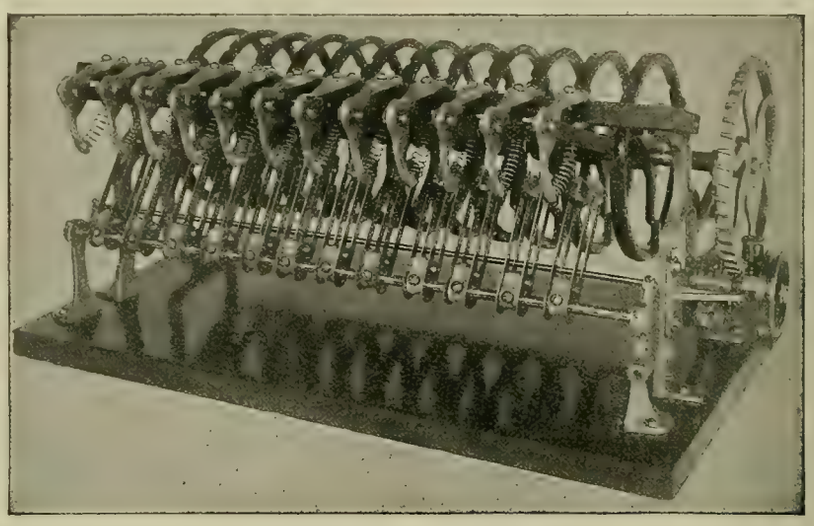


CREST GAS-ENGINE SPARKING PLUG.

The Holland and Lake Michigan and the Saugatuck, Douglas and Lake Shore electric railways have been transferred to the Grand Rapids, Holland and Lake Michigan Rapid Railway company. Twenty cars will be put in service when the line is opened.

A Modern Sign-lamp Commutator.

While the average electrician is more or less familiar with devices of various kinds for automatically "flashing" incandescent lamps in signs and displays, the technical construction of an up-to-date article of this class will undoubtedly be new to many. An important thing to be considered in flasher construction is the fact that 30 days' ordinary use is equal in the number of breaks to 412 years' normal use of the standard jack-knife switch. Bearing this fact in mind will help to show the necessity of some of the unusual features to follow.



A MODERN SIGN LAMP COMMUTATOR.

The accompanying illustration shows a 12-circuit machine, two-wire system, with a capacity of 100 amperes (about 8½ amperes per circuit). It is 18 by 12 inches on the base, 10 inches high, and can be driven by any ordinary 12-inch fan motor, either belt or direct-connected. It is geared down 600 to one, making about 2½ revolutions per minute on the drum when driven by a motor running 1,500 revolutions.

No part of the drum or driving gear is in contact with or forms a part of the circuit, but, on the contrary, is insulated from the live parts. The main feed wire goes to a bus-rod, connecting with the forks, and is distributed over the various branches at such times as the various switches may be closed. The knives are brought down by lugs on the face of the disks and are adjustable to any portion thereof by means of a set-screw for each. Being furnished in assorted lengths, arranged on the "point" system, it will be readily understood that where a lug is placed with relation to the circumference of a disk determines when the lamps on that circuit shall burn, and the length of the lug used determines how long they shall burn, without regard to the others. The blades are forced up by means of a spring as soon as released by the lug. The contact surfaces are about four times as great as the standard measurements for switches of like capacity and the breaks must of necessity be of the quickest possible character. The forks engaging the blades are very pliable, being capable of one-half-inch expansion. They are made of four independent uprights, across the top of which the shoe is riveted. The uprights being independent of any twist, insures the shoe lying flat against the blade, and the former, ending abruptly at the base of the stroke, is automatically kept clean by all accumulations of dust and oil being pushed off the bottom.

It is said to have been conclusively demonstrated that the arc due to the opening of the circuit has very little to do with the destruction of switches in these machines—oxidization being due to entirely different causes. Where it is desired to change a large number of circuits controlling colors some machines are set to one revolution in five minutes; for show-window effects and electric signs, 2½ revolutions per minute is the average speed; for columns of light and outside festoons of lamps, about six revolutions per minute is the average, and for a waving flag at least 20 revolutions per minute is required. As some of the switches on the latter break 12 times per revolution and run seven hours per day, it will be seen that the manufacturer is confronted with the proposition of making a switch capable of withstanding 100,800 breaks per day. The foregoing description is of a No. 12 new Reynolds flasher, built by the Reynolds Manufacturing company of Chicago.

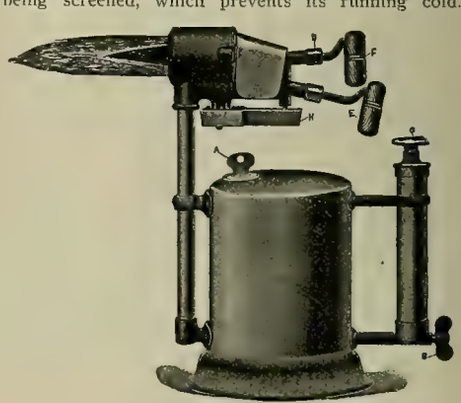
BOOK TABLE.

Induction Coils: How to Make, Use and Repair Them. By H. S. Norrie (Norman H. Schneider). New York: Spon & Chamberlain. London: E. & F. N. Spon. 1901. Pp., 270, 5 by 6½ inches, with 79 diagrams and illustrations. Second edition, revised and enlarged. Price, $1.00.

The extended use which is made of the induction coil in many forms of electrical work and experiment has created a demand for literature on the subject, and among those who are seeking for general information relating to this useful apparatus, this little book will undoubtedly meet with favor. The volume has been enlarged and revised, and much new and up-to-date matter has been added. Although some of the subjects are necessarily treated rather briefly, owing to restriction in space, the most essential points are covered in a clear and practical style. Directions for the construction of coils and for their various applications take up a considerable portion of the book. There is a chapter on wireless telegraphy, and another one, short but entirely practical and up-to-date, on X-ray work. Other chapters describe Tesla and Hertz effects, primary and secondary batteries, new forms of contact-breakers, and various experiments.

Turner Mogul Torch.

The accompanying illustration shows a new linemen's torch manufactured by the Turner Brass Works of Chicago, known as the Turner Mogul. This torch is particularly adapted for outside use in windy weather on pole or underground work and generates sufficient heat to handle the heaviest kind of soldering. It is said to be superior in heat-producing qualities to the common gasoline torch and maintains its heat under all conditions, the burner being screened, which prevents its running cold.



TURNER MOGUL TORCH.

One customer writes that he can handle No. 6 and No. 4 wire out of doors very nicely with the Mogul torch. He adds that it is "a torch that will work when you want it to."

The Telegraph in Porto Rico.

A problem is confronting the United States government in relation to the telegraph system in Porto Rico. In coming into possession of the island, the government also became owner of the telegraph system. The conditions existing in the United States and Port Rico are so different that what might be satisfactory in the United States would not meet the needs of the people of Porto Rico. The commercial business of the island does not, and as far as can be seen, will never, maintain these lines; the patronage of a telegraph does not promise to become sufficient to support such an enterprise.

General Greeley, chief signal officer of the army,

who until lately had charge of these lines, made three plans as to their future disposition: First, their operation by the United States Postoffice Department; second, their transfer to the insular government, to be operated and maintained at the expense of Porto Rico; third, their operation and maintenance as military telegraph lines. The disposition of this service is a matter for Congress to determine.

Siegrist Automatic Lubricating System.

The automatic oiling system manufactured by the Siegrist Lubricator company of St. Louis is a mechanical device which has been perfected after 15 years of hard study and costly experimenting and which is now believed capable of overcoming all the numerous troubles that arise in power plants caused by lubrication. The system is claimed to be absolutely reliable in delivering oil as desired. It does not depend on gravity, but a high steam pressure, for its operation.

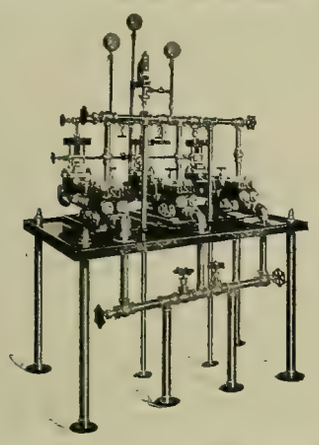


FIG. 1. SIEGRIST AUTOMATIC LUBRICATING SYSTEM.

The oiling table used in connection with this system is made of iron, highly polished and japanned, having a beveled edge on the table which will prevent oil running on the floor. On this table are placed four specially made duplex steam pumps, which are connected in pairs, two being used for engine and two for cylinder oil. On the steam chest of each pump is placed a specially made governor, which controls each pump automatically. There is a gauge for each engine and cylinder oils, allowing the engineer to see that the same pressure is maintained at all times, and from a distance. A quarter-inch pipe for steam will operate the system, and on this pipe is a gauge. Only one pump for each oil is used at a time, the others being held as a reserve in case of accident, or to repack the ones in use. Either pump can be thrown into service in a second by a valve. All the piping on the table is of highly polished brass, giving it a fine appearance. The piping from the table and the four legs are brass, and run through the floor. When the table is once started it requires no attention from those in charge, as governors control the pumps, no matter how much or how little oil is being used, and the same pressure is maintained on the oil line that the governors are set for. If no oil is being used, the pumps stop of their own accord, though the governors keep the same pressure on the oil line; when one engine is started, the pumps work fast enough to supply the oil, still keeping the pressure the same, and so on with one or several, with the same results. In Fig. 1 is shown an oiling table provided with three pumps.

The entire Siegrist system is easy to install and operate. The oiling table can be placed in any convenient portion of the building. Fig. 2 shows a plan and elevation of a portion of a modern power house with the oiling installation indicated in full lines. There are two tanks, one for engine and one for cylinder oil, and they are connected to the pumps on the table by the suction pipes which go through the floor and up under the tank. The oils are forced by the pumps through the discharge pipes to the points to be lubricated. By a system of return piping the unused oil is returned automatically to filters, where it is refiltered, and then repumped to the original tank, where it is repumped over again. Two main discharge pipe lines are required, with branch pipes, to each engine. In a convenient place to the engineer are placed two valves, one in each oil line, which controls that particular engine only. These branch lines are run to all the points on the engine to be lubricated, where Siegrist automatic oil cups or sight-feed lubricators are placed. With this system everything in a power house can be oiled without the assistance of oilers.

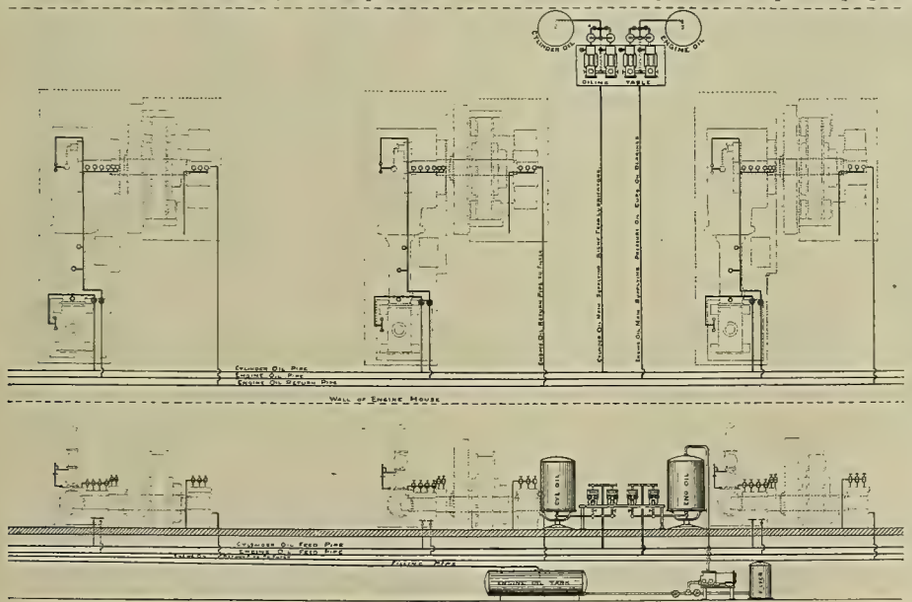


FIG. 2. SIEGRIST AUTOMATIC LUBRICATING SYSTEM.—DIAGRAM OF INSTALLATION.

Station Work.[1]

By George H. Cushman.

The duties of successfully operating a station are many, and as they fall directly on the superintendent of the plant, they may be made either easy or hard by his employers, and they generally depend upon the money market. If money is easy it is easy to get such materials as are needed; if the market is tight it is hard to convince the manager that certain changes which cost much are needed. Always try to keep the confidence of your manager under both conditions of the market, and things will be smoother. The first duty daily is to see heads of all departments and get their reports, and if changes of men are made during the night, see the reports left by them. If any part of the plant needs repairs, see to it at once. Go through the boiler room and see if the work of caring for the boilers and pumps is properly done; then the engine room and the dynamo room, also. All circuits should be tested for grounds, and, if any appear, send the line force or a part of it out to remove the grounds.

All orders for new work from the office should be given to the line foreman and in an intelligent form. These orders should be numbered and in duplicate, so that if the original should be lost the duplicate can be used for reference. This order, when returned to the superintendent, should show what was done, what material was used, if a transformer was used, where it was placed; and if a meter was set, the number, size, make, index, constant, and by whom set. Also on the back of this order should be a sketch showing the location of the house and the pole from which the service wires were run, and a diagram showing which cross-arm and pins the wires are run on and whether on the property side or street side of the pole. The proper use of such an order system will help in keeping work properly done, and give the superintendent and office force a complete record of same. After line forces are sent out see that all reports are properly placed and charged to the proper account.

Then look after the economy of the plant, and see that it is kept up to a high standard. In the boiler room see that all is in order: that coal of a good quality is on hand, and that the firemen are handling it to the best advantage. In the engine room see that oil and waste are properly used and taken care of. Have a press of some kind and press all the oil out of the waste used in taking up waste oil. Wash the waste, dry it and use it over again. Oil picked up and saved this way and properly filtered is as good as new. Then the dynamo room needs looking after. If possible, have compressed air for cleaning the dynamos and switchboard, for air removes dirt where it is impossible to otherwise reach it. The switchboards should be looked after carefully and be provided with such safety devices as will protect the plant from lightning and outside trouble, and these devices should be very accurate. For fuses, none are better than those of the enclosed type, for they are not affected by the outside or surrounding air, and generally they blow without burning and blacking up everything in sight. Circuit-breakers are good, and should be used as much as possible.

In this day and age all arc lights should be run from the same generator that furnishes the incandescent lights. For street arc lights the constant-current transformer is now a complete success, and the enclosed arc, burning from 100 to 150 hours, makes trimmers scarce. For commercial lights, the alternating-current arc on 110-volt circuits, with meters, enables the customer to have light at any hour, instead of from five until 10, or seven o'clock, or all night, as is now done. The cost of keeping up the long-hour lamps compared to the series open arcs of to-day is far cheaper. When furnishing light to a city there should be means arranged between the company and police department for letting the plant know by telephone when the lights are out, and a trouble book showing where such order was received, by whom, when the trouble man got the order and when he O. K.d it. Such a record is a check on the electric company, and the police as well, and when the trouble man finds a lamp he can't make burn it must be changed at once, or at least on the following day. When the trouble man is not at work on calls he should work on lamp repairs. When a lamp comes in, a card is attached to it showing where it came from and what is the matter with it; the lamp man puts on the same card what new parts are put in, how long he took to clean and repair it and on what date it is again O. K. When the lamp is again put in service it is marked on the card where and what date, and the card returned to the superintendent. All lamps are numbered and a record is kept of them in that way. The lamp repairer has a circuit at his command all the time, supplied with an ampere and a voltmeter, and a lamp is never sent out which requires more than 50 volts, or feeds its carbon on more than a four-volt variation.

The meter department is where the fine work comes in, if the plant is run on a meter basis. The meters must be kept as near accurate as possible, as the revenue of the plant depends upon them. An electric meter seldom, if ever, is too fast; but, on the contrary, slows up and gets slower and slower, until it ceases to run altogether. They must be ordered into the repair shop and cleaned and readjusted as fast as detected. When they are removed a card is attached showing who removed it, giving date and index, and where from. The meter man cleans, adjusts and tests it, and makes the required alteration, fast or slow; a meter is never sent out showing a fast operation, but if it is within two per cent. slow it is O. K. The test meters must be sent to the factory once a year at least for recalibration, and oftener, if necessary. The meter repairer marks on the card the date tested, and when set the man who sets the meter gives the index, for whom set, and the date set on the same card. The reading of meters is very important, and should be done properly. The meter inspector should also open meter loops and see if any lights in the house will burn with the loop open. If so, they are on the service ahead of the meter, and the parties are stealing that much light, either intentionally or otherwise. On concealed work this is very often done, and I find it necessary sometimes to set the meter on an open-meter loop. Some people try various means to beat the meter. One man I have in mind did so, and I found it necessary to set a meter on a pole to get ahead of him.

The line work is very important in a plant, and the proper distribution system must be used to effect the most economy. A house-to-house transformer system of 52 volts is fast giving way to a system of three-wire network of 110 and 220 volts' secondary. With alternating current, this system is more perfect than a direct-current plant; where 2,000-volt primary current is used, a small feeder system can easily feed a system of transformers, and they a network of secondaries, and as the secondary system becomes overloaded, the losses can be taken care of and pressure brought back to normal by inserting a few more transformers on the circuit. It requires good judgment to prevent a complete shutdown, due to short-circuits on the secondary system, but if, at the electrical center between transformers, is placed in each of the outside wires of the secondary network a cut-out with fuse one-fourth the capacity of transformers, a short-circuit will only put out a district which, under normal conditions, would be fed by one transformer alone. A short-circuit would have the following result: Draw all the current the nearest transformer could give and one-fourth the current of the two next on the line, then the primary fuse in the overloaded transformer would go, and the current rushing in from the next two transformers to feed the short-circuit would blow the fuse in the second circuits and put out that district alone. If all lines be kept free from grounds, short-circuits would be less liable to occur. A good system of lightning arresters should be on both secondary and primary systems. A demand system of some kind should be used, a flat rate charged for such connection, and then a charge

1. Paper read before the Southwestern Gas, Electric and Street Railway association at Houston, Texas, on April 19, 1901.

made of so much per kilowatt-hour on the meter.

I recently saw advertised a demand switch which could be placed beside a meter, set and locked for any amount of current desired, and if more lights were turned on than contracted for the circuit-breaker worked and would not stay in until part of the lights were turned off and the load got back to normal. I recently had a case of trouble which such a system would have prevented. A trouble call came in from a large store, "Lights are dim." I sent down a man to see what was wrong, and found 168 lights on a 100 light transformer, and it was still doing business. Such things should be prevented, and could be, I am sure.

The Lighting of Railway Cars.[1]

By George D. Shepardson.

In the well-appointed passenger trains of to-day, traveling is a pleasure as compared with the tedious journeys of a few decades since. The railways are on the alert to meet the requirements of a discriminating public, not only caring for their safe and prompt transportation, but also catering to their demands for comfort and even luxury. A large part of travel must be done during hours of artificial lighting, especially by business men, who constitute the majority of passengers, and who wish to do their traveling as much as possible outside business hours. The problem of securing satisfactory light in the cars is therefore one of considerable importance.

In the early days, when people were accustomed to the light of flickering candles, no better light was desired on trains. At first the trips were short and were made only during the daylight hours. The first artificial lighting of railway cars began nearly three-quarters of a century ago, passengers sometimes furnishing their own candles or oil lamps on long journeys. Candles, furnished by the company and placed in convenient pockets, were gradually displaced by lamps burning animal, vegetable or mineral oils. The oil lamp was developed until it gave quite a respectable light, although accompanied by disagreeable and expensive features, and the suspicion that fires in connection with wrecks were aggravated, if not caused, by oil lamps quite as often as by stoves.

As early as 1856, experiments were made on the Chicago and Galena railway with the use of compressed city gas for car lighting. Coal gas loses much of its illuminating power when compressed, and has therefore been practically abandoned for train use. In 1867, Julius Pintsch of Berlin began experimenting with various gases, and found that gas made by heating oil to a high temperature would stand compression with little loss of illuminating power. He succeeded in building up a business of great magnitude. During the last few years, acetylene gas, made from calcium carbide, a product of the electric furnace, has been applied to car lighting, with more or less success. Incandescent electric lamps were first used for train lighting in 1881, and are now used in many of the best trains in all countries.

Each of the old methods of car lighting has certain features which are objectionable to the traveling public, to railway men, or to both. The first requirement in any satisfactory method is safety. The devices for burning oil and gas have been brought to a high state of progress. Yet, with any illuminant requiring a flame, there is at least a possibility of fire risk. In the case of gas, there is the added possibility that pipes may become broken and allow the gas to escape and mingle with the air, until an explosive mixture is formed. The results of the explosion of such a mixture would not be pleasant to contemplate.

The worst features of oil and gas are the products of combustion. Oil and gas lights not only cause a large amount of heat, which adds to the discomfort of summer travel, but they use up the oxygen of the air faster than do the passengers. The products of combustion are generally carbonic-acid gas, water vapor and heat. When the lights do not burn properly, they may give off more or less of a poisonous gas, known as carbon monoxide. The presence of the carbonic-acid gas and of the water vapor has a tendency to make a person feel drowsy and dull. The water vapor adds to the discomfort by reducing the evaporation from the skin. A large part of the waste from the body is eliminated through the skin by insensible perspiration, the evaporation of which cools the body. As the air becomes saturated with water vapor, evaporation from the body diminishes, and one soon becomes hot, drowsy and uncomfortable. The principal function of the fan is not so much to cool the air as to blow fresh air upon a person, and so increase the evaporation from the body, and thereby indirectly cool it. The electric fan in dining and parlor cars is a grateful luxury, as it causes the air to circulate, even though it be warm, and thus continually brings near the skin air that is less fully saturated with moisture.

The degree of emphasis to be placed upon this consideration may be inferred from a few figures. For illuminating various kinds of American passenger cars, the light varies from the equivalent of that given by about 40 candles to that given by 1,200 or 1,500 candles. The ordinary car has an illumination equal to that of about 170 candles. The consumption of oxygen and the products of combustion in the lamps giving that amount of light may be compared directly with the presence of a number of passengers; the candles being equal to about 115 adults, oil lamps being equal to about 80 adults, and gas being equal probably to about 25 adults. The above comparison makes no allowance for the additional discomfort of dirty lamps, which smoke and smell.

A great objection to the oil lamp is its liability to smoke, and another is its liability to leak oil on the carpets and upon the clothes or baggage of passengers. It was stated, several years ago, that it was costing the Pullman company about $200,000 annually to replace carpets and other furnishings injured by oil lamps, no record being available, however, of the damage to the property of passengers.

When the incandescent electric lamp approached a commercial form, in 1879, its advantages were quickly recognized. Experiments looking toward its use on railway cars were begun almost before the first central station for stationary lighting was in operation. In spite of the frailties of the early lamp and the limited sources of electricity then available, the London, Brighton and South Coast railway in England began in November, 1881, to operate electrically lighted trains, and has continued this method of illumination until the present time, making improvements from time to time, as experience dictated. Soon after this trial began, other roads in nearly every country followed, and to-day the number of cars lighted by electricity runs up into the tens of thousands, not counting the myriads of trolley cars which are lighted and propelled from the same source of power. A history of the development of electric lighting for railway cars would make an interesting study for railway officials and others who desire to keep fully posted in this branch of electrical work.

As is generally known, the light of an incandescent electric lamp comes from a slender carbon filament in a vacuum maintained within a closed glass bulb, this filament being heated to a high temperature by an electric current. So little heat escapes to the outside that the lamp may be placed with safety in almost any location desired. There is no open flame which may set fire to combustibles near by, and the external temperature is so low that only actual contact for a considerable time will carbonize or ignite the most inflammable material. It heats the atmosphere to a very limited extent only, and does not vitiate it in the least, there being no combustion. The lamp may be lighted without a match by the simple turning of a key, and may be extinguished with equal facility and safety. With proper care on the part of those in charge, there will be no fluctuation in the light, neither streaks nor shadows. Experience has shown methods of construction and operation which make the electric light safe as a fire risk, and the voltage used is so low that it is impossible to receive a shock of any consequence.

When the electric berth lamp was introduced it met with instant success. A passenger who has enjoyed the luxury of a cool light at his shoulder, available at any time during the night, without any disturbance, always seeks a sleeping car with electric lights. The traveling public is satisfied with nothing less; and to-day no train can be called thoroughly modern and up-to-date unless it can advertise berth lights. The latter are electric, of course, for no other kind has appeared. Along with the berth lamp is the possibility of having electric fans to keep the air in circulation. Another advantage which appeals to ladies is the comfort of heating a curling-iron without the nuisance of an alcohol lamp, so trying and dangerous in the cramped quarters usually allowed for ladies' dressing rooms. On trains equipped with storage batteries, each compartment and each dressing room may be furnished with electric heaters, always ready for use by simply inserting the tongs.

Power for operating the electric lamps and other devices may be obtained form storage batteries, carried underneath the car, from dynamos, or from a combination of the two. The storage battery consists of a number of lead plates immersed in diluted sulphuric acid. When a current is sent through the battery from an outside source, certain chemical changes take place which make the plates electrically different, so that, when the circuit is provided, they will cause a current to flow through. There is no storage of electricity as such, the energy of the charging current being changed into chemical energy, which is stored and later is retransformed into electrical energy.

The dynamo, often called an electrical generator or a dynamo-electric machine, is a device for changing mechanical energy into electrical energy; it is based upon the interrelations of electricity and magnetism. For train lighting, the dynamo is driven by a steam engine in the baggage car, or it is belted to the axle. For the engine-driven dynamo steam is obtained from the locomotive, and provision must be made for supplying light when the locomotive is changed at division points. There is likely to be some vibration from the engine throughout the train, which, however, is noticeable only when the train is standing still.

With the axle system provision must be made for lighting the train when standing, and also when running at too low speed for the dynamo to operate. The storage battery furnishes the simplest means of supplying light at such times, suitable devices being arranged to transfer the lights from dynamo to battery, or vice versa, as required. In connection with the axle-driven dynamos, the batteries are charged from the dynamo on the car, either while the lamps are lighted, or during the day, or at both times. Batteries used as auxiliaries to engine-driven dynamos are charged, either en route or at the terminals, while the train is being cleaned and inspected for the next trip. Batteries used for lighting without any dynamo on the train must be charged at the terminals of the road.

The choice of an electric-lighting system best adapted to a given train or to a given road involves a number of technical considerations which require careful investigation. It may be said in general, however, that the storage battery without any dynamo on the train is suitable for trains which are not more than one day away from a source of charging current; that the system of engine with dynamo in the baggage car is suitable for solid trains going through to their destination, without any changes in make-up, and that the axle-lighting system finds a field almost its own in the case of through trains on runs several thousand miles long, and on trains which are split up by having cars added or removed en route, while it can compete in point of economy and good service on trains for which the other systems are suitable.

Comparing the different sources of light, passengers prefer gas to oil, and electricity to gas, provided the electric lights are properly taken care of and are reliable. Since experiments with electric lights on trains have been made from the time when the electrical art was in an early stage of development, it is not surprising that some of the early attempts were not as conspicuously successful as they were expensive. The compressed-gas system was brought to a reliable and commercially successful stage 10 years before the electric incandescent lamp was ready, and the gas interests made good use of their opportunity to pre-empt the field. After much expensive development, and in the face of many discouragements, the advocates of electric light for train use have overcome nearly all obstacles, and to-day the electric light is recognized as the only thing for the best service. The modern apparatus is developed to such a state of reliability and perfection that it is now possible for the railways to purchase electric-lighting outfits, or to secure them on a rental basis at moderate cost and guaranteed by ample capital. Now that the electric light has won its standing with the railways, the public may expect a rapid adoption of this admirable source of light and ventilation.

1. From The Forum.

CORRESPONDENCE.

New York Notes.

New York, May 11.—The power on the Lexington avenue division of the Metropolitan street-railway system was changed on Sunday, May 5th, from cable to electricity. A trial trip was made from the power house at Ninety-ninth street to Twenty-third street and return. The car contained only the officials of the road, among whom was Herbert H. Vreeland, president of the Metropolitan company. During the evening about 30 cars were run and the next morning the full quota of cars was put on.

Stockholders of the New York and Electric Light, Heat and Power company will hold a meeting on May 20th, to consider the proposition to consolidate with the Edison Electric Illuminating company of New York. The stockholders of the latter company will meet for the same purpose on the same day.

Announcement is made by the Metropolitan Street Railway company of a rearrangement of its transfer system. Last year the company issued 160,000,000 transfers. The transfer slips that have been in use were very confusing in both size and color. In the new system there are three colors, green, red and white. The green is for northbound, red for southbound and white for crosstown passengers. This system will simplify transferring to a great extent and will also do away with the continuous riding that has lately developed into a cheap amusement for idle persons.

The Johnson syndicate has recently acquired the Trenton, Morrisville and Yardley trolley line in New Jersey. This road skirts the Delaware River for three miles on the Pennsylvania side, and controls the approaches to one of the bridges over the river, and will form a link in the proposed line from New York to Philadelphia.

On Thursday the Rapid Transit Commission met and passed the largest requisition for a month's work on the subway that it has yet voted. The outlay was $977,000 for the month of April and was over $200,000 more than any hitherto voted.

Between Twenty-third and One-hundred-and-tenth streets the cable on the Columbus avenue street-car line was removed to-night, and electric cars will be substituted. The work of taking out the old cable was done under the supervision of Engineer M. T. Starett. The cable was wound in on a large wheel, the engines running with about one-fourth of the usual power necessary when the line was running regularly. The last car carried passengers, but went very slowly. Signal boxes were placed at every corner along the line, and whenever it was necessary to stop the car the conductor had to run ahead and notify the power house, and the engines were stopped.

The Mineola, Hempstead and Freeport Traction company has obtained from the trustees of Hempstead, L. I., a franchise to build a trolley line through the village, to connect with the proposed line to Queens. The company will commence the work of construction before August 1st.

The first of the eight large engines for the Man-

hattan Elevated Railway power house has been completed in Milwaukee and shipped. The engines are each guaranteed to have an ultimate capacity of 12,000 horsepower and will run at a speed of 75 revolutions a minute, driving a generator mounted on the main shaft. The diameter of the shaft is 37 inches and the main bearings are each 34 inches in diameter and 64 inches long. The weight of the shaft, with the moving parts of the generator, is about 250 tons, and the total weight of each engine with its generator is 1,200 tons. The eight engines are to be installed in one room and will have an economical capacity of about 70,000 horsepower and a maximum of 96,000 horsepower. Power for operating the entire elevated-railway system will be derived from these engines.

Employes of the Brooklyn Rapid Transit company are being organized by the American Federation of Labor. There are reports afloat that demands will be made, to be enforced by strikes, when the union is well on its feet. Herman Robinson and J. J. Pallas, who were appointed to wait upon the officers of the company, with regard to the discharge of three members of a committee of employes, visited President Greatsinger yesterday. It was claimed that the men dismissed from the company's employ were discharged because they were members of a grievance committee. The officers of the road say that the men were dismissed for infractions of rules. President Greatsinger referred his visitors to General Manager Brackenridge. The latter told the committee that the three men who had been discharged would not be taken back, as they had been dismissed for violations of the rules, and for no other reason.

G.

New England News.

Boston, May 11.—It is now believed that the elevated-railway system in this city will be ready for service the first week in June. Practice trains are running daily on the Charlestown and Roxbury sections, and the officials are preparing the time schedules. Trains will be run at least every two minutes from Dudley street, Roxbury to Sullivan Square, Charlestown—the termini of the elevated structure. Some of the company's directors favor making a gala day of the opening day, with free rides to hundreds of invited guests, but the majority opposes any special formality. The completed system will contain nearly eight miles of track and will represent an outlay of $10,000,000 and the labor of 2,200 persons.

President John T. Manson of the Milford, Holliston and South Framingham Street Railway company and the directors of the Grafton and Upton Railroad company recently held a conference at which they perfected plans for equipping the Grafton and Upton road with electricity, it having heretofore been operated by steam. The road is in operation between Milford and Hopedale, and cars will be run in connection with those on the Milford, Holliston and South Framingham road.

The Cahill Electric Typewriter company, capitalized at $1,000,000, is considering the question of locating its plant in Worcester, Mass. The machine is operated by an electric current. Springfield also wants the factory.

The state Gas and Electric Light Commission has granted the Worcester Electric Light company's request for more stock, by giving it authority to issue $200,000 worth at 150. The issue of last year amounted to $100,000 and was sold at 140. The proceeds of the sale of the new stock will be used in extending the underground system and installing 800-kilowatt and 1,200-kilowatt units on a three-phase, direct-connected system.

The purchase of the Lowell, Lawrence and Haverhill and the North Woburn street railways by the Lynn and Boston Railroad company places 390 miles of track in the control of a single company, covering territory from this city to Nashua, N. H. The company has announced its intention of reducing fares between certain places.

The House of Representatives has requested the attorney-general of the commonwealth to give his opinion as to whether there are any inconsistencies between a bill reported by the committees on manufactures and mercantile affairs, providing for the sale of the Boston Electric Light company's plant to the Edison Electric Illuminating company of Boston, and a bill from the same committee prohibiting the combinations of electric-light companies, unless the same is approved by the gas and electric-light commissioners. The House desires to know whether the combination authorized by the first-mentioned bill (which does not call for the approval of the commissioners) will conform to the provisions of the other bill, and whether, if the consolidation bill should pass first, the companies interested would come under the provisions of the prohibitive bill.

The Gloucester (Mass.) City Council has authorized an investigation into the advisability of establishing a municipal lighting plant.

B.

Canadian Intelligence.

Ottawa, Ont., May 11.—The power at the head of Shiek's Island dam, at Cornwall, Ont., is being developed by Mr. H. P. Davis, from plans prepared by T. Pringle & Son of Montreal. The power is to be utilized for operating the canal locks. It is understood that the Bullock Electric Manufacturing company of Cincinnati, Ohio, has secured the contract for the building of the first of four three-phase generators to be installed.

According to the statement submitted last year by ex-Mayor Shaw of Toronto, Ont., that city was to receive from the electric street-railway company, during the next 20 years, enough money to enable the city to construct a system of intercepting sewers, and also to improve the city's water supply, in addition to paying off the present debt incurred for street-railway pavements, and providing for future extension of the routes and necessary repairs to the pavements. Mr. Shaw estimated that the city's revenue from the electric railway would hereafter exceed $200,000 a year, or $4,000,000 in 20 years.

When Mr. Duncan McDonald, late superintendent of the Montreal Electric Street Railway company was appointed as manager of a tramway company in Paris, France, some months ago, he engaged several conductors and motormen from the Montreal street cars. He then received a great many applications from Montreal street-railway men, but as it was impossible to accept them all, he promised to endeavor to find work, after a time, for some of the rejected ones. Mr. McDonald appears to have fulfilled his promise, for he has recently engaged engineers Pare and Griffin of Montreal, who will be road inspectors for the Parisian company.

Reports received from the various committees which have in hand the perfecting of arrangements for the annual convention of the Canadian Electrical association, to be held at Ottawa, are of a most satisfactory character. An excellent list of papers has been secured. Interesting reports will be presented by special committees appointed at last year's meeting, to consider certain matters affecting the welfare of the electrical companies. The constitution of the association has been carefully revised and improved in many points and rendered more workable. The local committees are exerting themselves to the utmost to give to the convention an interesting, enjoyable and profitable time. A satisfactory attendance of the members is now the only requirement for the success of the meeting. The dates selected for the convention are the 19th, 20th and 21st of June, the most enjoyable season of the year, when most people are looking forward to an outing. All the conditions are therefore favorable to a large gathering of electric men at the Canadian capital.

A. V. W.

From the Buckeye State.

Columbus, Ohio, May 11.—It is said that the promoters of the Canton-Akron Electric Railway company contemplate much more than the name of the road would indicate, and that is nothing less than the connection of Cleveland and Columbus by an electric line, with the possibility of an extension to Cincinnati. The company has been granted a franchise in Tuscarawas County, and the plan is said to include the towns of New Philadelphia, Zanesville, Newark and Columbus. Traffic arrangements have been made with the Akron, Bedford and Cleveland road, which will insure an entrance to Cleveland. It is the intention to make it a freight road, and it will be built to accommodate heavy traffic as well as the passenger cars.

Another big deal which has been reported within the last few weeks is the acquisition of a controlling interest in the Miami and Erie Canal Transportation company by the Everett-Moore syndicate. It was supposed that W. H. Lamprecht would control this property, but it seems that a deal has been consummated that gives control to the other syndicate, although the Lamprecht interests are still important. The right to use the berm banks of the Miami and Erie Canal was given to Thomas N. Fordyce of Detroit, for the purpose of constructing a trolley line to haul canalboats by means of a motor, but it is said the contract calls for much more, and that under it an electric line may be built from Cincinnati to Toledo. It is for this purpose that the Cleveland people have taken hold of it, although it will no doubt be used for the original purpose also, as freight can be hauled very cheaply that way, and it will not bother the regular traffic, if the proper number of switches are used. The line will be 250 miles in length. Two millions of the $3,000,000 capital stock has been subscribed.

From what has been said, it would seem that the line proposed by the Fort Wayne, Dayton and Cincinnati Traction company will be put through, although it is admitted to be a great undertaking. The line will be 173 miles in length and will pass over a private right-of-way for most of the distance. This right-of-way has been secured for the most part between Fort Wayne and Hamilton, Ohio, and agents are now at work on the portion between Hamilton and Cincinnati. The officers elected by the stockholders are as follows: President, Dr. S. M. George, Dayton; vice-president, D. W. La Fetra, New York; second vice-president, Charles L. Hyde, South Dakota; secretary and treasurer, C. W. Gephard, Dayton. After the main line is completed there will likely be branches built that will bring the total mileage up to over 350 miles.

The People's Heat and Light company of Kenton has been incorporated, with a capital stock of $100,000. A hot-water heating plant and an electric-light plant will be built.

The Little Miami Traction company has filed notice with the secretary of state of an increase of capital stock from $1,000 to $500,000. It is the intention to push the work from Xenia to Springfield as rapidly as possible.

Powell Crossley, president of the Cincinnati and Cleveland Railroad company, has made a second application to the board of legislation of Cincinnati for a franchise. This time he makes it specific that his road is to be operated by electricity. The first one provided for either steam or electricity.

The Toledo and Bryan Air Line Railway company has been incorporated, and the capital stock is placed at $1,250,000. The purpose of the company is to build a line from Toledo directly to Bryan, a distance of something over 50 miles. Joseph L. Yost, F. V. Collins, Milton Taylor and other prominent Toledo business men are the incorporators. Mr. Yost has secured a good part of the right-of-way already.

The deal by which George B. Kerper of Cincinnati secured the Toledo, Bowling Green and Fremont electric line has been closed, and it is said the cash, $140 a share for 1,600 shares, has been paid over. This line will be connected up with the Findlay street railway, which will require the building of about 13 miles of new road. The new company that secures both these roads is the Toledo, Bowling Green and Southern.

Henry A. Everett has returned to Cleveland from his California trip. It is said that all the big deals engineered by his associate, E. W. Moore, will at once be ratified after he has taken a look over the situation, and that all gaps between the portions of the road proposed from Cleveland to Detroit and Cleveland to Pittsburg, by way of Youngstown and Warren, will be closed as fast as they can be reached. These matters have been gone over thoroughly in the Western Electrician.

The Cincinnati Gas Light and Coke company filed notice with the secretary of state a few days ago of a change of name to the Cincinnati Gas and Electric company and of an increase of capital stock from $9,280,000 to $28,280,000. This action was taken in anticipation of the taking over of all the lighting interests of Cincinnati, Newport and Covington. The fee to the office of the secretary of state in this transaction was $18,000. The officers of the company are now as follows: President, General Andrew Hickenlooper; vice-president, Norman G. Kenan; vice-president in charge of the electrical department, C. W. Wetmore; secretary and assistant treasurer, H. W. Sage; treasurer and assistant secretary, Charles I. Foust.

It is said that the offer made by the Everett-Moore syndicate for the property of the Toledo Traction company is between $9,000,000 and $10,000,000.

It is reported that George Metzger, representing a syndicate in which Guy G. Major is interested, has purchased the Toledo and Maumee Valley electric-railway property which was owned principally by A. K. Detwiler. The price is stated to be $480,000, or $29,000 per mile. The Maumee Valley was the first interurban road built at Toledo, and it was not made as heavy as others have been. For this reason it is said that it will be largely rebuilt by the new owners. There is a report extant that George B. Kerper of Cincinnati also had his eye on this property.

The Detroit United Railway company has purchased the Detroit and Northwestern Suburban trolley line, the price being $800,000. The owners receive an issue of 4½ per cent. bonds for the property. This is another step in uniting the roads about Detroit, which is in the hands of the Everett-Moore syndicate.

The organization of the Tiffin and Southwestern Electric Railway company of Kenton has been completed by the election of the following-named officers: President, Henry Price; first vice-president, Robert Carey; second vice-president, W. S. Rogers; treasurer, J. B. Seymour; secretary, Thomas Espy. It is the intention to increase the capital stock from $50,000 to $2,000,000.

The city of Zanesville has granted a franchise to George K. Browning to build a line of road from Zanesville to Hebron, to connect with the Columbus, Buckeye Lake and Newark road. A franchise was also granted the Newark, Zanesville and Coshocton Traction company to build a line through the county, connecting the towns named and several other smaller places.

A. E. Appleyard of the Dayton, Springfield and Urbana Electric Railway company has closed a deal by which he becomes owner of the Dayton, Lebanon and Cincinnati Traction property. It is now operated between Lebanon and Lebanon Junction, but will be connected with the other road near Harshman. Several extensions will also be built, and the ultimate intention is to build it on to Cincinnati as a part of the larger system.

Plans are being made to make the Little Miami Traction company a third-rail system. Will Christy of Akron says that it will differ radically from any other now in use and will also be used on the Aurora, Wheaton and Chicago line, which is now owned by Akron and Cleveland men.

The Detroit and Toledo Short Line company has been incorporated in Michigan, to build a road from Detroit to Monroe, Mich. It is said that the new company has arranged to purchase the Toledo and Monroe line, which will give them a through line. A. E. F. White, Clarence A. Black, J. M. Mulkey and M. E. Farr of Detroit are among the incorporators. Mr. Mulkey will be general manager.

The council of Marysville has granted a 25 years' franchise to the Union Electric Railway company, which is being financed by Pittsburg parties, and of which Thomas N. Kerr of Columbus is the manager.

The two lines of road, one running from New Philadelphia to Canal Dover and the other from Uhrichsville to New Philadelphia, have been con-

solidated and it will hereafter not be necessary to change cars in making the trip from Uhrichsville to Canal Dover. It is possible that the Akron-Canton Electric Railway company may use these tracks for its southern extension.

The People's Heat and Light company of Kenton (capital stock, $100,000) has been incorporated by George A. Carter, L. A. Ansley, George Crane and others. A hot-water-heating plant and an electric-light plant will be built.

The United States Electric and Manufacturing company, Cleveland, has been incorporated, with a capital stock of $10,000. O. M. C.

Information from Indiana.

Indianapolis, May 13.—Each of the two electric-railway companies seeking to build a line from this city to Martinsville, practically over the same route, applied to the Circuit Courts of Marion and Morgan counties last week for condemnation proceedings to appraise and condemn the right-of-way. Previous to this move a conference was held by the officials of the two companies, with a view of selling or buying out, one to the other, or consolidating their interests, but an agreement could not be reached, hence, the haste to secure the right-of-way.

A company was organized on the 11th inst. at Middletown to construct and equip an interurban railroad, connecting that place with Mechanicsburg, Shirley, Wilkinson, Willow Branch, Greenfield, Cross-roads and Muncie. The company is to be known as the Muncie, Middletown and Greenfield Traction company. The capital stock was placed at $25,000, with a provision to increase the amount. The proposed road, when built, will form a link that will complete a direct line from Fort Wayne to Indianapolis. William McCampbell is temporary manager of the undertaking.

A new electric road is planned to connect Fort Wayne and Goshen. James F. Rothwell of St. Louis, accompanied by James Lynch, an experienced engineer, held a meeting on the 7th inst., with local capitalists, and the projected road is the result of the conference. The promoters and engineer drove over the proposed route, on a tour of inspection, and reported the route feasible, and that it is over a populous and wealthy country through which there is no direct road.

The Western Indiana Railway company was incorporated last week, with a capital of $100,000. This company proposes to build an electric line between Indianapolis and Crawfordsville, via Danville and Ladogo. The preliminary survey was completed on the 9th and the promoters announce that arrangements have been made to finance the road as to construction and equipment.

Within a week the track of the extension of the Greenwood electric-railway line to Franklin will be put in running order. The franchise requires the work to be completed and in operation by June 1st. But for the difficulty in getting fishplates, the work would have been completed a week ago.

Application has been made by Frank Keegan and others to the county commissioners of Clay County for a franchise to construct a traction line from Brazil to Caseyville, the work of building the line to begin at once. An Indianapolis syndicate is also trying to secure a franchise over the same road. The line will be 10 miles long and connect a score or more mining districts.

Two corporations have been struggling for possession of the old canal-bed between Huntington and Roanoke. Recently it was the property of A. N. Dukes of Peru, but the Fort Wayne and Southwestern Traction company began condemnatory proceedings to secure the property. On the same day the Wabash Railway company was granted a franchise, and Mr. Dukes claimed to have transferred his interest to that company. But the court appointed appraisers and they submitted a report placing the value at $6,500, and thus the Fort Wayne company won. This settles the long controversy. The grading will begin at once, and President Reed says that electric cars will be running between Fort Wayne and Huntington, along the route where canal-boats plied 40 years ago, by July 1st.

At the present time franchises have been issued to individuals and companies permitting the use of every highway leading out into the county from Indianapolis, and the township assessors have announced their purpose of assessing for taxation all franchises for electric roads. These franchises have never heretofore been assessed, but the assessors are advised that they are valuable assets, that they are being sold and bought, and, therefore, liable to taxation.

The appointment of a receiver for the electric-light plant of Marion, Ind., until it can be determined to whom the property belongs, was approved by the Supreme Court last week. M. C. Mead and associates owned the plant, and agreed to sell it to B. F. Burke and others for the purpose of reorganizing the company. They were to receive $25,000 in cash and $23,500 in stock. After the contract was made they realized that this would give the controlling interest in the new company to its new members, who, they discovered, would not let them buy any more stock than the amount given to them for their property. The purchasers paid the money, tendered the stock, and then sued to compel performance of the contract, procuring a receiver to operate the electric-light plant in the meantime. The Supreme Court said that where it is shown that the property is in danger of loss or injury from the neglect or misconduct of contending factions and there seems likely to be a fierce and protracted litigation over its ownership the court is justified in taking the property away from both parties until the dispute is settled. F.

Southern Developments.

Charlotte, N. C., May 10.—Atlanta men have obtained control of the street-car lines of Mobile, Ala., Judge Henry B. Tompkins, Dr. A. W. Calhoun and others having closed a deal giving them control of the principal street railways of the Alabama city.

Mayor Mims of Atlanta, Ga., has stated to the council that, in his opinion, there is no use to proceed further in an attempted arbitration between the city and the Georgia Electric Light company, relative to fixing the price of lights for Atlanta.

The town of Albany, Ga., at a meeting of citizens, has decided to call an election on the question of issuing $25,000 bonds to be used in installing an electric plant adequate to the city's needs. The matter was finally placed in the hands of the council.

The city of Thomaston, Ga., has contracted with the Bibb Manufacturing company to furnish power for the city's system of electric lights to be installed. The Bibb Manufacturing company owns certain waterpowers on Potato Creek which it will develop.

The Atlanta (Ga.) Railway and Power company has accepted the franchise offered by the city, thus assuring Atlanta competition in electric lights. President Ernest Woodruff says that the company will be supplying power and lights in the central portions of the city within 90 days. Bonds amounting to $65,000 were required of the company.

In the taxation case of the Western Union Telegraph company against the North Carolina corporation commission, a compromise having been effected some weeks ago, an order has been forwarded to Judge Simonton for his signature. The Western Union, according to the agreement, submitted to a compromise on valuation of their property at $850,000, and further agreed to pay taxes on this amount for the years 1899, 1900, 1901 and 1902.

The Norfolk (Va.) Heat, Light and Power company has elected George M. Bunting of Chester, Pa., president. The new power house of the company is nearing completion and the company is expected to begin its service at no distant date. L.

Northwestern Notations.

Minneapolis, May 11.—The electric-light company of Great Falls, Mont., has made a new rule, whereby all customers having more than five lights will be required to use meters.

Appleton (Wis.) capitalists have bought the water-power at Kilbourn City, Wis., and propose to develop it and transmit the power electrically to Madison, Wis., to operate the street cars. Power can also be furnished for Portage and Kilbourn, and to operate an electric railway in the Dells region.

The Street Railway and Light company of Winona, Minn., has the new line across the lake completed and ready for operation.

The Sioux City Traction company of Sioux City, Iowa, plans to abandon the Third street line if given permission to bring the Morningside cars down Fourth street. The company thinks it is operating too many parallel lines for its own good.

The Council Bluffs (Iowa) Electric Light and Gas company is working hard to have its new system completed in time to be in operation on May 25th, the date set by the contract.

The Ottumwa (Iowa) Electric Street Railway company seeks a new franchise for its street-railway and electric-light plants. It asks for a 25-year existence for all of them.

The council of Albert Lea, Minn., has made a contract with the lighting company for every-night-in-the-year street lighting. The contract can be terminated at the end of any year and the city can go in for municipal lighting.

The Detroit Light and Land company of Detroit, Minn., has made a proposition to the council to renew its contract for street lighting for a period of 10, 15 or 20 years. The company offers to sell its plant to the village at any time within one year at a valuation to be determined by a committee of five residents and taxpayers, two of which are to be selected by the company, two by the council and the remaining one by the four so chosen.

John M. Seamann has announced the route of the projected electric line from Sheboygan, Wis., to Elkhart Lake. It will go via Riverside, Sheboygan Falls, Parrish's Corners, Plymouth, Crystal Lake, and thence to Elkhart Lake. From Parrish's Corners a spur is to be built to Waldo.

Fred E. Sander, the holder of a franchise for an electric car line between Seattle and Tacoma, Wash., announces that the bonds for the line have been sold in the East, and construction will be started within 60 days. The right-of-way has been secured from end to end, and cars are to be running by September 1st. The line will be 36 miles long.

Arrangements are fast being completed for the construction of the proposed Coon Creek power dam across the Mississippi River, nine miles above Minneapolis, by Thomas Lowry. The location will enable the power to be transmitted to Minneapolis, and also to Anoka. The dam will cost about $1,000,000, and will require two years to complete it.

The Supreme Court of North Dakota holds that under its charter the city of Fargo cannot contract for anything for more than one year. A citizen attacked the validity of the present contract with the Fargo Gas and Electric company, running for 10 years. His contention was ruled against in the District Court, but the Supreme Court reverses the lower court.

Four university students of the University of Minnesota, at Minneapolis, and Prof. George D. Shepardson, the head of the electrical engineering department, will make exhaustive tests of the electric-lighting systems in use on railroads running out of Minneapolis. They propose to take tests as to the power available at all times from the beginning of charging the batteries at the terminal to the end of the run. These tests will reveal the power, cost of operation, efficiency, etc., of the systems. They will take the current and voltage of the battery from the time it leaves the charging yard in Minneapolis till it leaves the run at Chicago, and will repeat the tests on the return trip. A record will be kept of the pressure, from which may be figured the number of lights in use on the train during the night. In the car-axle systems tests will be taken from the dynamo itself to measure the volume of energy delivered, and from the storage battery to show the volume which goes into that. Another set of instruments will be used to find the amount of energy actually consumed by the lights.

The street-railway company of Tacoma, Wash., proposes to make Spanaway Lake a popular resort and will build a car line to that place.

A new electric-light plant has just been installed for the hospital for insane at Mount Pleasant, Iowa. The plant has a capacity for 3,000 lights, and is expected to make a saving of $300 per month to the state.

J. A. Moore, G. Henry Whitcomb and Alver Robinson have petitioned the council of Seattle, Wash., for a franchise for an electric car line. They propose to invest from $300,000 to $400,000.

Two cars collided on the Green Lake line in Seattle, Wash., injuring seven people, but none seriously. The company has a single-track line and a block-signal service. When a light burns it indicates that the last car was outward bound. But sometimes the incoming car fails to turn off the light, and it is customary to take a look ahead after waiting a while, and proceed if no incoming car is in sight. This was done, and the two cars met on a curve.

The annual report of the Western Union Telegraph company to the auditor of state in Iowa shows an increase of mileage to 7,188 from 6,894, reported last year.

A movement has been started in Duluth, Minn., toward securing a city electrician. The office was abolished about three years ago, in the interest of economy. Recent fires are charged up to improper wiring, and have had the effect of arousing a demand for the re-establishment of the office.

The promoters of the electric line from Fort Madison, Iowa, to Nauvoo, Ill., announce that the line will be built if the right-of-way is donated by the farmers living along the route.

The corporation which will construct an electric railway from Charles City, Iowa, to Greene, has been formed, and will begin its existence June 1st. The capital stock is $100,000. It is expected to have construction work start soon after June 1st.

The Edison Electric Light company has notified the city of Des Moines, Iowa, that pay will be demanded for the 20 incandescent lights furnished the city fire station. A bill of $79 for the last three months was submitted to the Board of Public Works, which promptly cut it out. The company threatens to appeal to the courts. The expired franchise specified that 20 lights should be furnished free to the city.

The Keota (Iowa) electric-light plant has been sold to J. H. Vail of Muscatine, Iowa.

The Astoria Electric company has been formed at Astoria, Ore., and has secured the street-railway system there. Improvements have been started on the line.

The construction of the proposed electric car line at Two Rivers, Wis., is delayed by the inability of the contractors to secure materials. It was hoped to have the line operating to Manitowoc by July 1st, but it will probably be September 1st before it is ready.

The Tri-city Railway company of Davenport, Iowa, has let a contract to the Falk company of Milwaukee to repair curves and do other special work for the company.

The Fargo Edison Electric Light company of Fargo, N. D., has been reorganized and has elected a board of directors and officers from local men.

The entire system of the Railway and Light company at Merrill, Wis., has been sold to Attorney T. F. Frawley of Eau Claire, Wis., who represents Boston capitalists. They propose to establish an electric line from Wausau to Merrill and to make a large number of improvements to the waterpower.

Loweth & Wolff, engineers of St. Paul, have been engaged to furnish plans and superintend the construction of the electric-light and water system to be established for Brookings, S. D.

The council of Spencer, Iowa, has completed the purchase for the city of the local electric-light plant and took control of it May 1st. The city paid a little over $15,000 for the system. Extensions to the plant will be begun at once.

Oshkosh, Wis., recently opened bids for street lighting. The lowest bid was from the Fort Wayne Electric Works of Fort Wayne, Ind. The firm

proposes to establish a plant, if awarded the contract.

It is announced that Kidder, Peabody & Co. of Boston have financed the proposed interurban electric line between Tacoma and Seattle, Wash., and the construction contract has been awarded to Carl G. M. Miller, also of Boston. This is the so-called Bucey road, of which George B. Blanchard is the Tacoma representative. The line will be 36 miles long, and it is planned to have it in operation by January 1st.

The Seattle Electric company of Seattle, Wash., contemplates a tunnel 600 feet long to overcome the grade on Queen Anne hill.

The Washington Water Power company of Spokane, Wash., is preparing to enlarge its plant and to develop additional waterpower to furnish electric power through the Big Bend country. The company plans to furnish light and power to the towns of Cheney, Sprague, Ritzville, Paha, Medical Lake, Reardan, Davenport and Harrington. The company's waterpower at Spokane is capable of developing, at the lowest stage of water, 30,000 horsepower. Another project is being fostered by David Wilson of Davenport, Wash. He proposes to develop the power from the little falls of the Spokane River, 35 miles from Spokane. The falls carry from 6,000 to 15,000 horsepower, depending on the stage of the water.

R.

CONVENTIONS AND EXPOSITIONS.

National Electric Light association, International Hotel, Niagara Falls, N. Y., May 21st to 23d.

Independent Telephone association of the United States, Convention Hall, Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American Hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Northwestern Electrical association, Sheboygan, Wis., June 26th and 27th.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

PERSONAL.

Barney Mahler, the street-railway man of Cleveland, inspected the electric roads about Sandusky, Ohio, last week.

Ernest Kilburn Scott has taken the position of engineer and manager (United Kingdom, colonies and Egypt) to the International Electric company of Liege, Belgium, the London offices being at Clun House, Surrey street, Strand, W. C.

Herbert A. Wagner, the well-known electrical and mechanical engineer of St. Louis, announces that, in addition to his St. Louis office, he has opened an office in the Times building, New York, for the practice of engineering. Mr. Wagner is making plans for extensive additions to the plants of the electric-lighting companies of Boston.

Louis A. Ferguson, general superintendent of the Chicago Edison company, and Frederick Sargent, of the well-known Chicago engineering firm of Sargent & Lundy, sailed from New York city for Southampton on the liner St. Louis on May 15th. Both gentlemen were accompanied by their wives, and the party will spend about two months in England, Mr. Sargent's native country, and on the continent, visiting points of historic and engineering interest. Mr. Sargent and Mr. Ferguson will devote considerable of their time to a study of central-station practice in Europe.

John Charter, the gas-engine inventor, died at his home in Sterling, Ill., on April 30th, aged 63 years. Mr. Charter showed inventive genius and business sagacity at an early age and was little more than 19 years old when he introduced his first invention. In 1875 Mr. Charter was chosen president of the Williams & Orton Manufacturing company of Sterling. In 1882 he invented the Charter gas engine, the first engine of its kind to use gasoline direct. At the time of the invention of this engine the Williams & Orton Manufacturing company was changed to the Charter Gas Engine company, and gas engines were manufactured exclusively. Mr. Charter was former owner of the Sterling gas plant, and the Sterling Gas and Electric Light company was organized through his efforts.

ELECTRIC LIGHTING.

Chillicothe, Mo., has voted to issue $25,000 in bonds, to build a municipal electric-light plant.

The Century Electric company of San Francisco has been incorporated, with a capital stock of $50,000.

The Rome (N. Y.) Gas, Electric Light and Power company has been incorporated, with a capital stock of $400,000.

The Robinson Water, Light and Heat company, Robinson, Ill., has been incorporated, with a capital stock of $70,000. The incorporators are C. S. Jones, F. Bartmes and A. H. Bayston.

The Wheeling Steel and Iron company, Benwood, W. Va., will install a complete electric-light and power plant.

The Graves County Water and Light company of Mayfield, Ky., has decided to erect a new plant, at a cost of $4,000.

The city of Orlando, Fla., will grant a franchise for an electric-light plant. Bids are solicited. J. Duke is the city clerk.

The Frenchtown Electric Light company, Frenchtown N. J., has been incorporated, with a capital stock of $50,000.

The Royal Center Electric Light company of Royal Center, Ind., has been incorporated, with a capital stock of $10,000.

The International Light and Power company, El Paso, Texas, will increase its capital stock from $25,000 to $50,000.

A syndicate of Philadelphia and Reading capitalists will build an electric-light, power and steam plant at Pottsville, Pa.

The Atlanta (Ga.) Railway and Power company plans to lay 300,000 duct feet in a subway for a three-wire lighting distribution system.

The Seaton Mountain Electric Light and Power company has been incorporated at Idaho Springs, Idaho, with $100,000 capital stock.

A bond issue of $500,000 will soon be made by the Dayton Electric Light company, Dayton, Ohio, to provide for improvements to its plant.

Houston, Texas, has passed an ordinance for a special election to authorize the borrowing of $100,000 for the building of an electric-light plant.

The Western Illuminating, Power and Heating company of Madison, Ill., was incorporated, with $2,500 capital stock, by E. W. Hilker and J. E. Molthrop.

The Paris (Texas) Transit, Light and Power company has been incorporated, with $250,000 capital stock, by W. F. Little, R. A. Cornell and S. B. M. Long.

The Michigan Central Railway company will erect a power house, machine shop and electric-lighting plant at Jackson Junction, Mich., at a cost of $300,000.

J. H. Gaither and V. G. Bloede, in connection with New York capitalists, will erect a large electric-light plant at Ellicott City, Md., utilizing waterpower for its operation.

The Wayne County Electric company, Lyons, N. Y., has been incorporated, with $100,000 capital stock. F. C. Eddy of Syracuse is the president of the company.

The Woodland (Cal.) electric and gas plants have been purchased by J. Martin of San Francisco, who will make extensions and improvements amounting to $20,000.

The Middleport Gas and Electric Light company, Middleport, N. Y., has been incorporated, with a capital of $30,000, by W. C. Johnson, F. A. Dudley and L. S. Sherritt.

A Chicago company has made an offer to the City Council of Lincoln, Ill., to construct a municipal electric-light plant, to cost about $30,000. The proposition is now under consideration.

The Clinton Light and Water company, Clinton, Mo., has been incorporated, with an authorized capital stock of $180,000. J. M. Avery, P. Tyler and J. T. Marsh are the incorporators.

The Toluca Electric Light and Gas company, Toluca, Ill., has been incorporated, with a capital stock of $15,000. The incorporators are Charles H. Devlin, H. Duggan and D. M. Wood.

The American Light company of Philadelphia has been incorporated, with an authorized capital stock of $5,000,000. It will engage in gas and electric lighting. The directors are J. Emory Bryan, M. C. Reed and A. F. Phillips.

At a meeting of the Village Council of Coopersville, Mich., a franchise was granted to the Grand Rapids, Grand Haven and Muskegon Railroad company, to construct a village lighting, heat and power plant at a cost of $38,000.

The city of Marshall, Minn., contemplates making extensive changes and improvements at once in its waterworks and electric-light plant. An entire remodeling of the plant is considered, necessitating new machinery throughout.

A bill providing for a state electric-lighting plant for the capitol building at Madison, Wis., was passed by the Senate. The bill authorizes the governor to contract for the construction of such a plant and appropriates $35,000 for that purpose.

A. M. Barron has added the Bloomington Light, Heat and Power company of Bloomington, Ind., to his other properties. Mr. Barron has been chosen president of the company, while Fred. L. Harris has been made secretary, and Frank B. Sherman, treasurer.

ELECTRIC RAILWAYS.

The Janesville (Wis.) City Council has granted an electric-railway franchise to the Janesville-Rockford line.

A New York syndicate is promoting the building of an electric railway between Augusta, Ga., and Aiken, S. C., a distance of 15 miles.

The Kalamazoo and Lake Michigan Electric Railway company of Kalamazoo, Mich., has increased its capital stock from $60,000 to $200,000.

The Wisconsin River Electric Railway company has been incorporated, to build from Tomahawk, Wis., to Nekoosa, Stevens Point and Grand Rapids, Wis.

The Schenectady Street Railway company, Schenectady, N. Y., contemplates the building of a trolley line from Schenectady to Troy, by way of the Troy turnpike.

J. M. Saeman is planning to build an interurban street railway from Sheboygan, Wis., to Elkhart Lake, by way of Sheboygan Falls and Waldo, to cost $350,000.

The first intercity electric railway in Texas was put into operation on May 6th, between the cities of Denison and Sherman. The line is 14 miles long and is owned by Chicago people.

The Coal City Electric Railway company, Marion, Ill., has been incorporated, with a capital stock of $100,000. P. M. Johnston, Frank P. Read and C. M. Atterbury are the incorporators.

The Wilmington City Railway company of Wilmington, Del., has awarded contract for the erection of a new power house. The building will cost $21,000 and the entire plant will cost $150,000.

P. J. Haynes and G. L. Claussen of Chicago have secured a right-of-way for the building of an electric railway from Kenosha, Wis., to the junction of the Chicago, Milwaukee and St. Paul railway at Truesdel.

The New Orleans and Carrollton Railroad company of New Orleans, La., has decided to increase its capital stock to the extent of $200,000. The company will build several extensions in the city and suburbs.

The Los Angeles and Pasadena Traction company, Los Angeles, Cal., has been incorporated, with $750,000 capital stock, for the purpose of building an electric railway between Pasadena and Los Angeles.

Messrs. J. Stambaugh, S. L. Jackson and other Youngstown (Ohio) capitalists are organizing a company with $500,000 capital stock for the purpose of building another electric street railway in Youngstown.

The Steubenville and Martins Ferry Traction company has applied to the county commissioners of Belmont and Jefferson counties, Ohio, for franchises for a trolley line to connect Steubenville, Ohio, and Wheeling, W. Va.

A new company, with $1,000,000 capital stock, has been formed by Northern Ohio traction men. It will be known as the Canton, Massillon and Akron Railway company and will build an electric road from Canton to Massillon.

A charter has been granted to a company at Independence, Kan., that proposes to put in an electric railway connecting Independence, Coffeyville and Cherryvale, Montgomery County. This company will also build an electric-light plant at Independence.

An 18-mile extension is to be built to the electric street railway in Seoul, Korea, by the American firm of Collbran & Bostwick. The firm named will also build an electric-light plant for the city of Seoul. The cost will be 720,000 yen ($358,560).

The Kansas City, Parkville and St. Joseph Electric Railway company of Kansas City, Mo., has been incorporated to build a trolley road between Kansas City and St. Joseph. The firm of Denison, Prior & Co. of Boston and Cleveland is financing the enterprise.

An electric railway from Chicago through the western part of Evanston to Gross Point is being promoted, and agents of the proposed company are busy securing the consent of property owners for right-of-way. Two east-and-west cross lines are proposed in the system for Evanston.

An electric railroad may be built from Dansville, N. Y., to Rochester, down the Genesee Valley. It will be 40 miles in length and intended for freight and passenger business. The corporation will be capitalized at $1,000,000, and will be known as the Rochester and Southern Traction company.

The commissioners of Tuscarawas County, Ohio, granted C. Kolp, W. H. Hoover and J. C. Welty a franchise to construct and operate an electric line from New Philadelphia to the northern boundary of the county. The line will be operated in connection with the Canton-Akron Electric Railway company's line.

According to statistics compiled by the royal bureau of electric railways, the traffic on the electric

roads of Saxony shows a decided increase over that of last year. The roads in 1899 showed a total length of 137.54 miles and carried 113,592,390 passengers, while in 1900 a length of 166.59 miles and 147,645,690 passengers carried were shown.

In the trolley-contact-spring case of the General Electric company against the Star Brass Works, involving Anderson patent No. 412,155, Judge Wanty, of the United States Circuit Court, Western District of Michigan, Southern Division, has filed an opinion, enjoining the defendants from further infringement of the patent in suit.

An opinion has been handed down by Judge Thomas of the United States Circuit Court, Eastern District of New York, in the series-parallel-controller case of the General Electric company against the Nassau Electric Railroad company and the Lorain Steel company. The suit involves certain claims of the Condict patent No. 393,323. The court reviews the arguments and asks for further counsel respecting certain groups of claims of the patent.

PUBLICATIONS.

Dixon's perfected graphite brushes for motors and dynamos are listed in different sizes and types in a pamphlet issued by the Joseph Dixon Crucible company of Jersey City, N. J.

The Rochester Electric Motor company of Rochester, N. Y., by means of an attractive folder, introduces the reader to a few Rochester people with whom it does business. An illustration shows a view in a corner of the company's factory.

The Wagner Electric Manufacturing company is announcing to the trade, by means of attractive folders, the conclusion of negotiations by which the selling organizations of that company and the Bullock Electric Manufacturing company of Cincinnati have been amalgamated.

The Akron Electrical Manufacturing company of Akron, Ohio, has issued a tastefully arranged and comprehensive 80-page catalogue, giving illustrated descriptions of its different styles of motors and generators. Separate bulletins issued by the same company are devoted to direct-current motors and generators and contain tables of dimensions, diagrams of connections, etc.

Columbus storage batteries are described and listed in a booklet issued by the Columbus Battery and Specialty company of Columbus, Ohio. These batteries are claimed to have a high efficiency, low internal resistance and other advantageous features. Cells for many different uses are described and charging-circuit diagrams are given. Interesting information on estimating the size of cells and the care of storage batteries is also contained in the booklet.

"A Step Forward" is the title under which the Bullock Electric Manufacturing company of Cincinnati and the Wagner Electric Manufacturing company of St. Louis are presenting to the trade a brief account of the recent consolidation of their sales departments. By this selling arrangement the Bullock company will handle all the territory east of the eighty-fifth meridian, and the territory west of that line will be handled by the Wagner company. The selling department will be under the management of E. H. Abadie, formerly sales manager of the Wagner company.

TELEGRAPH.

The Western Union Telegraph company lost 100,000 telegraph poles by fire at Delray, Mich., on May 12th. The poles were valued at $600,000.

The laying of the first of a series of projected cables, to be laid by the French government in the Atlantic and Indian oceans and Mediterranean Sea, was successfully completed between Marseilles and Tangier on May 3d. The most important of the cables soon to be laid are a line from Dakar in Senegal to Rochefort on the French coast, 2,224 miles; several lines to the far East, aggregating 2,865 miles, and other lines in the eastern Mediterranean, a total of 2,173 miles. The entire project will cost 150,000,000 francs ($30,000,000).

Judge Kohlsaat of Chicago, in the United States Circuit Court, granted an injunction on May 8th in the case of the Western Union Telegraph company against the National Telegraph News company and others, restraining the latter from publishing, selling or transmitting, through their tickers or otherwise, news, quotations or other information which may hereafter be collected, formulated and transmitted by the Western Union Telegraph company through its tickers. The prohibition holds good until the lapse of fully 60 minutes from the time such news items are first printed and appear upon the ticker tape. Judge Kohlsaat held that the Western Union Telegraph company has a right of property in the news and information collected by it.

POWER TRANSMISSION.

One feature of an "industrial city" planned as a suburb to Indianapolis is a central plant to furnish power, light, heat and water to factories and residences. The gentlemen interested contemplate the organization of a company with $300,000 capital stock. Mr. H. H. Fay is prominent among those discussing the project, and it is said that an option on 800 acres of land near Brightwood has been secured.

The Great Falls Power company has been incorporated, with a capital stock of $20,000, for the purpose of supplying electricity to Nashville, Tenn., for light and power purposes. The incorporators are T. G. Kittrell and G. Jungermann.

SPACE TELEGRAPHY.

United States Consul Grout of Malta notes that recent experiments in wireless telegraphy off the coast there have resulted in the successful transmission of a message 134 miles. While experimenting on a ship in the open sea, he adds, the operators were surprised to receive a message in Italian, asking as to the position of the ship. It afterward turned out that the message came from an Italian war vessel at Syracuse.

A practical demonstration of the use of wireless telegraphy was recently given off the coast of Belgium. A channel mail steamer, which is equipped with an apparatus for wireless telegraphy, received a message from the French lightship which is anchored about 25 miles from Dunkirk, stating that the latter would be unable to show a light unless help arrived from shore. The captain of the mail steamer at once sent a wireless message to La Panne, on the Belgian coast, from which point it was forwarded to Dunkirk by the regular telegraph line. A boat was dispatched to the lightship and the necessary repairs were made.

ELECTRICAL SECURITIES.

The Whitney-Ryan syndicate, in furthering the interests of the Electric Storage Battery company of Philadelphia, has during the last year purchased many of the large lead mines in Missouri, and now the syndicate is said to be arranging a combination of all the lead properties in the state. To further this combination the capital stock of the Union Lead and Oil company, which was recently incorporated in New Jersey at $15,000,000, is to be increased to $50,000,000.

The Electric Vehicle company of New York city has completed arrangements for the issuance of $1,675,000 in six per cent. gold bonds of $1,000 each, giving a trust deed to the Morton Trust company of New York to its grounds and plant in Cicero, Ill. The deed was given by Henry M. Byllesby, vice-president, and T. W. Goodridge, secretary, of the company. The bonds will run to May 1, 1904. The land is 641 by 1,886 feet in dimensions, and the business formerly was conducted by the Siemens & Halske Electric Company of America.

SOCIETIES AND SCHOOLS.

Preliminary plans for a group of buildings for the proposed Carnegie Technical School at Pittsburg, to cost $1,000,000 or more, have been prepared. They provide for six large buildings of brick, two and three stories high. They will be grouped about a central courtyard or hollow square.

The annual catalogue of the Massachusetts Institute of Technology of Boston for the year 1900-1901 has recently been issued. It is a book of 390 pages and, as usual, contains, besides general information, lists of officers, students and graduates, courses of instruction, requirements for admission and graduation, subjects and methods of instruction, etc. Accompanying the catalogue is the annual report of President Pritchett and the treasurer of the Institute.

The Universalist Club of New York city recently gave a banquet at the Hotel St. Denis. Among the addresses was one by a principal of the International Correspondence Schools, Scranton, Pa. The extensive interest felt by intelligent men generally, by students of economics and by educators in this remarkable educational institution was evidenced by the close attention of members of the club to an address lasting an hour. The speaker described the text-books used by the schools, the method of teaching by mail, and answered numerous questions regarding the schools.

The Franklin Institute of Philadelphia, on behalf of the National Export Exposition, has awarded to the International Correspondence Schools of Scranton, Pa., a diploma and silver medal for its exhibits at the recent exposition. The specific reason given in the diploma states that the diploma and medal were awarded for a "unique, thorough and comprehensive system of technical education by correspondence." John P. Birkenbine, president of the Franklin Institute, made a personal visit to the schools, and with other officers made investigations which led the Institute to make the award.

A school of electrical and mechanical engineering is to be established at Northwestern University, Evanston, Ill., at the beginning of the college year in September. According to the plans the work in the school will be equal to that of the courses during the first two years at the Massachusetts Institute of Technology in Boston. The work in this department will be commenced under the direction of Professor Crew, the head of the physics department at the institution. Already the services of Dr. Baskin, at present doing fellowship work at the university, and F. H. Starkweather, a mechanical engineer of Boston, have been secured.

MISCELLANEOUS.

The General Electric company has given $15,000 to the city of Schenectady, N. Y., with which to purchase a site for the $50,000 library donated by Mr. Andrew Carnegie to that city.

Alderman Dixon of the Chicago City Council secured the passage of an ordinance on Monday evening, May 13th, which will compel the owners of business buildings to equip their gas-pipes and electric wires with a cut-off, located in such manner that in case of fire the firemen can shut off the supply from the outside.

Judge E. Henry Lacombe of the United States Circuit Court for the Southern District of New York, has issued an order in the case of the General Electric company against the Lorain Steel company, enjoining the defendant from infringement of the second claim of letters patent No. 394,999, issued to E. W. Rice for a brush-holder attachment.

Some changes have been made recently in the mechanical and electrical plant of the Schiller building by Charles G. Armstrong, consulting engineer. The old plant, consisting of a small dynamo connected to a jack-shaft, which in turn was driven by a Corliss engine, was replaced by Erie City, four-valve engines, direct-connected to 150-kilowatt Western Electric generators. An expensive steam pump was replaced by an electrically driven pump, and an ejector sewer system was taken out and electrically driven bilge pumps installed. Mr. Armstrong has also been superintending some alterations and additions in the plant of the Union Restaurant, Chicago.

TRADE NEWS.

The Electric Motor and Generator Ventilating company has been incorporated at Wilmington, Del., with a capital stock of $100,000.

The Weston Electrical Instrument company has changed its Newark address from 214 William street, Newark, N. J., to Waverly Park, Essex County, N. J.

The Manhattan Electrical Supply company of New York and Chicago is pleased to advise its customers that its new catalogue has been received from the printers and that copies are being mailed daily from the New York office.

The Spies Electric company of Chicago announces that it is ready to supply the market with bug-proof bells. The company is distributing its price-lists, and will be pleased to enter into correspondence with and furnish information to anyone interested in bells.

The Allis-Chalmers company was incorporated at Trenton, N. J., on May 7th, with an authorized capital stock of $50,000,000, of which $25,000,000 is to be preferred, bearing a seven per cent. cumulative dividend. John F. Charlton, Henry S. Wardner and Stuart Lyman were the incorporators.

The International Specialty company has opened an office in Chicago, at 1005 Monadnock block. The company is preparing to accept orders for making any kind of wood work, metal work or specialties. It has a large and well-equipped factory for turning out electrical and mechanical specialties and supplies.

The Electric Storage Battery company of Philadelphia, manufacturer of the Chloride accumulator, has recently closed a contract with the Minneapolis General Electric company for the enlargement of its present storage battery, which was installed in October, 1899, and the removal of the same to a new location. The original installation consisted of 140 elements of type H-31 in H-39 lead-lined tanks, and had a capacity, at the normal rate of discharge, of 4,000 ampere-hours. By burning eight additional plates to the bus-bars of each element, this capacity is now brought to a normal discharge rate of 5,000 ampere-hours.

William M. Porter, formerly sales agent of the Lea Electric Manufacturing company of Elwood, Ind., manufacturer of direct and alternating-current arc lamps, has been made manager of the company, and the concern is making an energetic bid for trade. Its business is rapidly growing, and it has decided to change its location to a larger city. Since the reorganization of the company William H. Northall, the electrical and mechanical engineer of the company, has designed a lamp with a swinging cover and also an arc headlight and a miniature lamp. These lamps were shown at the Kansas City street-railway convention last fall, but have since been materially improved. The surprising achievement was the designing of a standard and miniature alternating-current lamp that could be used on either 60 or 120 cycles, and the placing of the necessary mechanism in the limited space of the swinging cover, and thus use this cover in all of the company's lamps. The company has an exhibit on the main aisle of the Electricity building at the Pan-American Exposition where some unique samples of its lamps will be shown.

The De Laval Steam Turbine company was incorporated in Trenton, N. J., on May 8th, with a capital stock of $1,000,000, to manufacture steam turbines, dynamos and other electrical apparatus. The company has exclusive control of the De Laval

patent for steam turbines and is now building a large plant in Trenton.

The Stanley Electric Manufacturing company of Pittsfield, Mass., has established a branch sales office at 26 South Fifteenth street, Philadelphia. James E. Cutler, late of the New York office, has been appointed district manager.

John E. Blake & Co. of New York city have recently purchased the factory owned by H. A. Peddycord and located at Rural Hall, N. C., and have placed their orders for the necessary machinery for the manufacture of bobbins, reels, etc. The firm will later add the manufacture of furniture of fine grade for the northern market.

The Bullock-Wagner sales organization has established a district office at 1624 Marquette building, Chicago. It will be in charge of George B. Foster, who has for about two years served the Wagner company as Chicago sales agent. He will have the able assistance of E. W. Goldschmidt, formerly of the Western Electric company, in covering this important field.

The firm of Ziegler & Dull, heretofore doing business in Chicago under the name of the Reynolds Electric company, has been dissolved, E. R. Dull having sold all his interest and good will in the firm to C. F. Ziegler. The Reynolds Electric company has been incorporated under the laws of the state of Illinois, and will continue the manufacture of the Reynolds flasher and other electrical appliances.

The increasing demand for Alberene stone for use in electrical lines, especially in high-tension work, has led to several interesting experiments by Professor George F. Sever of Columbia University, in order that the Alberene Stone company might present to the trade a careful analysis of the stone and prove its superiority over slate or marble. These experiments, conducted in February of this year, brought out some valuable results which are embodied in a detailed report by Professor Sever, the essential points being the density of the material, positive non-absorption, the ease with which it can be milled and drilled, and, lastly, the absence of cracks or fracture under the arc. These features are fully explained in the report by Professor Sever, a copy of which will be mailed to anyone addressing the Alberene Stone company, 393 Pearl street, New York city.

BUSINESS.

The Batesville Insulator Pin and Bracket Works of Batesville, Miss., state that they will begin manufacturing all styles of pins and brackets within a few days.

The Pittsburg Reduction company, Pittsburg, Pa., has ordered from F. R. Dravo & Co., Pittsburg representatives of the Ball Engine company, Erie, Pa., a 350-horsepower engine, arranged for direct-connection to a generator.

These are busy days for the shipping force of the Electric Appliance company, Chicago. While the demand seems to be for everything in the line of electrical goods, the Adams-Bagnall arc lamps are leading the company's other specialties in percentage of sales.

The W. C. Vosburgh Manufacturing company, 269-281 State street, Brooklyn, N. Y., is a designer and manufacturer of electric and gas fixtures. It manufactures from original designs and reproduces any styles after old models. The company is now installing the fixtures in the 18-story Atlantic building, New York city.

The Western Electric company, Chicago, is receiving an exceedingly heavy demand for fan motors this season. It is claimed the company's total sales thus far for 1901 have by far exceeded those of any previous year. The demand from foreign trade is especially heavy, unusually large orders coming from India, and, in fact, throughout the British possessions.

W. N. Matthews & Bros. of St. Louis say that their orders for the Stombaugh guy anchor, for which they are exclusive distributing agents, have been so far in excess of their expectations that they have run from a week to 10 days behind. Last week they had orders from New York and San Francisco, Minnesota and Florida, in addition to many of the other states in the Union. Some of the purposes for which these anchors are used, other than for securing electric poles, are for guying smokestacks, derricks, fences, tents and dredges. Considering its great utility and small cost, this anchor is said to be one of the best inventions that has been given to the public in years.

J. H. Bunnell & Co. of 20 Park place, New York city, announce that the annoying delays in filling orders caused by the recent fire in its Canal street works are about over. They have equipped a new factory, in a modern factory building, located at Nos. 5 to 15 Sullivan street. The firm has very largely increased space and facilities, and has put in the most approved machinery. These advantages, together with the employment of skilled mechanics, will enable them to execute orders expeditiously for their standard high-grade telegraph instruments and other electrical apparatus.

The Central Electric company of Chicago reports receiving some nice orders for electric fixtures (chandeliers, brackets and portables). This company can furnish anything desired in this line of material at attractive prices and is in a position to make prompt shipments. Before making shipments the Central company is very careful to see that the goods are exactly as the customer ordered, a precaution which will be readily appreciated by purchasers of electric fixtures. The company is distributing to the trade a price-list of I. X. L. weatherproof wire, double galvanized telephone wire, annunciator, office and magnet wires and lamp cord. It is also calling attention to its well-known Okonite wires and National telephone cables.

The De Dion-Bouton Motorette company, Brooklyn, N. Y., employs gas engines as a source of power in its various departments. A large twin-cylinder gas engine was installed when the factory was first equipped, over a year ago, and recently a smaller engine of 25 horsepower arrived. This machine will be fitted up at once, as the increasing business demands larger manufacturing facilities. The nickel-plating department has a little power plant of its own, consisting of a 3½-horsepower, water-jacketed De Dion motor, such as drives No. 1 type motorettes. The dynamo is driven at a speed of 1,600 revolutions per minute by a 3½-inch belt. The motor runs so steadily that no equalizing device is required, the fluctuations of the dynamo current being hardly perceptible. The whole nickel-plating outfit is very interesting, as it shows a thoroughly practical application of the successful De Dion motor.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 7, 1901.

673,376. Electrical Signaling System. Harry R. Bennett, San Francisco, Cal. Application filed August 9, 1900.

Alarms are provided at subscribers' stations. At the central station is a number of dissimilarly vibrating transmitters with a pole-changing switch at each transmitter for causing rapid successive alternations in the current and also a number of vibrating receivers at subscribers' stations arranged respectively in synchronism with the transmitters. Means are derived from the vibration of any receiver for sounding the alarm at that station.

673,381. Printing-telegraph Instrument. Louis M. Casella, London, England. Application filed August 10, 1900.

This invention consists of a vibrating armature and two electromagnets in a transmitted alternating current. An extension of the vibrating armature is connected as an insulated terminal in a relay circuit, and a divided contact is also connected as an insulated terminal in the relay circuit, situated on either side of the vibrating extension. The vibrating contact is ineffective to close the relay circuit and to energize the printing electromagnets therein, until the transmitted alternating current ceases, and the vibrating extension is at rest upon one part or the other of the divided contact.

673,386. Flash Lamp. Jules Courtier, Paris, France. Application filed December 8, 1899.

A revoluble insulating support has metal disks on its ends connected to the terminals of a suitable electric circuit, and means are provided for feeding fusible wires into contact with the metal disks.

673,391. Current Regulator. James P. Erie, New York, N. Y., assignor to the Erie Exploration company, New York, N. Y., and Dover, Del. Application filed January 4, 1901.

The device described comprises a movable series of segments with a flexible-band contact connected to one of the segments. Means are provided for bringing the band into engagement with or disengaging it from the segments, progressively.

673,392. Rheostatic Support. James P. Erie, New York, N. Y., assignor to the Erie Exploration company, New York, N. Y., and Dover, Del. Application filed September 13, 1900.

A body portion is provided with interlocking portions whereby a core is adapted to interlock with a similar core.

673,418. Apparatus for Use in Wireless Telegraphy. John Burry, Fort Lee, N. J. Application filed September 2, 1899.

This device involves a conductor, a number of imperfect electrical contacts and a commutator with means for electrically connecting the segments of the commutator and the contacts by pairs. A trailer is connected with the wire or conductor and coacts with the commutator and circuit completing connections from the contacts. The circuit includes a relay or sounder and a battery

673,428. Current Regulator. James P. Erie, New York, N. Y., assignor to the Erie Exploration company, New York, N. Y., and Dover, Del. Application filed September 17, 1900.

The regulator comprises a series of separately insulated segments. Means are provided for electrically including a longer or shorter segment in the circuit. There is a brush or contact for the segments, and also means for moving the brush and segments with relation to each other.

673,429. Long-distance Typewriter. Arthur J. Farmer, Detroit, Mich. Application filed June 4, 1900.

This typewriting telegraph embraces a type wheel having projections thereon at varying distances from their centers and means for imparting motion thereto. Key-bars and rods are provided, and there is a hammer to each wheel. Catches are shown, each engaging one of the type wheels and the operating mechanism of one of the hammers, while the armature of a magnet is secured to each catch, with a wire connecting each magnet with its rocking-pin bar. An electrical connection is made between the key-bar rod and the similar bar of the second machine, and means are provided for cutting the key-board of each machine out of circuit.

673,441. Trolley Base. Frank A. Merrick and Frank W. Garrett, Johnstown, Pa., assignors to the Lorain Steel company of Pennsylvania. Application filed August 16, 1900.

The pivotal bracket has longitudinally extending arms. A spring support is held by the arms and slides are mounted on the support with a spring between the slides. A pole socket piece is pivoted to the bracket and is forked to straddle the bracket and springs in both vertical and horizontal positions of the pole. There are link connections between the socket piece and the slides.

673,449. Telegraph Key. Frank J. Raab, Toledo, Ohio. Application filed June 14, 1900.

A casing is combined with a stem pivoted therein which has a beveled free end. An adjustable stud has a beveled end adjacent to the corresponding end of the stem. Wires are connected to the stud and stem respectively and a spring is adapted to hold the stem normally out of contact with the stud. Means are provided lying within and extending through the casing for forcing the stem and stud together.

673,452. Electrolytic Apparatus. Isaiah L. Roberts, Brooklyn, N. Y., assignor to the Roberts Chemical company of New Jersey. Application filed January 21, 1892.

The anode and cathode compartments are separated by a diaphragm or partition sufficiently non-porous to prevent filtration but permeable to electrolytic action. A mass of comminuted conductive substance fills one of the compartments, and means are provided for maintaining the flow through the compartment of the solution to be treated. Means are also provided for maintaining a pressure in the compariments.

673,453. Connector for Electrodes. Isaiah L. Roberts, Brooklyn, N. Y., assignor to the Roberts Chemical company of New Jersey. Application filed June 25, 1895.

This connector is composed of an outer plate to which the supply wire is attached. An inner plate is electrically connected with the outer plate, and a number of sections are provided, each composed of a mass of a granulated conducting material united by a cement.

673,474. Flash-light Apparatus. Samuel S. Pingree, St. Louis, Mo. Application filed December 10, 1900.

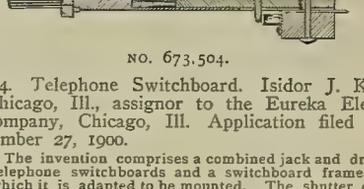
A support for the powder to be ignited is combined with electrical terminals arranged on opposite edges of the support, and a fuse in electrical connection with the terminals and traversing the support. When a circuit is established through the fuse, it will burst and the powder will be ignited directly therefrom.

673,476. Device Employing Electric Resistance. Conway Robinson, Elwood, Ind. Application filed March 15, 1900.

A device employing electric resistance is combined with a heat-conducting body having a cavity therein. There is a resisting body within the cavity, and insulated from the heat-conducting body are suitable electrical connections. Cushions composed of a refractory substance, which is a conductor of electricity but a poor conductor of heat, are interposed between the electrical connections and the resisting body, whereby injury from strains or expansion or contraction is prevented, good electrical contact is maintained, and the metallic connections are protected from excessive heat.

673,480. Apparatus for Signaling by Night. Leopold Sellner, Vienna, Austria-Hungary. Application filed April 3, 1897.

This apparatus comprises top and bottom sections with tie-rods connecting the same rigidly. An illuminating device or devices are supported from the tie-rods, and a shell composed of transparent and non-transparent sections and tie-rods connects the same rigidly. The shell encompasses the bottom section of the lantern and extends to its top section and is adapted to be moved bodily from the top section over and off the bottom section.



NO. 673,504.

673,504. Telephone Switchboard. Isidor J. Kusel, Chicago, Ill., assignor to the Eureka Electric company, Chicago, Ill. Application filed September 27, 1900.

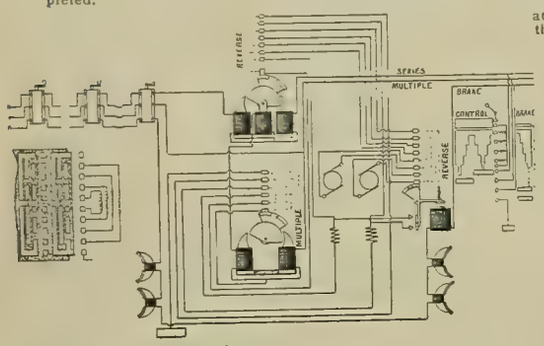
The invention comprises a combined jack and drop for telephone switchboards and a switchboard frame upon which it is adapted to be mounted. The shutter of the drop falls in a vertical plane, being pivoted below its center of gravity on an oscillatory shaft which extends along and parallel with the core of the magnet. The end of the shaft carries a detent finger which is normally engaged by a latch controlled by the magnet. The finger is also engaged by a restoring arm which co-operates with the plug on insertion to restore the drop shutter. Night-bell contacts are closed when the shutter falls. These contacts, together with the subscriber's line-wire contacts, are brought out to terminals, which, in securing the combined jack and drop to the switchboard frame, connect with registering contact springs thereon. (See cut.)

673,512. Microtelephonic Apparatus. Jacob Berliner, Hanover, Germany. Application filed December 4, 1900.

A connecting member between the receiver and the microphone is combined with a tapping switch comprising a spring blade fixed to the connecting member and connected to the line. A contact screw is placed opposite to the one end of the spring blade and is connected to the call-bell circuit, and a contact screw is placed opposite the other end of the spring blade and connected to the microphonic circuit

673,519. Multiple Telegraph. Samuel T. Foster, Jr., Laredo, Texas. Application filed March 14, 1899.

The component parts of this device are a source of electricity of progressively varying voltages; a single-wire main circuit in which the several electromagnets are connected; a source of electricity, with which the main wire has connections in varying voltages; an armature lever operated by each electromagnet; a local circuit for each armature lever adapted to be closed thereby and opened by the armature lever of that electromagnet just above it in voltage when the electromagnet is operated. Connections with contact points in the local circuits are such that each armature lever will form a part of one local circuit normally, and when drawn down by its electromagnet will open the local circuit and then form part of the next local circuit just above it in the series in such a manner that when several armature levers of adjacent electromagnets are attracted simultaneously each closes its own local circuit but opens the one just preceding it, so that only the local circuit closed by that armature lever of that electromagnet having the highest resistance of all the group will be completed.



NO. 673,531.

673,521. Manufacture of Solenoid or Other Electric Coils. John A. Heany, Philadelphia, Pa., assignor to the Teter-Heany Developing company, Philadelphia, Pa., and Charleston, W. Va. Application filed February 18, 1901.

A coil of bare wire is wound spirally upon a sheet or layer of asbestos or its equivalent under tension sufficient to embed the coils partially in the sheet or layer. A noncombustible, moisture-proof and insulating cement is adapted to embed completely the remaining bare portions of the wire and to enter the spaces between the coils to maintain in conjunction with the sheet or layer the proper spacing of the coils.

673,531. Electric-railway Controller. Edward M. Bentley, Lawrence, N. Y., assignor to the General Electric company, Schenectady, N. Y. Application filed June 17, 1899.

Two or more sets of motors are combined with two or more series multiple switches and a rheostat adjustable in capacity. There is a controller for the rheostat and also electromagnets for operating the switches and a circuit from the magnets to the controller by means of which the controller may operate the rheostat directly and the switches indirectly through the magnets. (See cut.)

673,538. Electric-railway Conduit. Frank Hewer, Chiswick, England. Application filed June 12, 1900.

This invention relates to an improved conduit for electric railways, which, however, involves no distinctively electrical mechanism.

673,553. Apparatus for Use in Wireless Telegraphy. John Burry, Fort Lee, N. J. Application filed September 9, 1899.

A conductor associated with a number of imperfect electrical contacts has means for progressively connecting and disconnecting less than the whole number of the contacts with and from the conductor. These contacts control circuit-completing connections, and there are electromagnetically controlled means for restoring each contact to normal condition while it is not in circuit with the conductor.

673,563. Safety Catch for Incandescent Electric Lamps. George B. Millen, San Francisco, Cal. Application filed July 14, 1900.

An incandescent electric lamp has an externally threaded foot arranged to screw into an internally threaded socket-piece. A safety catch consisting of a barb cut out of the thread of the lamp foot is adapted as it is screwed in to project into an opening of the socket-piece so that the lamp cannot be unscrewed without first pressing back the barb.

673,564. Rheotrope. William Morrison, Chicago, Ill., assignor to the Helios-Upton company, Chicago, Ill. Application filed June 18, 1900.

Contact segments mounted upon an insulating shaft have cylindrical outer ends and semi-cylindrical overlapped inner ends. There are projecting insulating strips between the edges of the overlapped portions, and brushes bear upon the outer cylindrical portions, and other brushes bear upon the overlapped central portions at opposite sides. (See cut.)

673,565. Electric Controller. William Morrison, Chicago, Ill., assignor to the Helios-Upton company, Chicago, Ill. Application filed June 18, 1900.

A fixed contact board which has two or more longitudinally separated series of insulated contacts is combined with a carriage comprising a rigid frame having a pair of laterally separated parallel side plates or ways, each engaging, and supported by, a number of guide rollers, whereby the carriage is guided to move parallel with the face of the contact board. Commuting brushes are mounted upon the carriage to slide over the contact board when the carriage is reciprocated. A cam plate is carried by the carriage and a yielding lever engages the cam plate. There is a fixed contact for the free end of the lever and also electrical connections for the several contacts and brushes. The cam plate is shaped and operated upon the lever to open the circuit at the lever contact only while the brush contacts are in electrical contact.

673,567. Electric Transformer. Louis M. Pignolet, Orange, N. J. Application filed September 10, 1898.

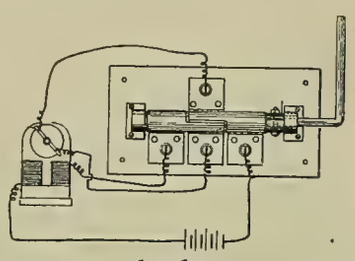
This patent covers the combination of electrically separated sets of transformer coils, concentric rows of contacts and a rotary switch for connecting the rows of contacts in a predetermined order. Conductors connect one row of contacts to the terminals of groups of coils of the one set of coils, and other conductors connect the other row of contacts to different coils of the other set of coils.

673,591. Coin-calculating Device. George A. Aldrich, San Francisco, Cal. Application filed November 14, 1900.

This invention consists of a series of coin slots or apertures, a coin receptacle for coins in gravitating tiers, and electromagnetic armatures at the bottom for sustaining the coins. Electromagnetic circuits are provided for operating the armatures, and electric contacts are arranged at the sides of the coin slots in these electric circuits, whereby the insertion of a coin completes the circuit, energizes an armature and releases a coin from the bottom of a tier.

673,628. Electromagnet and Annunciator. Charles E. Scribner, Chicago, and Frank R. McBerty, Downer's Grove, Ill., assignors to the Western Electric company, Chicago, Ill. Application filed April 6, 1893.

The core of an electromagnet has a movable armature at each end. An indicator is adapted to be displayed by the simultaneous movement of both armatures, but to be

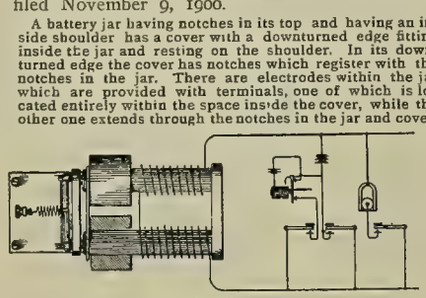


NO. 673,564.

replaced in its normal position by the action of a particular one. A tube of conducting material encircles the core of the electromagnet near the armature, which acts to replace the indicator. In this way the indicator is displayed when alternating currents find circuit through the device, but is replaced when a continuous current is sent through it. (See cut.)

673,652. Storage-battery Cell. Jacob C. Chamberlain, New York, and Henry R. Sutphen, Highbridge, N. Y. Original application filed September 11, 1899. Divided and this application filed November 9, 1900.

A battery jar having notches in its top and having an inside shoulder has a cover with a downturned edge fitting inside the jar and resting on the shoulder. In its downturned edge the cover has notches which register with the notches in the jar. There are electrodes within the jar which are provided with terminals, one of which is located entirely within the space inside the cover, while the other one extends through the notches in the jar and cover.



NO. 673,628.

673,656. Bushing for Electrical Outlet Boxes. Hubert Krantz, Brooklyn, N. Y. Application filed February 9, 1901.

This device has near one end an external annular groove and at the opposite end an internal thread extending only part way through the bushing.

673,678. Storage Battery. Jacob C. Chamberlain, New York, and Henry R. Sutphen, Highbridge, N. Y. Application filed September 11, 1899.

A plurality of cells are placed on a frame and electrically connected by terminals extending from cell to cell. Elastic washers surround the terminals between the cells and engage with the adjacent cells. There are insulating supports for the corners of the cells, and insulating supports are placed between the cells and the supporting frame.

673,694. Machinery for Covering Electrical or Other Wires for Insulating Purposes. Walter W. Colley, London, England. Application filed June 4, 1900.

A revolving frame is combined with means for simultaneously revolving the frame and passing the wire longitudinally through it. There are a number of spools carrying covering material and stud shafts in the frame upon which the spools are mounted. Means are provided for varying the resistance to the rotation of the spools upon the shafts, also adjustable guides, one located in front of each of the spools and independent of the spools. The covering passes off the spools in a direction parallel to that in which the wire passes through the machine and has its direction changed once by the guides before it reaches the wire.

673,710. Terminal and Binding-screw for Electric Batteries and Connections. William R. Edwards, Weybridge, England. Application filed November 2, 1900.

The pin is screw threaded at both ends. A pair of interiorly screw-threaded closed nuts or caps have conically recessed inner faces, and a pair of pliable washers of conducting material is interposed between the closed nuts or caps.

673,713. Spark-discharging Device for Electric Lighting for Gas Burners. Paul Hoffmann, Charlottenburg, Germany. Application filed March 24, 1900.

A metal piece or stick is connected with the current-conducting line and projects with its upper portion across the edge of the burner head. A hook is provided, by means of which the device may be hooked under the burner gallery.

673,731. Electric Motor Controller. Oscar F. Shepard, Jr., Madeira, Ohio, assignor to the Warner Elevator Manufacturing company, Cincinnati, Ohio. Application filed October 3, 1900.

This controller comprises three sets of partial circuits, connected, respectively, with different motor windings. Means, included in the partial circuits of one set and in shunt with the partial circuits of the other set, are provided for varying the flow of current through two of the windings. The other set of partial circuits is in shunt with its windings and circuit-closing devices for the partial circuits. The circuit-closing devices for one set of partial circuits are arranged to control the circuit-closing devices for the other two sets of partial circuits.

673,754. Process of Electrolytic Decomposition. George Bell and George W. Bell, Liverpool, England. Application filed June 7, 1898.

This process consists in passing an electric current through an electrolyte of an aqueous solution of salts of alkaline metals to a body of liquid metal beneath it in the decomposing chamber, next expelling the body of the liquid metal from the decomposing chamber into an oxidizing chamber, and finally returning the body of liquid metal freed from alkali metal back to the decomposing chamber by an artificial fluid pressure acting on the surface of the liquid metal.

673,766. Overhead Trolley. Henry C. Eno, Pittsfield, Mass., assignor of one-fourth to George H. Russell, Pittsfield, Mass. Application filed July 7, 1900.

The bifurcated harp casting having the bifurcations thereof formed on their inner sides with dovetailed grooves are combined with dovetailed plates positioned in the grooves.

673,792. Storage Battery. David W. Beebout, Pittsburg, Pa. Application filed February 19, 1900.

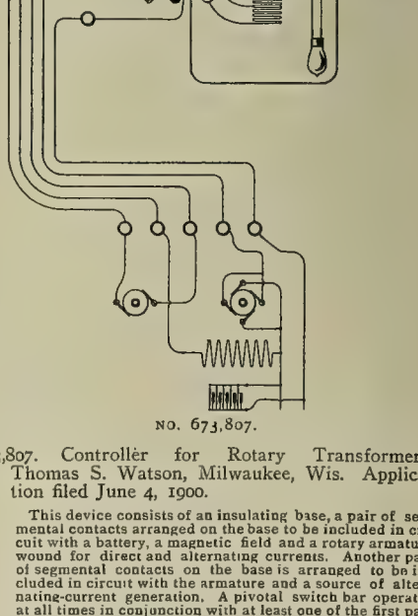
An enclosing case of insulating material is provided with receiving grooves in the sides and bottom. A series of imperforate individual corrugated plates are provided with oppositely disposed V-shaped retaining gutters, and a reinforcing integral frame is set in the grooves. The plates are insulated from each other and have their opposite surfaces covered with positive and negative active matter, respectively. End plates have their inner faces only covered with active material, and are provided with terminal projections extending outside of the case and which have terminal attaching devices. There is an intervening electrolyte between the plates and also cover plates for the case.

673,794. Electric Signal and Telephone System. Charles L. Fortier, Milwaukee, Wis., assignor of one-half to Alfred Weller, Milwaukee, Wis. Application filed June 12, 1899.

Combined with an electric circuit are a source of electricity, signal-receiving apparatus and a telephone at a central station. There is a switch for connecting the circuit either with the source of electricity or with the telephone at the central station. Signal-transmitting devices, each of which is adapted to indicate at the central station the source of the signal and telephones, are arranged in series in the circuit. Means are adapted, when the circuit is deprived of current, to lock all the signal-transmitting devices and to prevent the operation of the associated telephones except that from which a signal is sent in.

673,796. Telephone-service Apparatus. Uriah S. Jackson, Ossipee, N. H. Application filed November 22, 1900.

A bent lever is adapted to operate the "push-button" of the telephone; hooks hang from the bent lever and from the receiver lever, these hooks being adapted to be operated by the hand that takes the receiver from its lever. A stop pin is attached to the receiver by a cord adapted to allow the stop pin to engage with the contact-pin dial, only when the receiver is taken off from its lever.



NO. 673,807.

673,807. Controller for Rotary Transformers. Thomas S. Watson, Milwaukee, Wis. Application filed June 4, 1900.

This device consists of an insulating base, a pair of segmental contacts arranged on the base to be included in circuit with a battery, a magnetic field and a rotary armature wound for direct and alternating currents. Another pair of segmental contacts on the base is arranged to be included in circuit with the armature and a source of alternating-current generation. A pivotal switch bar operates at all times in conjunction with at least one of the first pair of contacts and is provided with brushes insulated from itself but electrically connected with each other and arranged to work on the second pair of contacts, provision being had for touch of the switch bar on both of the aforesaid first pair of contacts in one position of its adjustment. An armature resistance is electrically connected to one of the first pair of contacts, and a field resistance is likewise connected to the other of this first pair of contacts. Armature-resistance contacts on the insulating base at intervals of an arc are traversed by the switch bar previous to its touch on one of the first pair of segmental contacts. There are also field-resistance contacts on the base at intervals of another arc traversed by the switch bar after leaving the other of the first pair of segmental contacts. The arc of the armature-resistance contacts is less, by one division, than the working face of the segmental contact with which the field resistance is electrically connected. (See cut.)

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Lighting System for Illinois Central Suburban Service.

As an example of the remarkable advances that have been made in the last few years in the electric-lighting industry may be cited the alternating-current lighting system recently installed by the Illinois Central Railroad company, for its Central and suburban stations in Chicago.

A little over seven years ago, the Western Electrician described the new electrical plant, installed shortly before in the main depot building of the Illinois Central railroad at Park Row and Twelfth street. This plant, which was put in for the purpose of supplying light throughout the station building, was at that time a good example of a modern electrical generating equipment. Its steam end consisted of three steel tubular boilers, five by 18 feet in size, equipped with Eddy furnaces; eight steam pumps for elevator, boiler-feed and other purposes, and two Hamilton-Corliss, 250-horsepower engines. These engines were belted to either end of a 60-foot line shaft, from which were driven two 100-kilowatt and one 50-kilowatt, direct-current generators. These dynamos were of the Brush incandescent type and were wound for 125 volts. The switchboard, which was also of the Brush type, was made of black enameled slate and controlled 10 lighting circuits.

The interesting feature about this plant was the remarkably small space into which the boiler and engine-room equipment was crowded. A room in the basement was utilized, which was about 50 feet wide and 70 feet long. This plant, which has been in continuous operation since its installation seven years ago, is now to be replaced by a sub-station equipment, occupying but about five per cent. of the old space, and receiving its power from a main generating station, nearly two miles south. Reasons leading to the abandonment of the old station equipment were the cramped space in the engine and boiler rooms and the facts that the space was needed for other purposes and that the coal for the boilers being unloaded under the station caused considerable dirt to accumulate in the building above.

Accordingly plans were made for erecting a central generating station which should not only supply the current for lighting and power needed at the Twelfth street station, but also, ultimately, furnish an electric-lighting system for all the stations on the route of the suburban train service which the company maintains along the shore of Lake Michigan, south from the center of the city.

The site selected for this central station was at Twenty-seventh street, on the lake shore, where the railroad company maintains a roundhouse and machine shops for its suburban trains. A new building was erected for the power plant. A contract was made with the General Electric company for the electrical generating and switchboard equipment. The generators consist of two 300-kilowatt and one 100-kilowatt alternators, delivering a three-phase current at 6,600 volts. These dynamos are of the compensating type, with revolving fields, and are equipped with compensating exciters, mounted on the generator frames.

A general view of the engine room, showing the three generating units, is given in Fig. 1, on this page. A detailed view of one of the larger generators and its exciter is shown in Fig. 2, on page 350. Each generator is directly driven by a four-ported, tandem-compound, Ideal engine of the railway type, manufactured by A. L. Ide & Sons of Springfield, Ill. The larger engines have cylinders 19 and 34 inches in diameter, with an 18-inch stroke, and are rated at 475 horsepower on 95 pounds' steam pressure, with 200 revolutions a minute. The smaller engine has cylinders 12 and 21 inches in diameter, with a 15-inch stroke, and is rated at 175 horsepower, with 257 revolutions a minute. The engines are run condensing, the necessary condensing water being drawn from the lake, only a few feet distant. Baragwanath syphon condensers are used and the station is equipped with a feed-water heater of the same manufacture. The boilers are five in number and are of the horizontal tubular type, 72 inches by 18 feet in size. They are equipped with coal-dust burners of a new design recently developed by the railroad company for burning finely ground coal.

The main switchboard in the engine room, shown in Fig. 3, is made of blue Vermont marble and consists of three generator panels, one load panel and one feeder panel. For each machine there are provided a horizontal edgewise voltmeter, an ammeter of the same pattern, potential and current transformers for these instruments, a synchronizing device, an equalizing switch, an exciter switch, an oil main switch and an expulsion fuse box. On the load, or main feeder panel, are mounted a polyphase induction wattmeter for the total output, six horizontal edgewise ammeters, provided with current transformers, and a Mershon compensator, together with a voltmeter, to measure the voltage at the further ends of the line. A static, three-phase ground detector, to indicate continuously a ground on any phase, is mounted on a swinging frame at the left edge of the board. A feeder panel at the right end of the board provides for the station circuit. All the instruments and switches are of a black gun-metal finish, giving to the switchboard a pleasing and striking appearance. The voltage of the generators is 6,600 volts, but this is reduced by means of current and potential transformers, so that no high voltages are presented on the front of the board, only the levers of the generator oil switches being mounted on the face of the panels. Fig. 4 gives a view of the back of the switchboard, showing the instrument transformers, regulating transformers, oil switches, etc.

Leaving the station, one three-phase circuit is run north underground between the tracks, in lead cable, to the extreme northern end of the company's right-of-way at South Water street. The cable is 16,270 feet long and it supplies all the stations and the railroad company's buildings on the way. The cable leaves the station as No. 6 wire and ends as No. 10, the voltage being that of the generators, or 6,600 volts. The cable is laid in stone conduit, manufactured by the American Stone Conduit company of Chicago. At each of the small stations a single transformer is connected on one phase of the circuit, while at the points of heavier load, Twelfth street, Van Buren and the terminus, three trans-

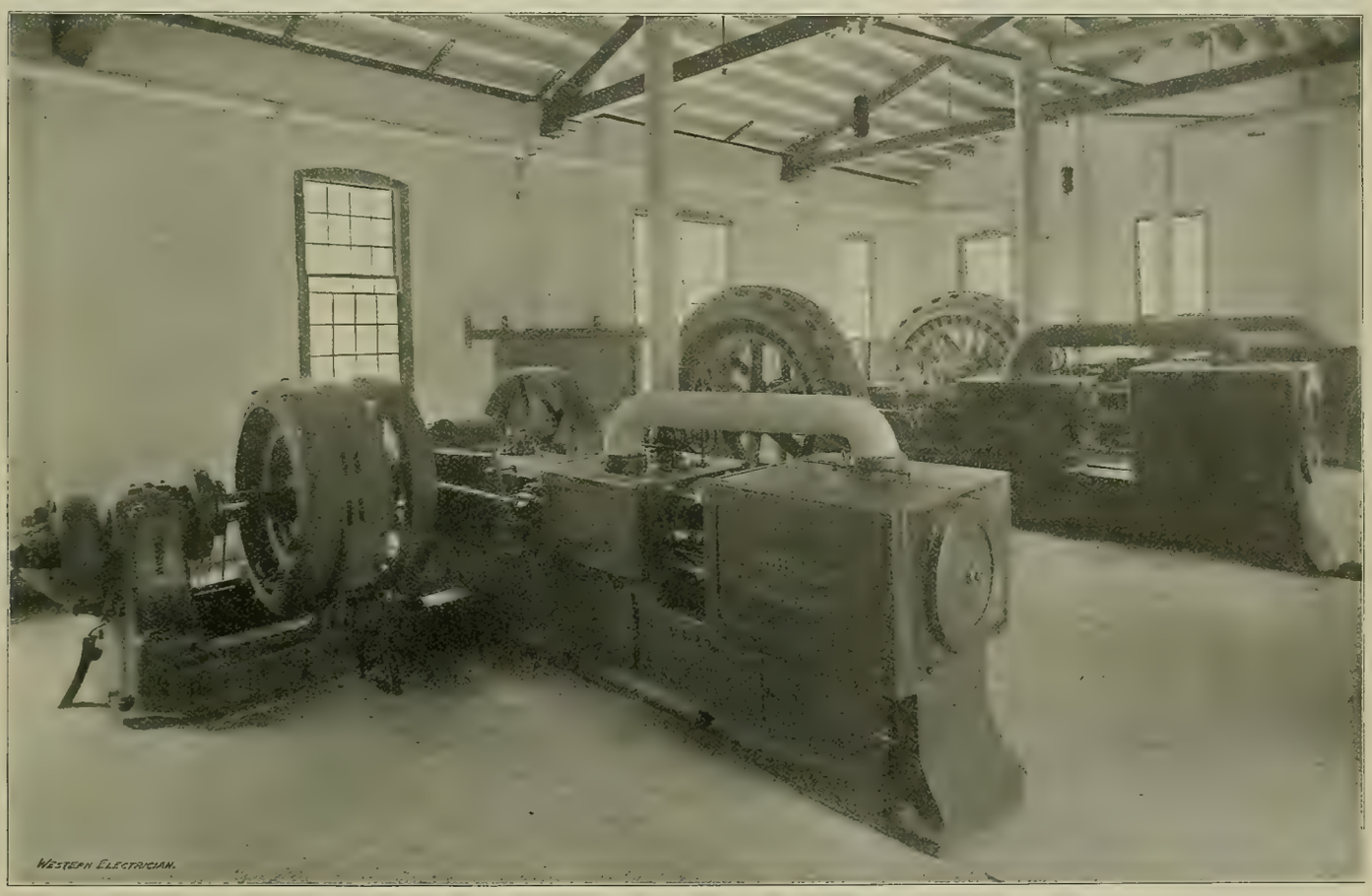

FIG. 1. LIGHTING SYSTEM FOR ILLINOIS CENTRAL SUBURBAN SERVICE.—GENERATING PLANT.

formers are connected across the whole circuit. At South Water street there are three 15-kilowatt transformers for supplying the company's own terminal buildings and the Wisconsin Central freight house and adjacent buildings. Possibly, later, some power will be taken off at this point for elevators, etc.

At the Randolph street station, where the suburban trains start, is a five-kilowatt transformer, at Van Buren street three of six kilowatts, and at the main power house there are three of 7½ kilowatts. These latter transformers furnish light for the suburban shops, roundhouse, etc., and eventually will supply power for operating the machinery in the shops and the coal pockets. The secondary voltage of the transformers is 115 volts, and they are connected into the circuits by "delta" connections.

The sub-station equipment at the Twelfth street station comprises a two-panel switchboard, shown in Fig. 5, and three 60-kilowatt transformers. These transformers are connected on the four-wire "Y"

FIG. 2. LIGHTING SYSTEM FOR ILLINOIS CENTRAL SUBURBAN SERVICE.—300-KILOWATT COMPENSATING ALTERNATOR.

system, the primary voltage being 115 volts. They are to be placed in a vault in the basement, occupying a portion of the present engine room. The switchboard is located in a small room above, and, together with the transformers, occupies about five per cent. of the space given up to the old engine and boiler plant. The board, which is made of blue Vermont marble, supplies eight two-wire feeder circuits. At present the wired capacity consists of 5,000 16-candlepower incandescent lamps and about 100 arc lamps. From this switchboard is driven a five-kilowatt motor-generator set for the telegraph department, a 10-horsepower induction motor in the company's laundry, and current is also used to charge the storage batteries of private railroad cars.

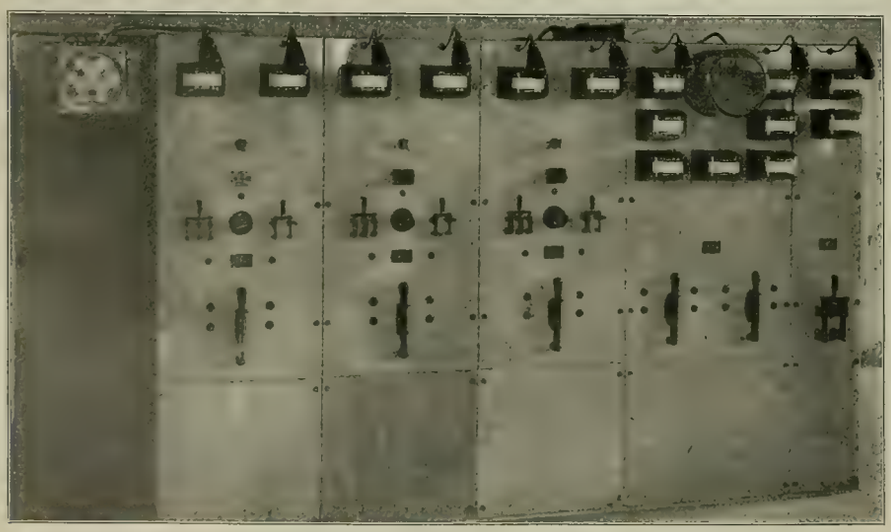

FIG. 3. LIGHTING SYSTEM FOR ILLINOIS CENTRAL SUBURBAN SERVICE.—MAIN SWITCHBOARD.

There are three hydraulic elevators, running the nine stories of the depot building, and it is probable that the elevator pumps will in the near future be electrically driven. When the present boiler plant at the depot is removed, steam for heating the building, for the elevators, etc., will be taken from a boiler plant at Fourteenth street, about 1,500 feet away. This steam plant is used for heating cars. The pipe line consists of two six-inch main pipes and a three-inch return.

Running south from the power plant at Twenty-seventh street a pole line is carried along the tracks to Dauphin Park, 43,200 feet distant. This circuit is also of No. 6 wire and it supplies all the suburban stations en route with both incandescent lights for the interior of the buildings and arc lamps for the station platforms. The cables are large enough to distribute the entire output of the generators, and eventually the lighting circuit will be extended south on the main branch to the terminus of the suburban service at Flossmoor, 27 miles south, and on the branch lines to South Chicago and Blue Island. In Fig. 6 is given a map of the suburban system of the Illinois Central, with the stations, the power house, and the present and ultimate southern ends of the lighting circuits marked thereon. The generators now are operating on about 50 per cent. of their normal load.

The transformers at the suburban stations vary in capacity from one to 20 kilowatts, one of the last-named size being located at the American Express company's building at Fourteenth street. These transformers average in size about four kilowatts and are arranged on the three phases of the circuit so as to balance the load. The power plant at present supplies the 5,000 incandescents and 100 arcs at the Twelfth street station, and about 100 arcs and 2,000 incandescents along the line. The incandescents are of the Bryan-Marsh manufacture and the arcs were made by the Manhattan General Construction company of New York city. The transformers were supplied by the Electric Appliance company of Chicago and the cable is of the Simplex manufacture. Kohler Bros. of Chicago were the general contractors for the plant, while Charles G. Armstrong, consulting electrical engineer for the Illinois Central Railroad company, has designed and installed the system. Mr. Armstrong was also the consulting engineer in charge of the original Twelfth street installation.

Albany Street-railway Strike Ended.

The street-railway employes' strike, which completely tied up the United Traction company's lines at Albany, Troy, Cohoes, Rensselaer and Watervliet, N. Y., from May 7th to May 18th, is at an end and the entire system has resumed operations. There have been concessions on both sides and an agreement was reached at a conference held between representatives of the corporation and the operatives under which it should be possible to avoid strikes in the future. On its part, the company agrees to receive representations regarding grievances from any committee of its employes, representing organized or unorganized labor; that men suspended or discharged by the superintendents shall be entitled to appeal to the executive committee of the company; that in case employes can disprove charges under which they were suspended or discharged, they shall be entitled to pay for the time they were idle during such suspension or discharge, and that there will be no discrimination against any of the men who engaged in the strike, except those guilty of unlawful or riotous acts. The company reserves the right to employ union or non-union men and to discharge employes for cause. Wages of all motormen, conductors, linemen and pitmen is to be 20 cents an hour, and of pitmen helpers, 17½ cents an hour.

The Cincinnati and Columbus (Ohio) Traction company has been granted the right-of-way from Greenfield, through Leesburg, Lexington and Samantha, to the northern corporation line of Hillsboro. Work will begin in one year.

Electric Railways in Western Michigan.

One of the most recent electric railways projected for Western Michigan is to be built from Muskegon along the lake shore to Pentwater and Ludington. The road, which will be built by the Muskegon and Oceana Rapid Transit company, will pass through North Muskegon, Whitehall, Montague, Shelby, Hart and Pentwater, between Muskegon and Ludington, making a length of about 70 miles. Franchises have already been secured for a considerable portion of the distance. This railway will connect a number of summer resorts and will also afford

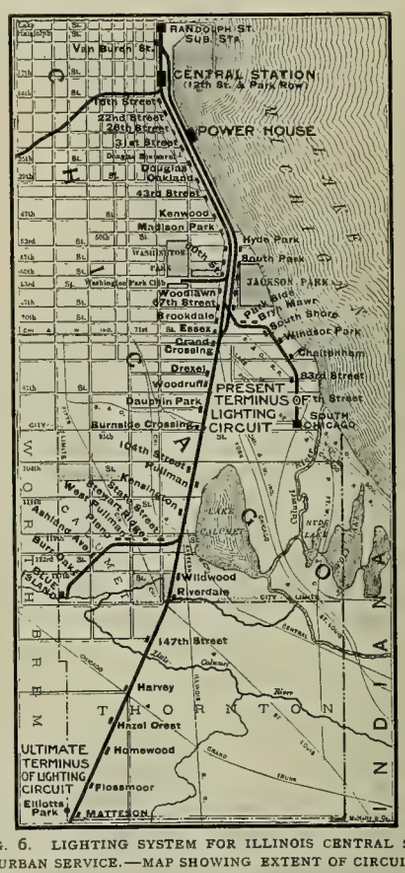

FIG. 6. LIGHTING SYSTEM FOR ILLINOIS CENTRAL SUBURBAN SERVICE.—MAP SHOWING EXTENT OF CIRCUIT.

a ready outlet to the Chicago steamers at Muskegon for the large peach orchards that will be tapped en route.

A group of officers and engineers of the Grand Rapids, Grand Haven and Muskegon Electric Railway company drove over the western end of the company's right-of-way last week, in order to inspect the progress of the work. The greater portion of the route has been graded. The car shops and power station of the interurban railway will be located at Fruitport, in Muskegon County. There will be two large buildings. The main shop will be 170 by 130 feet in size, and a portion of the structure will be two stories high. The power house will be 100 by 75 feet and of substantial construction. It will have brick walls, cement floors, iron trusswork and slate roof. The machinery will be of Westinghouse manufacture and the plant will cost about $250,000.

A new railway is projected from Battle Creek to Grand Rapids, and thence to Muskegon. More than half the right-of-way between Grand Rapids and Muskegon for this extension has already been secured. The road will pass through North Grand Rapids to Millcreek, and run to Muskegon, via Lisbon, Gooding, Sparta, Casnovia, Moorland and Egelston. A spur will be built to Ravenna, which may later be extended to Coopersville and Allegan.

The latest electric line talked of in this vicinity is one running from Grand Rapids to Newaygo, via Sparta. Preliminary surveys have already been made, and rights-of-way are now being secured. James Townsend of New York is said to be managing the financial end of the deal. Cheap water-power will be developed at Croton, on the Muskegon River, for supplying motive power.

The Muskegon Traction and Lighting company of Muskegon has begun work on a two-mile extension in a southern direction to Mona Lake Park. It is expected the extension will be completed in about three weeks.

The Snohomish Electric company of Snohomish, Wash., is rebuilding and enlarging its present plant and changing to the alternating-current system. It has just secured a contract for five years from the city to light the streets and pump the city water, and the electric plant is being rebuilt at the city pumping station. A Stanley alternator and Stanley transformers and a McEwen engine are being installed. About 30 arcs and 1,500 incandescents will be the capacity of the plant. E. S. Aldrich is manager of the company.

Rate of Discharge of Batteries in Electric-vehicle Work.

By Thomas J. Fay, E. E.

Storage batteries are variable in point of output, depending upon the rate of discharge. To illustrate the point, it is enough to say that the output of a battery if discharged in one hour will be 50 per cent. of the output if the same battery is discharged in 10 hours, but the charge will be that which will produce the 10-hour discharge, allowing for loss in conversion besides.

The essence of all that can be said about storage-battery rates of discharge and the resulting efficiency is contained in the foregoing statement, but vehicle builders have lost sight of the question since they found that batteries can be discharged at high rates and still leave a battery with which to continue the performance. It is true that at the high speeds established for vehicles, the high rate is unavoidable, because the vehicle requires a large expenditure of energy, and the weight of battery prevents adding more battery, with a view to reducing the rate of discharge.

The only way to consider this question fairly is to go back to first principles, which, to do, requires that we compare electric vehicles with horse-drawn vehicles. It is a fact that the diameter of travel of horse-drawn vehicles is about 18 miles a day, the average speed being about three miles an hour, reference being had to vehicles in commerce, such as delivery wagons. This limitation on this class of vehicles is absolute, so that, if electric vehicles draw equal loads at equal speeds, they may be equally as effective. If, however, electric vehicles draw equal loads at twice the speed, they will be twice as effective, and were vehicle makers to establish a six-mile rate of speed, it would be one-half the speed now in general practice, and it is now fairly well established that, when an electric vehicle makes two trips to one of the horse-drawn vehicle, it is profitable to employ the electric vehicle in place of the other.

An electric delivery wagon, requiring an expenditure of 30 amperes of current to attain a speed of 12 miles an hour on a level, hard road, will easily run on the same road at six miles an hour on an expenditure of 18 amperes of current, and in such case the time of discharge of the battery will increase; therefore,

$$18 : 30 :: 3 : x = 5 \text{ hours.}$$

The gain by so doing is more than the gain in battery efficiency, because the life of the battery will be materially increased, the cost of charging current will be reduced, and the depreciation of the vehicle will be cut down a large amount. It is true that the users of vehicles will not like the change, because they think the higher speed productive of more result; but they are mistaken; the gain they see is a mere bagatelle compared with the loss they fail to see. Moreover, the present success of electric vehicles is but meager, and it may be that electric-vehicle makers are trying to do more than can be done on a basis that will be reassuring if we consider depreciation, which at present is so large that there is no considering it at all.

There is now an increasing number of advocates of a lower speed, which, as before stated, means a lower depreciation factor.

Large trucks for transporting heavy machinery are not being constructed to operate at a high speed; in fact, the writer examined one truck for heavy work, geared to run at about four miles an hour, and it is believed that that truck will be a success.

From what has been said, it is not the battery alone that cries for a more sensible rating, but the battery would surely be a great success if, in the course of events, the rate of discharge were reduced to that which would discharge the battery in five hours, instead of the present three-hour basis.

The following table shows just about the difference, as between the two rates, and a perusal of the table will be convincing, it is believed:

Table Showing Battery Performance in Electrical Vehicles.

Three-hour Basis.					Five-hour Basis.				
Three-hour Output, Amperes.	Full Charge, Amperes.	Ampere-hour Efficiency, Per Cent.	Mileage Factor.	Three-hour Rate.	Five-hour Output, Amperes.	Full Charge, Amperes.	Ampere-hour Efficiency, Per Cent.	Mileage Factor.	Five-hour Rate.
63	105	60	36	21	73	105	70	42	14.6
90	150	60	36	30	105	150	70	42	21
117	195	60	36	39	136	195	70	42	27.2
137	227	60	36	45.6	160	227	70	42	32
166	276	60	36	55.3	193	276	70	42	38.6
185	309	60	36	65	215	309	70	42	43
216	360	60	36	72	250	360	70	42	50

The ampere-hour efficiency is based on 80 per cent. efficiency, on a basis of the full discharge in 10 hours, and a loss of 13 per cent. of that result on a five-hour basis, or 25 per cent. on a three-hour basis. The exact loss will vary a little, as between makes of batteries, but not enough to be a factor in practice, from the point of view here in evidence. There are many who assume that the ampere-hour efficiency is from 80 to 90 per cent., without considering the rate of discharge. That their assumption is non sequitur, may be illustrated by the following proposition:

Take the battery giving 63 ampere-hours at a three-hour rate, or $\frac{63}{3}$ = 21-ampere rate. If the efficiency may be considered as 80 per cent., then the charge would only need to be equal to $\frac{63}{80}$ = 78.7 ampere-hours; but we know that this battery, when fully charged, will give outputs as follows:

Three-hour rate = 63 ampere-hours.

Five-hour rate = 73 ampere-hours.

Eight-hour rate = 80.64 ampere-hours.

So that it requires but a glance to show that the efficiency at a three-hour rate cannot be 80 per cent., because the full charge would then only be, as before stated, 78.7 ampere-hours, whereas with a full charge the battery will give 80.64 ampere-hours' output simply by reducing the rate of discharge, so that the battery will be discharged in eight hours, or $\frac{80.64}{8}$ = 10.08 ampere rate. It is obviously impossible to realize 80.64 ampere-hours from a battery into which 78.7 ampere-hours is put. It is true that electrochemically formed batteries, in which the active material is in a thin layer over a great area, are most efficient and withstand heavy discharges without the marked drop in efficiency that is in evidence in other types of batteries, but even they will show no such results at high rates of discharge as would seem to be the climax of popular imagination.

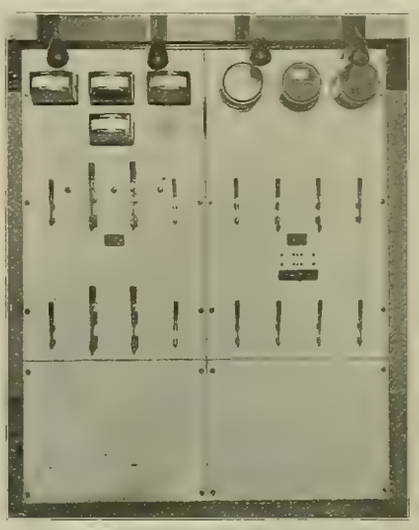

FIG. 5. LIGHTING SYSTEM FOR ILLINOIS CENTRAL SUBURBAN SERVICE.—SUB-STATION SWITCHBOARD AT TWELFTH STREET.

The mileage factors given in the table are based on the assumption that the batteries will be used in vehicles requiring one-third of their output as a rate, or one-fifth of their output as a rate, taking the respective cases. The three-hour batteries are to go into vehicles making 12 miles an hour and the five-hour batteries going into vehicles making six miles an hour. While the six-mile vehicle only travels at one-half the speed of the other, yet, even so, it travels farther, because the battery gives a greater output, even allowing that the six-mile speed does not cut the current rate of consumption in two, and the reason it does not, in many cases, is that the fixed losses in motor windings, hysteresis of armature core, Faucault currents, friction of bearings and brushes and the C^2R losses overshadow the decrease in power theoretically necessary to maintain a velocity of six miles an hour, instead of 12 miles an hour.

It is also a fact that the energy dissipated in the brake usual to a 12-mile rate of speed will be far less in the case of the six-mile rate, and there are other considerations. For illustration, the higher speed is not practicable in a congested street; thus the vehicle must be operated for a large part of the time under conditions not at all economical, since the controller combinations must be taken into account, and besides, a high-speed vehicle, in the hands of a low-speed driver, is about as safe as a treed wildcat.

The law limiting the speed of vehicles to eight miles an hour, while of the deplorable class-legislation character, and stupid enough in its framing, will tend to produce the results herein cited. The same law will also give vehicle builders an excuse for reducing speed, but if the matter is left to purchasers or vehicle salesmen, the present 12-mile standard will be stretched to the limit of elasticity.

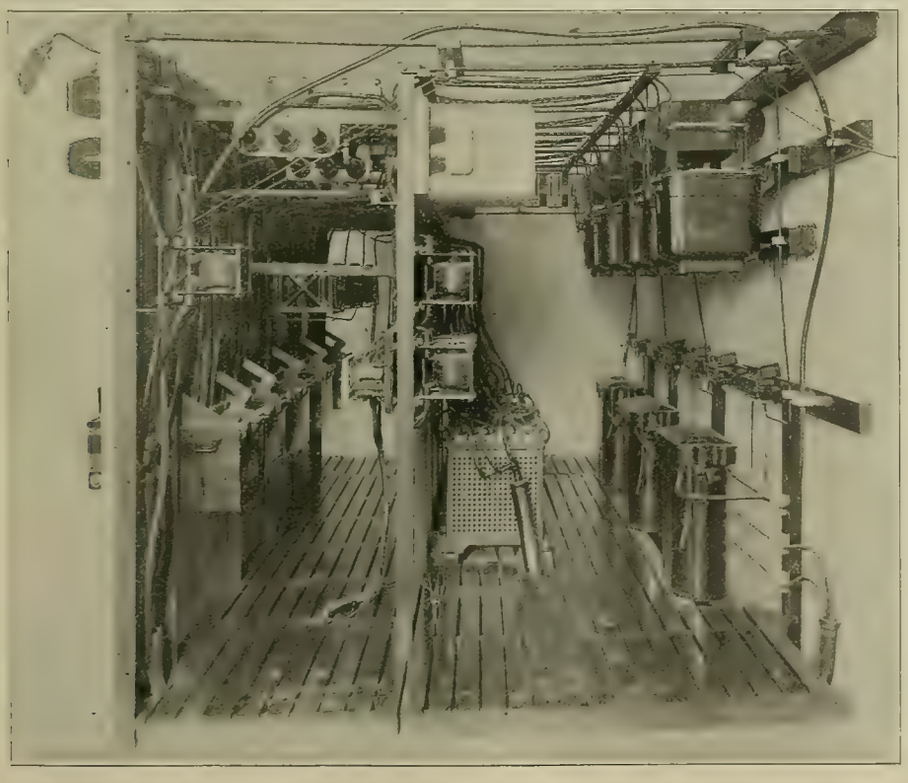

FIG. 4. LIGHTING SYSTEM FOR ILLINOIS CENTRAL SUBURBAN SERVICE.—REAR OF MAIN SWITCHBOARD.

New Street-railway Commission for Chicago.

At the meeting of the Chicago City Council on Monday evening, May 20th, Mayor Harrison named a committee on local transportation, which is to report from time to time on street-railway questions. The committee is to devote its attention to the needs of every ward in the city, with regard to street-railway transportation. The following committee was appointed: Alderman Bennett, chairman; Aldermen Goldzier, Jackson, Foreman, Herrman, Mayor, W. F. Brennan, Connery and Minwegen.

The Las Vegas and Hot Springs Electric Railway, Light and Power company has been incorporated, with an authorized capital stock of $200,000. The purpose of the company is the construction of a street-railway and electric-light plant at Las Vegas, N. M., and neighboring towns.

Photometric Value of Arc Lamps.[1]

This committee is composed of Henry L. Doherty, chairman; Professor W. E. Goldsborough and J. Q. Brown. As was the case last year, the report is one of progress, the various investigations outlined by the committee not being as yet completed. The report opens with an acknowledgment of the uniform courtesy that has been shown by the various manufacturers of arc lamps and carbons, in placing at the disposal of the committee the materials needed for the tests. Practically all American makers of lamps and carbons have assisted the committee by furnishing samples of their output for test. The committee calls attention to the growing importance of the enclosed arc as an artificial illuminant and the need of an accurate knowledge of its performance.

The tests have been carried out for the committee in the photometric laboratories of Purdue University. The committee expresses its great obligation to the authorities of the university for the use of its laboratories and equipment, and for the power facilities so essential to the conduct of the tests.

The bulk of the report deals with the life and efficiency of commercial brands of enclosed-arc carbons, although the questions of steadiness of operation in lamps and the photometric values of series

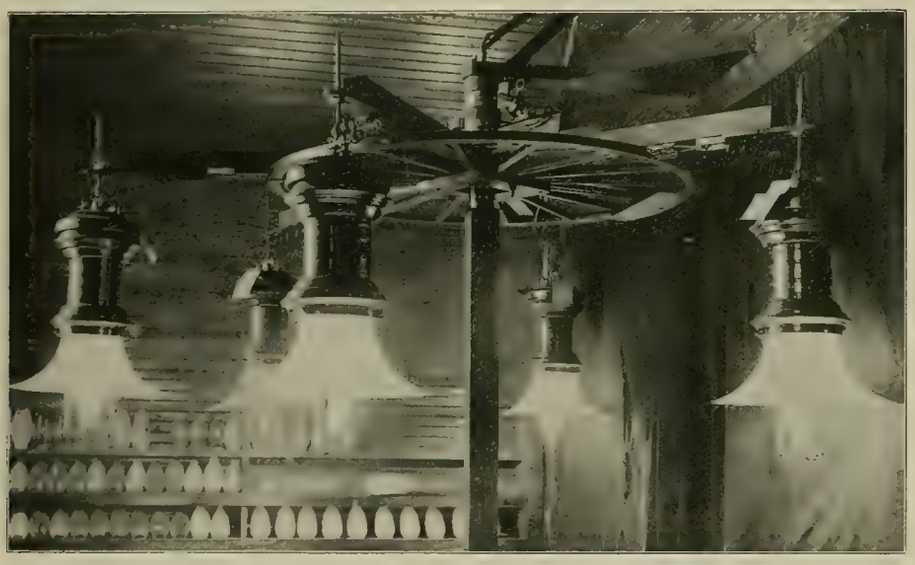

FIG 1. PHOTOMETRIC VALUE OF ARC LAMPS.—SUPPORT FOR LAMPS.

direct and alternating-current enclosed arcs are given some attention.

For the testing of the arc-light carbons, a special photometric equipment has been designed and installed by Professor C. P. Matthews. Mr. Paul B. Sawyer has assisted him in the work through the year. Acknowledgment is also made to Messrs. Winter, Hardwicke, LeFever, McBroom and Watjen, members of the graduating class at Purdue University, for their assistance in various parts of the work. Professor Matthews' report is as follows:

"Curves of the distribution of luminous intensity, such as those given in last year's report, are obtained by what may be called the step-by-step method. That is to say, the mirrors are moved stepwise about the source until the complete distribution of intensity in a vertical plane has been obtained. In each position of the mirrors it is necessary to take from 15 to 25 settings in order to get a good mean. To secure these settings, to make the subsequent calculations and finally to plot and integrate the necessary curves for a single lamp require the best part of a day. Now, a test upon enclosed arc-light carbons, to be in any degree representative, must be the combined result of measurements made upon a number of samples from each brand. Such measurements should be made at intervals of 10 hours, say, throughout the life of the carbons. It becomes at once evident that to apply the stepwise method to an undertaking of this kind would be a well-nigh endless task. I therefore set out to develop and install an apparatus which should give at each photometer setting a value of either the mean spherical or mean hemispherical intensity, as might be desired. The difficulties encountered in the perfection of this method were frequent, and oftentimes annoying. When finally the sources of error were taken care of, all the constants determined, and the method in successful operation, more than half the available time for testing had elapsed. Notwithstanding this, it is doubtful if the results could have been obtained by the slower method in time for presentation here, and one has the satisfaction of feeling that the apparatus is now in working order for expediting further work on arc-light photometry.

"A detailed description of this apparatus, with the theory of its operation, and with due acknowledgment to my sources of aid, will be given elsewhere. However, attention may be called to one feature of the apparatus which has proved to be of great convenience. As shown in Fig. 1, this consists of a wheel with six radial arms, the whole being mounted so as to turn in a horizontal plane. Six lamps may be suspended from the arms, provision being made to adjust the height of the lamp accurately by a suitable turnbuckle. To test a lamp, at any period of its life, it is only necessary to turn the wheel until the lamp is thrown into its proper position with reference to the mirror system. After closing the black curtains, so as to cut out all extraneous light, the operator can proceed with the measurements. These finished, another lamp is turned into place, and the operations repeated. Thus, during the 100 or more hours of their life, the lamps burn quite unmolested. They are tested as often as may be desired, and always in the same position with respect to the photometer system. I am confident that in no other way can consistent results be obtained in an investigation of the life performance of enclosed arcs."

After certain preliminary runs to determine the efficiency of the method employed, preparations were made to test samples of five brands of carbons for enclosed-arc lighting, these brands being well known and obtainable in the open markets of to-day. The samples represent the product of three American and two European manufacturers.

The carbons were burned in six General Electric, 110-volt, alternating-current lamps, provided with opalescent inner globes and shades. Of these lamps, five were fitted with the particular brand of carbons to be tested, the sixth lamp being held in reserve, lest accident or poor operation should require a substitution. Experience showed, in one or two cases, the wisdom of this precaution. The lamps were suspended from the radial arms of the wheel shown in the foregoing figure. In this position the lamps ran out the life of one trimming. With few exceptions, the only stops were at the close of the laboratory day. Counting all interruptions, the average run was about eight hours. Not infrequently, a steady run of 12 hours occurred. These conditions are probably somewhat better, and certainly no worse, than the average conditions of practice. The carbon life shown in the following results seems to corroborate this statement, as the life usually claimed for lamps of this type is 80 to 100 hours. It may be well to note just here that the duration of burning in these lamps is limited by the allowable range of descent of the upper carbon holder. This range is a fixed quantity. The life on one trimming may, therefore, be expressed by the simple formula

$$t = \frac{l_o}{r_u + r_l}$$

where l_o is the fixed range referred to and r_u, r_l the respective rates of burning of the upper and lower carbons. The life, clearly, will be a maximum for that case in which the sum of these rates is a minimum.

A lamp fitted with a shade is, in itself, an intimation that only the downward flux of light is of value.

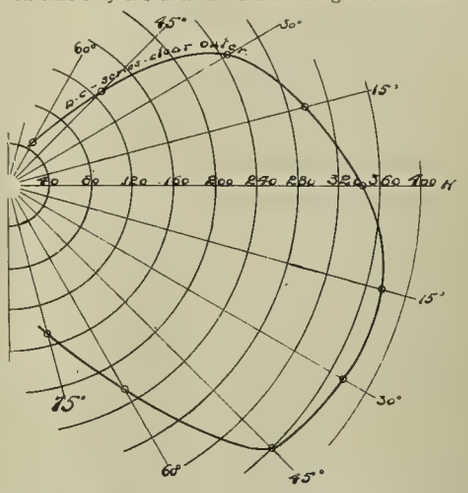

FIG 3. PHOTOMETRIC VALUE OF ARC LAMPS.—LUMINOUS INTENSITY OF DIRECT-CURRENT SERIES ARCS.

The logical basis of comparison in such cases is the mean hemispherical intensity, or, if desired, the downward flux of light which is 2π times the mean hemispherical intensity. In the following carbon tests, the mean hemispherical intensity is the quantity determined. In the curves it will be found plotted as an ordinate against time as an abscissa.

In what follows, the brands of carbons will be designated by Roman numerals, in the order of the tests, while the lamps will be referred to as (A), (B), etc. The upper carbon in all the tests was cored, the lower carbon solid.

Carbons I.—The results of the first test are to be found in Fig. 2, which shows the life curves of the individual lamps in light lines and the mean performance of the five lamps in the heavy line. We note here that the trend of the mean curve is, in the main, upward. After 85 hours' burning, these carbons showed 10 per cent. better performance than at the start. Lamp (B) distanced its companions by showing a life of 114 hours. On the third, fourth, seventh and eighth tests the points are quite close together; on the other tests there is more or less divergence. Why this difference? The use of an apparatus for recording the changes in the arc length in lamps, such as these, has convinced me that these differences are due, in a large measure, to changes in the arc length. Now, the time between successive feedings is, in a well-regulated lamp, an interval considerably longer than that required for a test. During this interval between feedings, the arc tends to grow steadily longer. It has been shown by Blondel and by Ayrton that the luminous intensity of an arc at constant current is dependent, in a very important way, on the arc length. It seems clear then that tests, such as those described here, might at one time find the arcs of approximately the same length, and at another time differing considerably in length. Lack of homogeneity in either upper or lower carbon might also have an effect. It is evident that any constant difference in the carbons or in the transparency of the inner globes would be made manifest by a permanent separation of the life curves.

While the length of these curves indicates the life

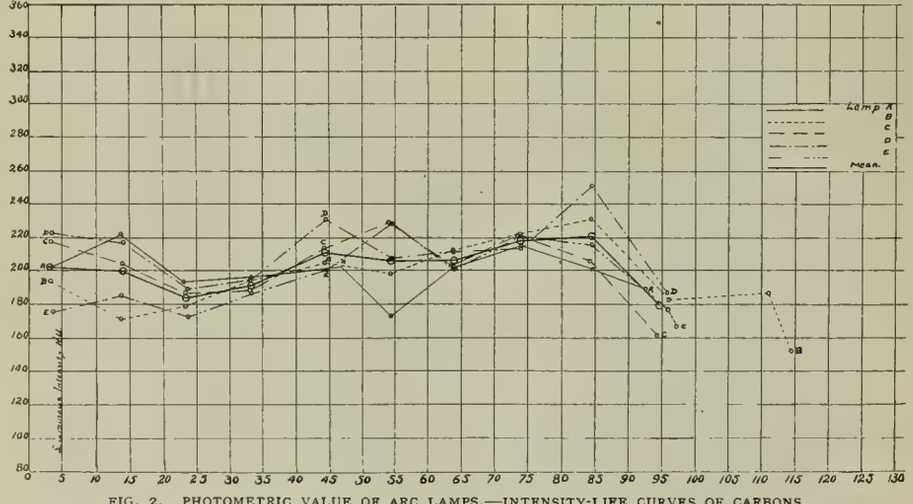

FIG. 2. PHOTOMETRIC VALUE OF ARC LAMPS.—INTENSITY-LIFE CURVES OF CARBONS.

1. Abstract of report presented to the National Electric Light association at Niagara Falls, N. Y., on May 22, 1901.

of the carbons and the mean ordinate their light value, these quantities alone are not a sufficient measure of the worth of the carbon. The area between the curves and the X-axis is an important basis of comparison. This area has been found for each test. It is measured in Hefner-unit hours. For carbons I, this quantity is 20,200, or 202 hekto-hefner-hours. The mean intensity is 202 Hefner units, and the life on one trimming, 100 hours.

Carbons II.—The mean life of this set of carbons is practically 99 hours. However, lamp (A) showed

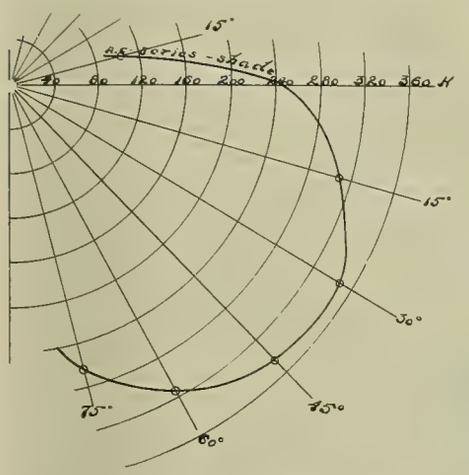

FIG. 4. PHOTOMETRIC VALUE OF ARC LAMPS.—LUMINOUS INTENSITY OF ALTERNATING SERIES ARCS.

the brief life of 62.5 hours. There must have been some imperfection in the fit of the gas cap on this lamp, although every precaution was taken to secure impartial treatment in this, as in every other respect. If it is justifiable to exclude (A), we find a life of 107.9 hours. The Hefner-unit hours rise in such case to 23,800. The performance of (A) indicates that the life of an enclosed arc may be seriously curtailed by causes not easily detected. The mean curve in this test rises to a maximum at 60 hours' life. Lamp (F) shows a somewhat remarkable performance, both as regards intensity and life. A mean intensity of 238 Hefner units is maintained throughout 111 hours, or a yield of 264 hekto-hefner-hours, which is about double the yield of (A).

Carbons III.—As regards life, these carbons show a noteworthy performance. The mean life is 115.6 hours, and the maximum life, 129 hours. The mean curve does not show the tendency to rise shown in the case of carbons I, although, as a whole, it lies high. By weight the per cent. ash and dust is about the same. An inspection of the inner globes after the tests showed that the deposit near the base of the globe in case III was darker, that is, contained more carbon dust than in case I. This is, in my opinion, the cause of the drooping tendency to be seen in the mean curve of carbons III after 45 hours. In this connection, it is important to note that the number of extinctions in these tests was somewhat greater than in the case of carbons I and II. The carbon dust is due, in large part, to the pounding or chattering of the carbons at the start. These carbons show a mean performance of 252 hekto-hefner-hours.

Carbons IV.—The contour of the mean curve of these carbons is smooth and represents, in an excellent manner, the life behavior of a lamp of this type. The arc appears beneath the edge of the shade at about 45 hours, giving a maximum luminous intensity at about 55 hours. The third maximum point at 100 hours was obtained in some of the other cases, and will, no doubt, always be present when the coating at the base of the globe is not too dense.

Carbons V.—The luminous intensity of these carbons is low and the life rather brief. The core of the upper carbon seemed to be of high conductivity, but of too loose structure, as it fell out in considerable quantities, because of the pounding of the carbons, and collected around the base of the lower carbon. The arc was very long and well centered at the start, but not particularly luminous. The materials in the core are such as to lower the luminous intensity, with little, if any, gain in steadiness of operation. The very considerable rise in the intensity curve shows that the ash on the globe was not excessive. The gain in the weights of the globes confirms this conclusion. The mean life is 85.6; the mean luminous intensity is 196, and their product, 16,600.

It is of interest to plot on one sheet the mean curves of these various life histories. We may compare these five brands of carbons in three different ways, viz., on a basis of luminous intensity, on a basis of life and on a basis of intensity-life. Arranging the carbons in order of excellence, the best first, we have:

Intensity.	Life.	Intensity-life.
IV	III	IV
III	II*	III
II	IV	II
I	I*	I
V	V	V

*If (A) be included in Carbons II, the starred values will be interchanged.

It is of interest to note that, after 75 hours' burning, carbons I, II, III and V gave approximately the same luminous intensity, and also that the trend of all the curves is, in the main, upward. Carbons IV maintain a distinct lead throughout their life.

A partial summary of the results is given in the following table:

	1.	2.	3.	4.	5.
Total consumption, inches	6.19	6.3	6.16	6.3	6.32
Consumption ratio	16.4%	16.5%	5.1%	8.4%	*
Clearance	.0094	.010	.0093	.0079	.0151
Number of extinctions	11	14	16	14	11
Average run	9.3	7.4	7.09	7.3	7.74
Life on one trim	100.1	98.8	115.6	103.2	85.6
Luminous intensity	202	218	222	259	196
Hefner-unit hours	20,200	21,500	25,200	27,500	16,600
Hefner-unit hours per in.	3,263	3,540	4,089	4,360	2,609

Owing to the growing importance of series enclosed arcs, it has seemed desirable to take up their photometric value in these investigations. Fig. 3 shows the distribution of luminous intensity in the case of a direct-current, series enclosed arc, provided with opalescent inner globe and clear outer globe. The data are:

Electromotive force	70 volts.
Current	6.8 amperes.
Power	476 watts.
Mean hemispherical intensity	329 hefner-units.
Mean spherical intensity	266 hefner-units.
Watts per mean spherical	1.78
Watts per mean hemispherical	1.45

Similarly, Fig. 4 shows the distribution of luminous intensity in the case of an alternating-current series enclosed arc, fitted with opalescent inner globe and metallic shade. The data are:

Electromotive force	70 volts.
Current	6.6 amperes.
Power, apparent	482 watts.
Power, true	455 watts.
Power factor	.94
Mean hemispherical intensity	314 hefner-units.
Watts per mean hemispherical intensity	1.44

As tests on series arcs are still in progress, discussion will be reserved until further data are available.

High-candlepower Nernst Lamps.

Although the efforts of the German manufacturers were first directed toward the development of Nernst lamps of 40 to 80 watts' capacity, the Allgemeine company of Berlin is now in a position to turn out 100 and 200-watt lamps (from 65 to 135 candlepower) of the type shown in Fig. 1. Lamps of 40 to 80 watts' capacity and from 25 to 50 candlepower still constitute the chief output, but the company hopes to bring the manufacture of the new model up to the same extent.

The lamp shown in Fig. 1 is designed especially

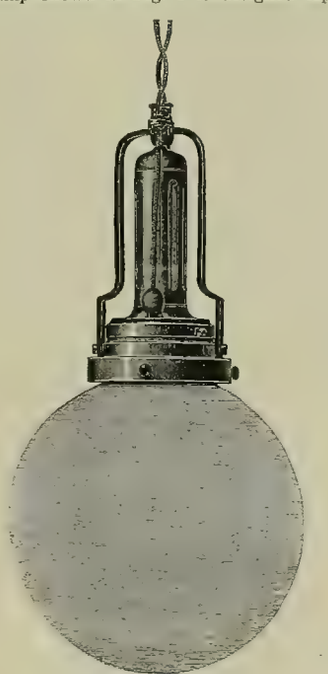

FIG. 1. HIGH-CANDLEPOWER NERNST LAMPS.—EXTERIOR OF LAMP.

to take the place of groups of ordinary incandescent lamps. It comprises, essentially, in addition to the burner with its support (the lamp proper), the pendant with the lamp globe and the shunt resistance. This resistance has a long life, and if destroyed can be easily replaced. The burner of the lamp has an average life of 300 hours; to replace it requires little skill, and it is not subject to injury if one handles only the porcelain disk to which it is attached.

Fig. 2 shows the lamp with burner, without the globe, and Fig. 3 shows the burner alone. By removing the screw (s), Fig. 3, the burner can be taken out from the support. In installing a new burner complete connection is made by inserting the stem (a_1), Fig. 2, in the quill (a), and the stem (b) in the quill (b_1). The screw (s) is then inserted to hold together the strips (c) and (c_1), and the burner is thereby prevented from falling out. The arrangement answers equally well for direct or alternating currents.

The accompanying statistics of comparison between 16-candlepower incandescent lamps and 50-watt Nernst lamps give proof, says the Elektrotechnischer Anzeiger of Berlin, of the economy of the latter.

Model A (the type shown in Fig. 1) of 100 watts (about 65 candlepower), replaced four 16-candlepower incandescent lamps. At a cost for current of 55 pfennigs (13 cents) per kilowatt-hour, for 600 hours yearly, the lighting cost of four carbon-filament incandescent lamps is: $\frac{200 \times 600 \times 55}{1,000}$ = 66 marks. Replacing four lamps at 55 pfennigs

Fig. 2. Lamp without Shade.

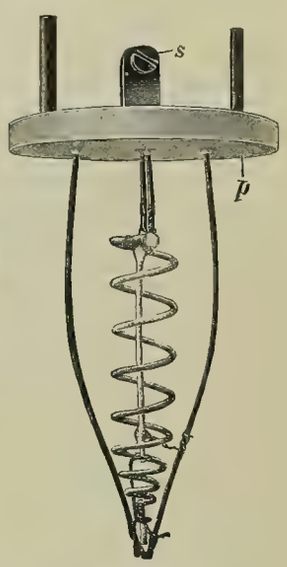

Fig. 3. Burner.

HIGH-CANDLEPOWER NERNST LAMPS.

= 2.20 marks, or a total of 68.20 marks. The Nernst lamp figures out $\frac{100 \times 600 \times 55}{1,000}$ = 33 marks. Replacing two burners at two marks = 4 marks, or a total of 37 marks. Thus, the cost difference per year is 31.20 marks, 45.75 per cent., or $7.42.

Model A, 200 watts (about 135 candlepower), replaced 8.5 16-candlepower incandescent lamps. At the same current cost and number of light-hours as above, the cost of operation of the incandescent lamp is $\frac{425 \times 600 \times 55}{1,000}$ or 140.25 marks. Replacing 8.5 lamps at 55 pfennigs = 4.68 marks, or a total of 144.93 marks. For the Nernst lamp: $\frac{200 \times 600 \times 55}{1,000}$ = 66 marks. Replacing two burners at two marks = 4 marks, a total of 70 marks. Thus, the cost difference per year is 74.93 marks, or 51.7 per cent.

The Nernst 65-candlepower lamp for 110 and 220 volts costs 12.50 marks, and the 135-candlepower lamp for 220 volts costs 14.5 marks, complete, with a simple globe. Roughly, a mark is equivalent to 24 cents.

The Machinists' Strike.

Machinists in all parts of the country went on strike May 20th for a nine-hour day, a scale of wages equal to the present 10-hour day, and other demands. It is estimated that fully 40,000 men are out. The cities most seriously affected are San Francisco, Cincinnati and New York. In Chicago less than 200 men struck, and indications are that the employes at nearly every large machinery manufacturing plant will adjust the wage question by arbitration. The Chicago Association of Machinery Manufacturers met at the Great Northern Hotel and decided to leave the whole question to the National association for adjustment. The men have agreed to be bound by any arbitration effectually carried out by the National Metal Trades association relative to wages.

President O'Connell of the National Association of Machinists said on Monday evening, May 20th, that his reports showed that 904 firms, employing 30,000 men, already had signed the agreements for the nine-hour day or made satisfactory arrangements with the local organizations. Among the electrical companies affected by the strike are the Electric Vehicle company, Hartford, Conn.; Incandescent Arc Light company, New York city, and the Western Telephone Construction company, Chicago.

The Council Bluffs (Iowa) Gas and Electric Light company will erect a new electric-light plant.

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CONVENTIONS AND EXPOSITIONS.

Independent Telephone association of the United States, Convention Hall, Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American Hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Northwestern Electrical association, Sheboygan, Wis., June 26th and 27th.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

On pages 360 and 361 of this issue of the Western Electrician is given Dr. Kennelly's paper on "The New Edison Storage Battery," delivered at the annual meeting of the American Institute of Electrical Engineers in New York on Tuesday, May 21st. To lay this interesting and valuable description before the readers of this journal, it was necessary to telegraph the full text of 3,000 words from New York. This was done, as the interest in Edison's latest work has been very great. Dr. Kennelly is a careful engineer and a close friend of the great inventor, and his description may be accepted as authoritative. It will be seen that the new Edison cell is a nickel-iron one of exceptional lightness. Now that electrical men know how the battery is made, the actual performance of the cell will be awaited with keen interest.

For outdoor lighting the Pan-American Exposition seems to have demonstrated conclusively that 25-cycle current is feasible for the operation of incandescent lamps. There is no flickering in the light, although at the low frequency employed many engineers of prominence expressed the fear that there would be. However, Mr. Stieringer, the consulting electrical engineer for the exposition, was confident that the illumination would be satisfactory, and the event has proved that he was more than right.

Electromedical inventions are announced from time to time that, as a rule, are rather unique than useful. One of the latest of these discoveries is credited to Germany, where a Dr. Theodor Berndt of Wiesbaden has invented what is termed "electric eyeglasses," that are "guaranteed" to restore dimmed or darkened vision. The article in question takes practically the same shape as an ordinary pair of spectacles. The frame, however, is specially constructed, being made of thin layers of copper and zinc. A set of these electric glasses, suitably equipped with a sufficiently strong electrolyte, might possibly serve to excite nervous action in the region of the nose and eye, but a practical demonstration of beneficial results to the vision caused by wearing the glasses may be looked for before much faith can be put in the physician's guarantee.

Data of central-station performance seldom receive the attention from the manager which their importance deserves. Mr. C. R. Van Trump, at the recent Niagara Falls convention of the National Electric Light association, read a paper on "A Station-load Diagram," in which he set forth a method of collecting and tabulating essential facts that is simple and effective and should prove of great practical assistance to the managers of plants. The method described by Mr. Van Trump in his paper, presented elsewhere in this issue, is one suitable for a station of a great variety of loads. The author has given the system the test of practical operation in his own plant for the last two years, and it has been the means of pointing out many places wherein it was possible to better materially the economy and efficiency of the plant. The simplicity and cheapness of the apparatus used and the small amount of time necessary to record and afterward average the data are features which especially recommend Mr. Van Trump's system.

One good feature of the electric-light convention at Niagara Falls during the week was the well-sustained good attendance at the sessions of the meeting. Whether this was due to the admonitions of the Western Electrician last week, the excellence of the convention programme, or to the fact that it rained one day, it is certain that the average attendance was excellent. The papers and committee reports were valuable, and some of them brought out interesting discussions. There were not many exhibits of apparatus, but the fact was easily accounted for by the nearness of the exposition in Buffalo, which was, in fact, the attraction that drew the convention to Niagara Falls this year for a third visit. However, the supply men were out in full force, and the central-station managers were reminded that there were still goods to be bought.

There are, of course, many things interesting to electrical men in the vicinity of Niagara Falls, and many of the visitors took advantage of the opportunity to visit some of them. The existing station of the Niagara Falls Power company has been but recently filled to its full capacity of 10 5,000-horsepower generators—50,000 horsepower—and it came in for its meed of admiration and wonder. Readers of the Western Electrician will be interested in the statement that we believe the picture in last week's issue, showing the line of 10 generators in this station, was the first to be published of the completed plant in Power House No. 1. Power House No. 2 is, of course, only in existence in the engineer's drawings as yet. It will likewise have a capacity of 50,000 horsepower, and thus the eventual capacity of the twin plants will be 100,000 horsepower. There are many other out-of-the-ordinary electrical plants in and about Niagara Falls, and probably each one had its quota of convention visitors, who thus found other means of increasing their stock of knowledge than by the convention alone, instructive as the latter undoubtedly was.

It begins to look as though the National Electric Light association was getting ready to back up years of protest against the unjust discriminations in freight rates on electrical machinery by more decided action. The association's committee on freight classification, of which James I. Ayer is chairman, has pointed out the injustice of classifying, to take a single instance, a dynamo casting as first-class material at a high rate and a steam-engine casting or a lathe as fourth-class material at a much lower rate. But representations to the official classification committee of the railroads were of no avail. After much correspondence, the official classification committee announced that it did not think it expedient to recommend a change. At the Niagara Falls convention this week Mr. Ayer brought up the old subject again, as in duty bound, and suggested that a test case be made to determine whether, under the interstate-commerce law, the railroads, as represented by their official classification committee, have the right to discriminate against electrical machinery in freight rates. The association adopted the suggestion, or, at any rate, authorized Mr. Ayer's committee to take such steps in the matter as seemed to it to be proper. It may be that a long litigation may result, or, possibly, when the railroad classification committee sees that the National Electric Light association is in earnest, it may concede the justice of its position. It seems to us that the association presents a very strong case, resting its claim for relief from unjust charges on simple justice, and we wish it success.

The report of the committee on the photometric value of arc lamps presented at the convention of the National Electric Light association this week proved to be one of the important features of the meeting. Like the first report at last year's convention, this report was one of progress, stating what had been accomplished during the year by the committee in arc-lamp investigation. The work was continued in the electrical engineering laboratories at Purdue University, under the direction of Professor W. E. Goldsborough, with the assistance of Professor C. P. Matthews and some of the members of the graduating class. Elsewhere in this issue is given an abstract of the committee's report, which is based principally on the sub-report of Professor Matthews.

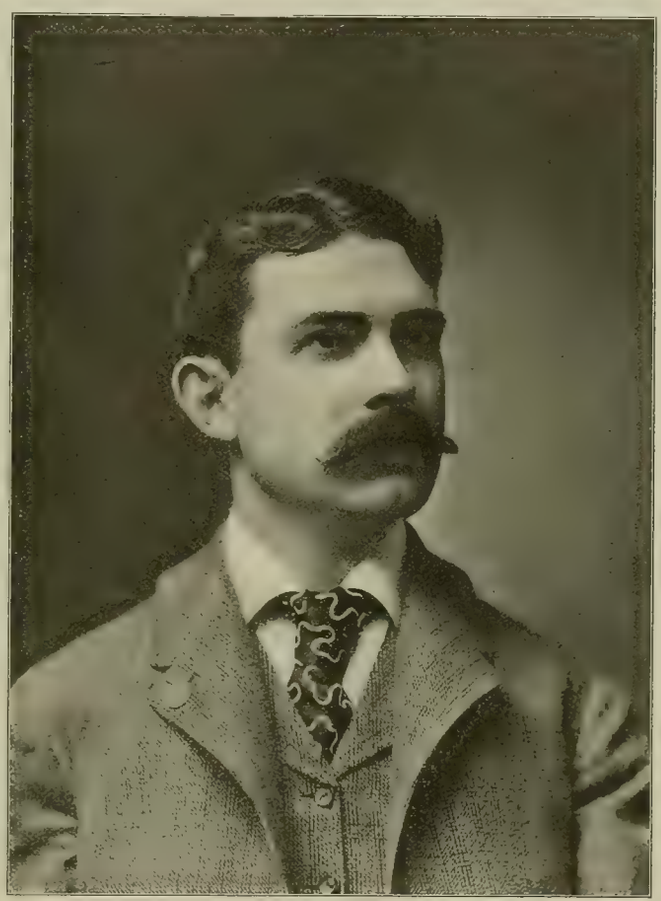
The first year's investigations were devoted, in the main, to a study of the luminosity of 110-volt, direct and alternating-current, enclosed-arc lamps, and some valuable results were obtained. This year's report deals chiefly with the life and efficiency of commercial brands of enclosed-arc carbons. Five well-known brands of carbons were tested, three of these being of American manufacture and two the product of European factories. For obvious reasons the makers' names are omitted from the text of the report, the different makes of carbon being designated by numerals. It is interesting to observe that four of the five brands gave approximately the same luminous intensity after 75 hours' burning, and that, in the main, all the carbons showed a better performance after burning for several hours than at first.

Other questions considered by the committee were the steadiness of operation in lamps and the photometric values of series direct and alternating-current enclosed arcs. Tests on series arcs are still in progress, and their result, as well as the consideration of other questions to be taken up by the committee, will be awaited with considerable interest by electrical engineers in general.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

With an attendance of about 350, an interesting programme well carried out and unrivaled attractions "on the side," the twenty-fourth convention of the National Electric Light association, at the International Hotel in Niagara Falls, N. Y., on Tuesday, Wednesday and Thursday of this week, will take no unworthy place in the roster of the gatherings of the organization. President Cahoon expedited business with commendable celerity, and the sessions were not allowed to drag for an instant. There were very few exhibits, but this was accounted for by the proximity of the Pan-American Exposition, with its overshadowing exhibit. One afternoon and evening were devoted to a visit to the exhibition in Buffalo, especially interesting to a gathering of electrical men by reason of its unequaled electrical illumination. The great and ever-increasing electrical development at Niagara Falls itself was also of great interest. The sessions were, however, well attended.

President Cahoon was greeted with vigorous handclapping, when, at 10:45 a. m., on Tuesday, he entered the assembly room and took the chair. He then proceeded to deliver the president's address.



HENRY L. DOHERTY, PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION.
(SEE PAGE 360.)

PRESIDENT'S ADDRESS.

It becomes my pleasant duty, in the first year of the new century, to greet you at this historic place, now peculiarly of interest to the electrical fraternity by reason of the partial harnessing of the great Falls of Niagara, rendering them useful and subservient to the demands of men. Yet, while we know that thousands of their horsepower are being utilized, which one of us, standing by their side and listening to their mighty roar, can detect this change? They seem to hurl back defiance at the puny attempts of man to control their restless energy. What will be the answer of man at the close of the twentieth century?

We are wont to class Niagara as the greatest waterpower in the world, yet it is only as the boy to the man, compared with some others. For instance, the Victoria Falls, on the Zambesi River, in the Dark Continent, have a fall of 391 feet and a width of 3,200 feet; while Niagara has only 165 feet fall and a width of 1,968 feet.

Long-distance transmission of electricity has become a well-established fact, and as high as 60,000 volts has been successfully transmitted, while the distance has been steadily increasing. The Snoqualmie Falls Power company of Seattle, Wash., recently operated a motor by means of current transmitted over a circuit 153 miles in length, the results obtained being so satisfactory as to demonstrate fully the feasibility of the plan.

In all parts of the country man is at work utilizing the waterpowers that nature has provided, which, until the advent of electricity, were in a great measure unavailable for his work. Those of our association who can recall the early days of central stations, when a few hundred horsepower were sufficient for the demand, may well feel amazed at the wonderful strides that have been made in their development during the closing years of the nineteenth century; but as the mind of man expands and develops, so will his ability to grasp higher and greater problems carry him on into those larger fields in the face of which our present works will appear even more primitive and puny than do now the central stations of the early days. As Shakespeare well says: "We must construe the times to their necessities."

In taking a retrospective glance over the last year, we are struck with the fact that but little has been brought out that marks any distinct advance in apparatus. It is as though our associate members in the manufacturing field had taken the good housewife for an example and had been cleaning here and dusting there; clearing away the cobwebs. I hardly dare say getting the "bugs" out of things, for no good housekeeper would admit that there were such things in her house; nevertheless, technical "bugs" have appeared, and must be gotten rid of before apparatus is perfected, and so, apparently, our manufacturers have been busy setting their house in order preparatory to the next great step in advance.

Turning to the field of invention, we see a few bright rays peeping forth, just enough to nourish the hope, ever latent in our breast, that some better method of illumination is to be given us. Experiments have been carried on with the Nernst lamp, with a view to reducing it to a commercial basis, and we may soon look for its appearance in a practical condition for ordinary use.

Ewald Rasch, a German, has brought out an arc lamp, somewhat similar in principle to the Nernst lamp, in that the carbon rods are replaced by rods of refractory material, such as the oxides of thorium, zirconium, magnesium, etc. These require heating before they will work, which is, of course, objectionable, but they possess the great advantage that the electrodes are permanent and do not require renewal. The efficiency is claimed to be about double that of the ordinary carbon arc lamps. By changing the material of the rods, the character of the light emitted may be varied.

At the conversazione of the American Institute of Electrical Engineers held on April 12, 1901, Mr. Peter Cooper Hewitt exhibited a method of lighting by vacuum tubes in which mercury had been placed. Upon current being applied from a 115-volt circuit, the mercury was first vaporized and then the vapor heated up to a point where it emitted a light so powerful and of such a color as to make the light from an ordinary enclosed-arc lamp look like that given forth by a common gas-jet. The lamp is not in commercial form, as the light is very objectionable on account of its ghastly green effect; but experiments are now being carried on with other metals, and we may look for a successful issue in the very near future, for we of this day do not question the value of experiments, as people did a century ago. In this connection, you will all recall an incident of Franklin's career, when he replied to a man that spoke rather contemptuously in his presence of Montgolfier's balloon experiments: "Of what use is a new-born babe?"

When you visit the great Pan-American Exposition, and behold the marked advance that has been made in the arts and sciences, even since the World's Exposition at Chicago, just think for a moment that this could not have taken place except through a series of experiments taxing the brain and the patience of genius, as well as the pocketbook of capital. Both have given freely, and the world has attained a higher degree of civilization by reason thereof.

As you probably have surmised, the reason for departing from our usual custom and holding this meeting here is that our members and friends may be able to visit the exposition, and thus combine business with pleasure and with instruction in broader fields than our own. I particularly commend to your attention, as typical of what American citizens can do, this great exposition. The citizens of Buffalo, unaided by state or nation, out of their own resources and by their courage, energy and grit, have created this magnificent exhibit, and they may well and proudly say to all the world: "Come! See! We bid you a cordial welcome, and we know you will depart with a higher idea of American skill, of American pluck, and of American civilization than you could possibly have entertained hitherto." All honor to Buffalo, and to its daring citizens who have had the courage to bring this to pass!

In a little work, entitled "The Thoughts of the Emperor Marcus Aurelius Antoninus," occurs a paragraph that struck me as applying with peculiar force to this association. Antoninus says: "We are all working together to one end; some with knowledge and design, and others without knowing what they do, as men also when they are asleep." Largely incident to the fact that our officers are not permanent, and cannot well be so, our association has dragged along from year to year with a membership barely sufficient to carry on the routine work of the association and bear the expenses incident thereto without too-frequent demands on the members for contributions to carry out some special line of work. During the last year the matter of increasing the membership has been taken up actively, and every central station in the United States, in towns of over 2,000 inhabitants, has had its attention called to the benefits that would accrue to it through becoming a member of this association. The result has been that new interest has been aroused in the work of the association, and a very substantial addition has been made to our membership. It has really been the inauguration of a campaign of education, and while only a beginning has been made, I feel confident that if my successors will continue the good work, material additions will be made and the association will reach the plane where it should have been long ago.

I doubt if there has been a president of this association, up to the present time, that has not, at one time or another, urged the co-operation of the members in this missionary work, and no doubt many a member has left the convention hall with the thought that he would turn over a new leaf and assist in this work, but when he has reached his home and settled down to his accustomed work the idea has promptly fallen asleep, and his good intentions have gone to naught. I cannot appeal to you in better or stronger language than have many of my predecessors. I have purposely avoided urging you unduly to aid me in this work, for the reason that past experience in similar matters showed that the result would be negative; but now that a substantial beginning has been made, I feel that I can appeal to you with some degree of assurance that you will join hands with your new president and carry on the good work to a successful issue.

Our committee reports will be presented for your consideration and action. There is not one of them but has a practical bearing upon the work of this association, and I urge that you give them most careful consideration. The papers that have been prepared are by men that speak with authority on the subjects in hand, and I wish to express to the authors my appreciation of the cordial response that they have made to our demands upon their time.

Every combination of circumstances seems to be in favor of this being the best convention this association has ever held, and I hope everyone present will depart at its close with the feeling that he has been well repaid for dropping his work temporarily and joining together here with others in a mutual endeavor to give and receive knowledge that will be of benefit to each and all of those interested in the work of this association.

TUESDAY MORNING'S BUSINESS.

Lieutenant Cahoon's address was listened to with marked attention. He called attention to the fact that the association had gained 35 per cent. in membership during the year, and this statement excited much interest.

The next feature was the reading by Calvin W. Rice, electrician of the New York Gas, Electric Light, Heat and Power company, of his paper on "The Transmission of Current at High Potential in New York City." Mr. Rice gave a brief description of the largest central station in the world, that of his company, now building in New York. The paper was discussed by Frederic Nicholls of Toronto and by the author of the paper.

The death of Z. T. Gramme, an honorary member of the association, was officially announced to the convention, and the following resolution, presented by T. C. Martin of New York, was adopted:

Whereas, The National Electric Light association has been officially advised of the death of Z. T. Gramme, in France; it is

Resolved, That this body hereby expresses its deep regret at the loss to electrical invention and discovery of our famous honorary member, whose work did so much to promote the success of the modern art of electric lighting and the economical generation of current.

Resolved, further, That this resolution be entered in the proceedings of this convention, and be also duly communicated to the technical press, and that a copy be sent to the Société Internationale des Electriciens of France, to the other European electrical societies, of which Monsieur Gramme was so distinguished a member, and to his business associates.

L. R. Wallis of Woburn, Mass., read a paper on the price-charging subject, entitled "The Fore-

see (4-C) System of Charging." The applause following the reading of Mr. Wallis' paper was hearty, and, owing to the importance of the subject, discussion was postponed.

Uniform Accounting.

G. E. Tripp of Boston presented the report of the committee on uniform accounting. This was a long printed document, carefully subdivided. After it had been read President Cahoon stated that it had been planned to present a scheme of uniform accounting for adoption at the Niagara Falls convention. He urged definite action on the report, and, on motion of Mr. Nicholls, the report was adopted, with thanks to the committee. Mr. Anthony, controller of the Chicago Edison and Commonwealth companies, a member of the committee, explained the report, and advocated uniform accounting. Managers should send their bookkeepers to some of the meetings, he said. Mr. Wallis said that, unless the directions were very specific, uniform accounting could not be achieved. President Cahoon remarked that, with uniform accounting from the start, many of the municipal plants would never have been thought of. C. F. Hewitt of Elkhart, Ind., agreed with the president. "We must arrive at our actual cost and at the actual cost of municipal plants," he said. Mr. Smith of Somerville, Mass., said that the Massachusetts law did not give full information. The great majority of central-station men do not know their kilowatt-hour cost. Mr. Price of New Bedford, Mass., asked, "What does cost mean? Let us have a uniform rule. I think the reform an admirable one." Mr. Anthony spoke of monthly statements of accounts. Each month should be closed up by itself, and thus possible mistakes could be corrected in time. Taxes should be considered more as an expense than as a fixed charge—a fixed expense or an operating expense, perhaps. Mr. Drum of Terre Haute, Ind., advocated the finding and establishing a system of standard costs. Thus each station would have a standard to judge itself. Mr. Nicholls explained that even the adoption of the report did not make the committee's system obligatory on all the companies in the association. The report of the committee was simply a guide to the best practice.

Nominating Committee.

F. Nicholls, J. I. Ayer and H. H. Fairbanks were appointed a committee to nominate officers for the ensuing year.

After the reading of regrets at non-attendance from Lord Kelvin, Elihu Thomson, C. F. Brush and others and letters of invitation from the Niagara Falls Power company and the company operating the Gorge road, the morning session was adjourned.

Tuesday Afternoon's Session.

The first thing done on Tuesday afternoon was the reading of Francis W. Willcox's long paper on "The Practical Side of the Incandescent Lamp." Mr. Willcox is connected with the General Electric company's factory at Harrison, N. J., and his paper was listened to with interest.

Standard Candlepower of Incandescent Lamps.

Dr. Louis Bell was unable to be present, and his fellow committeeman, James I. Ayer, read the report of the committee on standard candlepower of incandescent lamps, as follows:

"Your committee has the honor to report that during the year elapsed since its last report commercial conditions have changed in a way which has seriously impeded progress toward a uniform standardization which we have earnestly desired to form.

"At the last convention your committee brought in a proposal for methods and apparatus for standardizing lamps which was accepted, and had in preparation both specifications for standard lamp testing and a standard form of photometer, which could be readily built and operated for the purpose of effecting such standardization. During last summer, and before these specifications were completed, there appeared changes in the art which compelled your committee to stay its hand. These changes are briefly stated, and we desire to call your special attention to them as having important bearing on the economic use of incandescent lamps.

"Your committee had recommended the standard measurement in the horizontal plane made by revolving the lamp, the forms of filaments in ordinary use at the time having been such as lent themselves readily to useful and fair measurement by this particular means which has, at all times, the recommendation of simplicity. There has developed, however, among some of the lamp manufacturers, a reversion to the long, straight horseshoe filament. The distribution of light from a source having its shape is such as to exaggerate the horizontal candlepower at the expense of the luminosity in other directions.

"If one takes a carbon filament of given dimensions, and by passing an electric current through it heats it to a given temperature, the total luminous radiation emitted therefrom is substantially a fixed quantity, independent of the shape into which that filament is built. If the filament be formed into a long, straight, hairpin shape, the horizontal illumination will be exaggerated at the expense of the illumination above and below the lamp.

"If, as is the practice in some recent lamps, the filament, instead of being so bent, is twisted into a number of convolutions, the result is a large increase of the light given toward the tip of the lamp, with a corresponding decrease in the illumination given in other directions. For, since a filament of given dimensions and at a given temperature will emit a fixed total quantity of light, other things being equal, that filament cannot be so convoluted or bent as to give a very large proportion of such radiation in any particular direction without a corresponding decrease of the light in some other direction or directions.

"The straight, hairpin filament just referred to facilitates the production of the lamp, having an apparently high efficiency when measured in the horizontal plane. In many, a looped filament gives a correspondingly high apparent efficiency when measured off the tip of the lamp, while, in point of fact, the two lamps, if provided with the same filament, work at the same temperature, and work absolutely equivalent in efficiency.

"Without expressing any opinion for or against any particular form of filament, your committee submits that under the commercial conditions just set forth a horizontal measurement, or a measurement in any other one particular direction, does not and cannot afford a fair basis for the measurement of the lamps having filaments of various forms; hence your committee has suspended action with regard to standard specifications for testing, pending investigation of the present commercial conditions for which it was believed that the testing facilities directed to be provided by your committee would afford a suitable opportunity.

"In regard to the establishment of this standardizing bureau for incandescent lamps with which your committee was charged we have the honor to report that negotiations were entered into with Professor F. B. Crocker and other officers of Columbia University, with reference to fitting up in that institution a laboratory for the preparation of standards and such testing as might be desired for the National Electric Light association. Through the courtesy of these gentlemen it became possible to utilize in a large measure the equipment which that institution already has, and the only expense which would fall upon the association was the addition of a certain amount of special apparatus for work purely of standardization. The president of the association, at the request of your committee, then laid the matter formally before President Low of Columbia University, and obtained, through him, a favorable response with respect to the project.

"At about the time that the matter was thus far settled, a very courteous invitation was extended by the testing bureau of the Edison association to join forces with it to the extent of having the standards and other testing work of the National Electric Light association transferred to the laboratory of the testing bureau. It also appeared that the National Bureau of Standardization would probably be authorized (as it since has been) by Congress, just adjourned.

"In this state of affairs your committee was notified by the president, through the executive committee, that the expenditure of some $800 to complete the preparations at the Columbia University might seem of dubious utility, and the matter was thus referred back to the committee.

"After mature deliberation, your committee is of the opinion that the National Standardization Bureau, however diligently the work of organization might be pursued, will be unlikely to be in a condition to undertake work of the kind required by the association for a considerable period of time, so that the production of standards cannot be depended upon in the immediate future, or other work necessary to the investigation of the lamp question from other sources.

"With respect to the invitation from the testing bureau of the Edison companies, your committee feels that, while the work of this bureau will undoubtedly be carried out efficiently, it will be of positive advantage to the art to have more than one independent investigation in the matter of developing standards and the correlated questions regarding incandescent lamps which lie within the province of the association to investigate, especially as the president of the association has very earnestly charged upon the committee the consideration of the matter of candle-hours, a subject which of itself requires considerable facilities for investigation.

"In our opinion, the original idea of the association should be carried out and the arrangement completed with Columbia University to do the work as originally outlined in general, subject to such changes and details as are hereinafter referred to, for the reason that, in the present state of the art, there is no doubt but that it is desirable to have as much investigation of the incandescent lamp from independent sources as may be possible.

"A deep interest in this particular branch of electrical development at Columbia University would necessarily be developed by carrying out your committee's plan, and in the way of profitable investigation in the matter of standards of incandescent lamps it would be equal to many times the sum of money involved on the part of this association in this transaction.

"Your committee therefore requests authority to carry out the organization of the standardizing bureau under the auspices of the Columbia University, as herein suggested, and to incur such expense as may be necessary in the way of additional apparatus for investigations of the candle-hour problem, which were not originally contemplated in the project for the production of standards. Your committee believes that this work, carried out as indicated, will be very profitable to the association, and particularly in view of some impending changes in the art which may call for the investigation of new types of lamp in the near future. Our estimate for this initial cost for apparatus is about $1,000, and we desire authority to expend that amount."

There was some opposition to the committee's recommendation on the ground that the government standardizing bureau would be able to take up the work within two years, and also on the score of expense. Finally, the subject was referred to the executive committee, with power to act.

Mr. Willcox presented to the association some interesting facts in reference to the accuracy of the incandescent lamp as secondary standards. "The Edison Lamp Works," said he, "recently had a number of such lamp standards and compared them in an interesting manner. Eight years ago they obtained from the Reichsanstalt, the German standardizing bureau, copies of incandescent-lamp standards, which have served as a basis for our photometric work ever since. About a year ago we submitted some samples to the United States Navy, to be sent to the Reichsanstalt for standardization for the navy, and the readings obtained on the second lot of lamps, when compared with our own readings, which were, of course, derived through the eight years from the early readings of the lamp, agreed within 0.70 of a volt, which corresponds to 0.14 of a candlepower, with 50-volt lamps. This, of course, may be nothing more than the personal error of two individual readers. It might be the other way on a second lot of lamps submitted. These figures are interesting, as showing the thorough accuracy of the incandescent lamp and how it can be preserved for a long course of years and be depended upon. I think, in relation to the question that the committee suggested, as to knowing the horizontal candlepower, that a formula might be worked out by which the spherical candlepower can be expressed in terms of horizontal and end candlepower. One of our engineers, Mr. Marshall, has given me the terms of an empirical formula which he has been considering, which runs something like this:

$$\frac{\pi}{4}(\text{horizontal candlepower}) + 0.22\left(\frac{\text{end candlepower}}{\text{horizontal candlepower}}\right)^2$$

which gives the spherical candlepower for different types of filament. It is an easy thing to measure the horizontal candlepower; and the end candlepower can be measured by means of a gooseneck device, attached to the photometer. The lamp does not need to be revolved to get the true mean end candlepower. Thus, it may be practical to get at the spherical candlepower without the necessity for elaborate testing apparatus."

Wednesday Morning's Business.

Wednesday morning proved to be rainy, and this caused a change in the plans, the excursion to the Pan-American Exposition being postponed until Thursday afternoon.

Mr. Ayer presented the report of the committee on freight classification. He gave a history of the efforts to secure an equitable readjustment of the freight rates on electrical machinery. These efforts had been fruitless in the endeavor to remedy the unjust discrimination against electrical apparatus. Mr. Ayer suggested that a suit be brought in the United States courts to compel equitable treatment of electrical shippers under the interstate commerce laws. He thought that such a suit could not fail to be successful. Mr. Scovil of Cleveland and Mr. White of Cincinnati discussed the subject. The latter believed that each member of the association should endeavor to influence his local freight man and thus reach the classification committee ultimately. Mr. Ayer said that that had been tried without avail. The manufacturers stood ready to aid the association in a legal battle. On motion the committee was empowered to take whatever steps, legal or otherwise, that might be necessary to right the existing injustice. Mr. Tilden of New York, who has had experience in the matter, doubted whether the operations of the classification committee were constitutional.

H. W. Hillman of Schenectady, N. Y., read an interesting paper on "Arc Lighting at the Beginning of the Twentieth Century." The paper was discussed at some length by Messrs. Walton of Lorain, Ohio, Wagoner of Schenectady, Walker of Newcastle, Pa., Almert of Chicago, Phipps of New York, Brophy of Boston, Bechtel of Toledo, McCabe of Bloomsburg, Pa., and Kelsch of Montreal.

In Executive Session.

At the executive session the report of committee on legislative policy, of which Samuel Insull is chairman, was presented. The report of the committee was accepted and the committee continued for another year.

The report of the committee on amendments to by-laws was also presented and this committee was continued, the incoming president and first vice-president being added to the committee.

Election of Officers.

The following-named gentlemen were elected as officers for the ensuing year:

President—Henry L. Doherty, Denver, Colo.

First vice-president—Louis A. Ferguson, Chicago, Ill.

Second vice-president—Charles B. Hunt, London, Ont.

Members of the executive committee to serve dur-

ing three conventions—Charles L. Edgar, Boston, Mass.; D. P. Robinson, Seattle, Wash.; C. C. Howell, Knoxville, Tenn.

Members of the executive committee to serve during two conventions—E. L. Bemis, New Orleans, La.; Dudley Farrand, Newark, N. J.

Frederic Nicholls, Toronto, Canada, was elected an honorary member.

Wednesday Afternoon.

The session on Wednesday afternoon was opened with a discussion of Mr. Wallis' paper on the 4-C system of charging, which was read the day before. E. Slade of Quebec began the discussion, and he was followed by Mr. Wallis, President Cahoon, J. M. Walker of Newcastle, Pa., Mr. Thompson of Newcastle, Pa., Charles Price of New Bedford, Mass., Mr. Turner of Cleveland, F. E. Smith of Somerville, Mass., Edward L. Bailey of Dundee, N. Y., Mr. Drum of Terre Haute, Ind., and J. W. Sachs of New York city.

The second progress report of the committee for investigating the photometric values of arc lamps was next taken up. This committee made its first report at last year's convention of the association and at this meeting reported on the progress of the work during the last year. Professor C. P. Matthews of Purdue University, the photometrist of the committee, read the report, an abstract of which is presented elsewhere in this issue. A motion was carried to accept the report, to tender a vote of thanks to the committee for its good work, and that the committee be asked to continue the work until its completion. The report was discussed by Charles B. Price of New Bedford, Mass., Professor Goldsborough of Lafayette, Ind., Professor Matthews, Converse D. Marsh of New York city, Mr. Scovil of Cleveland, W. F. White of Cincinnati, and E. F. McCabe of Newcastle, Pa.

Captain William Brophy next presented the report of the committee on rules for electrical construction and operation. Captain Brophy also reported on the subject of the grounding of the neutral. Both reports were received and then the meeting adjourned.

Closing Session.

At the closing session of the convention on Thursday morning the report of Treasurer Porter showed a balance in the treasury of $6,001.64.

C. R. Van Trump of Wilmington, Del., read a paper on "A Station-load Diagram." This was followed by a discussion of steam heating from central stations, opened by C. R. Maunsell of the Topeka (Kan.) Edison Electric Illuminating company and Charles P. Weles of Towanda, Pa. Mr. Treadwell's paper, on "Storage Batteries in Central-station Work" was read by T. C. Martin, in the absence of the author. There was a spirited discussion of this paper, and at its conclusion the convention was adjourned.

Side Trips.

On Tuesday afternoon, immediately after adjournment, at the invitation of the Niagara Falls Power company, a number of the visitors inspected the power house of that company. The imposing row of 10 generators of 5,000 horsepower each, so clearly illustrated for the first time in the last issue of the Western Electrician, was viewed with admiration, while the switch galleries, transformer plant, aluminum conductors and old and new wheel pits were also viewed with the greatest interest. The engineers and employes of the company were very courteous and obliging in explaining the massive plant by which 50,000 horsepower of the force of the great cataract is transformed into electrical energy and sent out over wires for industrial use.

The evening entertainment of Tuesday was a trip over the "Great Gorge route" of electric railway to view the electrical illumination of the Whirlpool Rapids. The excursion was due to the courtesy of Mr. Godfrey Morgan, general manager of the Niagara Gorge Railroad company, and it was voted an unqualified success. There were three carloads of ladies and gentlemen in the party, and all were greatly pleased. The searchlight used to light up the wildly tossing waters of the rapids was mounted on a flat car and supplied with current from the trolley circuit through a motor-generator. Arc lamps were also mounted on the car to give, when desired, a more general illumination than that of the piercing beam of the projector. By colored-glass screens the color of the light was changed at will, and the effects secured were most beautiful and striking.

Thursday afternoon was devoted to an exodus to the Pan-American Exposition in Buffalo. A special New York Central train was provided, and nearly all the convention people embraced the opportunity to "do" the exposition in a body. The visitors found the exhibits still far from completion, especially in the Electricity and Machinery buildings, in which they were particularly interested. But there was much to see and admire, nevertheless. Nothing but lavish praise was bestowed upon the electrical illumination, which is the crowning and most beautiful feature of a beautiful exhibition.

Construction has begun on the Delaware and Northern Interurban Railway company's line, which is to extend from near Columbus, Ohio, to Marion, Ohio. The company has increased its capital stock from $10,000 to $1,000,000.

Members and Visitors.

Following is a list of the names of those in attendance at this week's convention of the National Electric Light association at Niagara Falls:

Ackerman, P. C., Rhode Island Electric Works.....New York
Adams, H. C., Jr., Phillips Insulated Wire company.....Pawtucket, R. I.
Adams, Mrs. H. C., Jr.....Pawtucket, R. I.
Allan, Charles M., Fulton County Gas and Electric company.....Gloversville, N. Y.
Almert, Harold, electrical superintendent, Lincoln Park.....Chicago
Anthony, W. N., Chicago Edison company.....Chicago
Anthony, Mrs. W. N.....Chicago
Armstrong, W. C., Westinghouse Electric and Manufacturing company.....Detroit, Mich.
Atterbury, G. W., Chicago Boiler Cleaner company.....Chicago
Austin, Charles H., Charles H. Austin Electric company.....Nashua, N. H.
Austin, M. B.....Chicago
Ayer, James I., Simplex Electrical company.....Boston
Babson, A. D., General Electric company.....Schenectady, N. Y.
Bailey, George C., John A. Roebling's Sons company.....Chicago
Bailey, Edward L., Dundee electric light plant.....Dundee, N. Y.
Baker, C. O., Jr., Baker & Co.....New York
Baker, Miss H. Lavinia.....Newark, N. J.
Baker, C. W., Baker & Co.....Newark, N. J.
Baker, Mrs. C. W.....Newark, N. J.
Baldwin, Miss Julia R.....New York
Baldwin, H. C., Edison Electric Illuminating company.....West Chester, Pa.
Ball, Henry Price, General Incandescent Arc Light company.....New York
Barkelen, Charles H., Barkelen Electric Manufacturing company.....Middletown, Ohio
Barnard, B. S., American Vitrified Conduit company.....New York
Barnard, Miss Helen.....New York
Barnes, Frank O., Marlboro Electric company.....Marlboro, Mass.
Barney, C. H., Monarch Fire Appliance company.....New York
Barr, Edward H., Westmoreland Light, Heat and Power company.....Greensburg, Pa.
Beam, E. E. Ashtabula lighting plant....Ashtabula, Ohio
Beaman, David W., New Bedford Gas and Edison Light company.....New Bedford, Mass.
Beard, W. K., American Electrician.....Philadelphia
Beard, Mrs. W. K.....Philadelphia
Bechtel, E. J., Toledo Consolidated Electric company.....Toledo, Ohio
Benbow, William C.....Columbus, Ohio
Benham, W. C., W. C. Benham company.....Columbus, Ohio
Bergthal, Edward, H. W. Johns company.....New York
Berry, A. Hall, H. W. Johns Manufacturing company.....New York
Bibber, Charles E., Stanley Electric Manufacturing company.....New York
Biggar, E. B., Canadian Engineer.....Toronto, Canada
Billings, Miss H.....New York
Bishop, Charles R., American District Steam company.....Lockport, N. Y.
Blizard, Charles, Electric Storage Battery company.....Philadelphia
Bolles, Frank G., Bullock Electric Manufacturing company.....Cincinnati, Ohio
Bosley, Arthur L., Electrical Material company.....Baltimore, Md.
Bottomley, H., Fall Mountain Electric Light and Power company.....Bellows Falls, Vt.
Bowman, M. P., John A. Roebling's Sons company.....Cleveland, Ohio
Bradley, J. M., Consolidated Electric company.....Birmingham, Ala.
Brady, Paul T., Westinghouse Electric and Manufacturing company.....Syracuse, N. Y.
Braugh, Paul H., Heine Safety Boiler company.....New York
Brooks, John, Pass & Seymour.....Chicago
Brophy, Captain William, Edison Electric Illuminating company.....Boston, Mass.
Bryan, O. J., Dale company.....New York
Bullen, D. B., General Electric company.....Boston
Bundy, H. J., General Electric company....Philadelphia
Cadwell, George J., Christensen Engineering company.....Milwaukee, Wis.
Cahoon, James B.....New York
Cain, J., Jr., Franklin Electric Manufacturing company.....Hartford, Conn.
Caldwell, R. L., E. B. Latham & Co.....New York
Carrier, A. E., National Carbon company.....New York
Chamberlain, R. H., Gould Storage Battery company.....New York
Child, Charles T., Electrical Review.....New York
Clark, A. T., American Circular Loom company..Boston
Clark, Mrs. A. T.....Boston
Clark, Frank H., Helios-Upton company.....Chicago
Clifford, A. E., American Electrician.....New York
Clifford, Mrs. A. E.....New York
Cobb, C. W., Chicago Mica company....Valparaiso, Ind.
Coghlin, J. P., Page Electric company.....Worcester, Mass.
Coghlin, Mrs. J. P.....Worcester, Mass.
Coie, John R., New York Insulated Wire company.....San Francisco, Cal.
Coles, Stephen L., Shaughnessy Agency.....New York
Condit, S. B., Jr., S. B. Condit, Jr., company.....Boston
Corey, R. B., American Circular Loom company.....New York
Cotabish, N. C., National Carbon company.....Cleveland, Ohio
Coughlin, W. H., Worcester Electric Light company.....Worcester, Mass.
Cravath, J. R., Electrical World and Engineer...Chicago
Crawford, R., Stamford Gas and Electric company.....Stamford, Conn.
Crider, J. M., Carlisle Gas and Water company..Carlisle, Pa.
Crider, J. S., Washington Carbon company.....Pittsburg, Pa.
Cross, Alfred B., General Electric company..Lynn, Mass.
Crossman, T. E.....New York
Crouse, J. B., The Crouse-Tremaine Carbon company.....Fostoria, Ohio
Curtis, G.....Hartford, Conn.
Cushing, L. K., Illinois Electric company.....Chicago
Dale, John H., Dale company.....New York
Davidson, J. E., Excelsior Electric company.....Port Huron, Mich.
Davis, Charles B., Standard Chemical company..Boston
Davis, George E., Electric Motor and Equipment company.....Newark, N. J.
De Camp, H. C., John A. Roebling's Sons company.....Boston, Mass.
Decker, E. L., American Circular Loom company.....Somerville, Pa.
Decker, Mrs. E. L.....Somerville, Pa.
Deeds, E. A., chief engineer, Natural Food company.....Niagara Falls
Deming, W. M., General Electric company..Atlanta, Ga.
Deming, Mrs. W. M.....Atlanta, Ga.
Donaldson, William W., Gould Storage Battery company.....New York
Donohoe, F. E., American Electrical Works.....Chicago
Downer, J. G., Western Electrician.....Chicago
Dresser, A. E., Fort Wayne Electric Works.....Syracuse, N. Y.
Drum, A. L., Terre Haute Electric company.....Terre Haute, Ind.
Dunlap, Orrin E.....Niagara Falls, N. Y.
Duseman, J. F., Edison Electric Light company..York, Pa.
Eckert, A. P., Safety Insulated Wire and Cable company.....New York
Edgar, H. T., Lowell Electric Light Corporation..Lowell, Mass.
Edgar, C. L., Edison Electric Illuminating company.....Boston, Mass.
Edie, J. A.....Baltimore
Eldredge, George L. R., Acme Switch company..Hartford, Conn.
Elliott, Thomas, Atlanta Railway and Power company.....Atlanta, Ga.
Emory, R., Cumberland Electric Light and Power company.....Nashville, Tenn.
Emory, Mrs. R.....Nashville, Tenn.
Evert, H. C., Westinghouse Electric and Manufacturing company.....Pittsburg, Pa.
Fairbanks, H. H., Worcester Electric Light company.....Worcester, Mass.
Fisher, E. A.....Rochester, N. Y.
Fleming, R., General Electric company.....Lyn, Mass.
Fletcher, P. M., Western Electric company....New York
Fogarty, M. J., Erie company.....Erie, Pa.
Gaffney, John J., United Electric Light company.....Newark, N. J.
Gale, F. H.....Schenectady, N. Y.
Gartland, C. C., Sioux City Electric company....Sioux City, Iowa
Garrison, A. C., The Columbia Incandescent Lamp company.....St. Louis, Mo.
Goddard, Stephen H., Electrical Review.....New York
Godfrey, J. W.....New York
Godfrey, Miss Pearl.....New York
Goldsborough, W. E., Purdue University..Lafayette, Ind.
Golding, F. H., Branford Lighting and Water company.....Branford, Conn.
Grier, T. G., American Circular Loom company..Chicago
Griffin, G. B., Manhattan General Construction company.....Boston, Mass.
Griswold, J. P., Edison Electric Illuminating company.....Topeka, Kan.
Habirshaw, Dr. William, India Rubber and Gutta Percha Insulating company.....New York
Hall, Andrew F., Gas and Electric company.....Southbridge, Mass.
Hamilton, R. B., Packard Electric company.....St. Catharines, Ontario
Hanley, W. J., General Electric company.....Cincinnati, Ohio
Harrington, F. W., John A. Roebling's Sons company.....New York
Harvey, A. W., Charles A. Schieren & Co.....New York
Hatch, B. B., City of Boston, Public Buildings Department.....Boston
Hawkins, F. M., Pass & Seymour.....Syracuse, N. Y.
Henderson, Alexander, Sprague Electric company.....New York
Hewitt, C. F., Elkhart Electric company....Elkhart, Ind.
Hill, Mr. and Mrs. J. M.....New York
Hillman, H. W., General Electric company.....Schenectady, N. Y.
Hills, C. I., H. T. Paiste company.....New York
Hinds, J. L.....Syracuse, N. Y.
Hires, B. F., Bridgeton Electric company.....Bridgeton, N. J.
Hires, Mrs. B. F.....Bridgeton, N. J.
Hoag, George M., city electrician.....Cleveland, Ohio
Hodgson, Joseph E., Westchester Lighting company.....Mount Vernon, N. Y.
Holmes, R. G. P., Chicago Edison company.....Chicago
Hover, P. H., New York Insulated Wire company.....New York
Hubbard, William C., Manhattan General Construction company.....New York
Hubbard, Mrs. William C.....New York
Hubley, G. Wilbur, Louisville Electric Light company.....Louisville, Ky.
Hughes, T. E., Standard Underground Cable company.....Philadelphia
Humphrey, H. H., electrical engineer.....St. Louis, Mo.
Hunt, Charles B., London Electric company.....London, Ontario
Hunt, Miss Anita.....London, Ont.
Huntley, Charles R., Buffalo General Electric company.....Buffalo, N. Y.
Insull, Samuel, Chicago Edison company.....Chicago
Insull, Mrs. Samuel.....Chicago
Insull, Joseph, General Incandescent Lamp company.....Cleveland, Ohio
Issertel, Henry G., Sprague Electric company.....New York
Ivins, D. F., John A. Roebling's Sons company..Trenton, N. J.
Jackson, W. B., Stanley Electric Manufacturing company.....Pittsfield, Mass.
Jewett, F. N., Evans Hot Water Heating company.....Chicago
Johns, S. C. D., Cleveland Electric Illuminating company.....Cleveland, Ohio
Johns, Miss Mabelle.....Cleveland, Ohio
Johns, Mrs. S. C. D.....Cleveland, Ohio
Jones, H. Whitford, Electric Supply and Manufacturing company.....Cleveland, Ohio
Judge, John R., General Electric company.....Baltimore, Md.
Keeney, Seth L.....Brooklyn
Kelly, W. E., Western Electrician.....Chicago
Kellogg, E. W., Frank Ridlon company.....Boston
Kelsch, R. S., Lachine Rapids Hydraulic and Land company.....Montreal
Kenfield, Fred S., Street Railway Review.....Chicago
Kenney, W. R., Westmoreland Electric company..Greensburg, Pa.
Kenyon, B. C., Diehl Manufacturing company..New York
Kerr, Frank R., Capital Electric Light, Motor and Gas company.....Boise, Idaho
Kirkland, H. B., American Circular Loom company.....New York
Kirkpatrick, E. F., McRoy Clay Works.....Chicago
Kreidler, W. A., Western Electrician.....Chicago
Kreidler, Mrs. W. A.....Chicago
Kuehmsted, A. O., Gregory Electric company....Chicago
Lampson, J. H., Jr., Thompson, Son & Co.....New York
Landis, H. G., Electric Supply and Construction company.....Wichita, Kan.
Lane, Winfield S., Irwin Electric Light and Power company.....Greensburg, Pa.
Lane, T. H., Warren Electric and Specialty company.....Warren, Ohio
Lardner, Henry A., Imperial Electric Light and Power company.....St. Louis, Mo.
La Sicla, Louis, Baker & Co.....Newark, N. J.
Learned, Waldo A., Newton and Watertown Gas company.....Newton, Mass.
Leonard, A. W., Edison Electric Illuminating company.....Brockton, Mass.
Leslie, E. A., Edison Electric Illuminating company.....New York
Leslie, Mrs. E. A.....New York
Leslie, Miss.....New York
Leslie, E. A., Jr.....New York
Lott, J. C., Fort Wayne Electric Works.....New York
Lovejoy, J. P., Schenectady Electric Illuminating company.....Schenectady, N. Y.

McCabe, E. F., American Electric Light company ..... Bloomsburg, Pa.
McCarty, Norman, United States Carbon company ..... New York
McCormack, E. D., Canadian General Electric company ..... Toronto
McDonald, W. D., Baltimore and Ohio Railroad company ..... Baltimore, Md.
McKinlock, George A., Central Electric company ..... Chicago
McManigal, W. J., New Omaha Thomson-Houston Electric Light company ..... Omaha, Neb.
McQuaide, James P., National Conduit and Cable company ..... New York
MacLean, A. J., National Conduit and Cable company ..... New York
Manson, George T., Okonite company ..... New York
Manson, D. E., Westinghouse Electric and Manufacturing company ..... New Haven, Mass
Manwaring, A. H., Brush Electric Light company ..... Philadelphia
Marsh, Charles J., Standard Underground Cable company ..... New York
Martin, T. C., Electrical World and Engineer ..... New York
Martin, Mrs. T. C. ..... New York
Matthews, C. P., Purdue University ..... Lafayette, Ind.
Mausseil, C. R., Edison Electric Illuminating company ..... Topeka, Kan.
Meister, John D., American Electrician ..... Chicago
Mereein, Thomas R., secretary, Northwestern Electrical association ..... Milwaukee, Wis.
Meyer, Albert, Crescent Manufacturing company ..... Chicago
Miller, John H., Springfield Light and Power company ..... Springfield, Ohio
Minkwitz, Herman, Meriden Electric Light company ..... Meriden, Conn.
Money, C. W. N., New England Electric Manufacturing company ..... Boston
Moore, A. P., Chase-Shawmut company ..... Boston
Moore, W. E., Augusta Railway and Electric company ..... Augusta, Ga.
Morrow, E. C., Walla Walla Gas and Electric company ..... Walla Walla, Wash.
Mulin, E. H., General Electric company ..... New York
Munder, C. F., Munder Electrical Works ..... Springfield, Mass.
Munder, Mrs. C. F. ..... Springfield, Mass.
Murphy, John, Ottawa Electric company ..... Ottawa, Ontario
Nathan, Marcus ..... New York
Nathan, Hyam ..... New York
Nicholls, H. G., Canadian General Electric company ..... Toronto
Nicholls, Frederic, General Electric Construction company ..... Toronto
Nichols, Edward L., Cornell University ..... Ithaca, N. Y.
Ochs, S. O. ..... New York
Olney, George H. (second), E. F. Phillips Electric Works ..... Montreal, Canada
Orr, W. V., Adams-Bagnall Electric company ..... Cleveland, Ohio
Ott, B. F., Franklin Electric company ..... Franklin, Pa.
Packard, W. D., New York and Ohio company ..... Warren, Ohio
Page, A. D., General Electric company ..... Newark, N. J.
Parker, H. L., The Emerson Electric Manufacturing company ..... St. Louis, Mo.
Patterson, A. H. ..... New York
Perkey, H. D., Page Electric company ..... Worcester, Mass.
Perry, Frank L., Western Electrician ..... Chicago
Perry, Mrs. Frank L. ..... Chicago
Phelps, W. J., Phelps company ..... Detroit, Mich.
Phillips, E. F., Peninsular Electric Light company ..... Detroit, Mich.
Phipps, C. W., General Electric company ..... New York
Pierce, Henry A., Pawtucket Electric company ..... Pawtucket, R. I.
Pomeroy, J. G., Adams-Bagnall company ..... Chicago
Poole, Cecil P., American Electrician ..... New York
Porter, William M., Lea Electric Manufacturing company ..... Elwood, Ind.
Porter, George F. ..... New York
Powell, G. A., Packard Electric company ..... St. Catharines, Ontario
Price, Charles R., New Bedford Gas and Edison Light company ..... New Bedford, Mass.
Purdy, C. J., Northwest Fixture company ..... New York
Pyle, James E., Edison Electric Illuminating company ..... West Chester, Pa.
Ramsey, Charles E., Carlisle Gas and Water company ..... Carlisle, Pa.
Redman, George A., Rochester Gas and Electric company ..... Rochester, N. Y.
Rice, C. W., Edison Electric Illuminating company ..... New York
Richardson, C. O. ..... Baltimore
Robinson, D. P., Seattle Electric company ..... Seattle, Wash.
Rockafellow, E. W., Western Electric company ..... New York
Rollins, R. W., Hartford Electric Light company ..... Hartford, Conn.
Rossman, J. G., Georgia Electric Light company ..... Atlanta, Ga.
Ruth, Edward D., Lancaster Electric Light, Heat and Power company ..... Lancaster, Pa.
Ryan, W. D. A., General Electric company ..... Lynn, Mass.
Sachs, Joseph, H. W. Johns Manufacturing company ..... New York
Sadler, G. L., Nashua Light, Heat and Power company ..... Nashua, N. H.
Salisbury, B. E., Pass & Seymour ..... Syracuse, N. Y.
Schwarm, C. A., Lorain Gas company ..... Lorain, Ohio
Scott, Charles E., Bristol Electric Light and Power company ..... Bristol, Pa.
Scott, Mrs. Charles E. ..... Bristol, Pa.
Scott, Miss Helen ..... Bristol, Pa.
Scott, Charles F., Westinghouse Electric and Manufacturing company ..... Pittsburg, Pa.
Scovil, Mrs. Samuel ..... Cleveland, Ohio
Scribner, J., General Electric company ..... Chicago
Seymour, F. P. ..... Hartford, Conn.
Shainwald, J. C., Standard Paint company ..... Chicago
Shaughnessy, M. J., Shaughnessy Agency ..... New York
Shippy, H. L., John A. Roebling's Sons company ..... New York
Slade, Edward, Jacques Cartier Water Power company ..... Quebec
Smith, Orin, Jr., Pawtucket Electric company ..... Pawtucket, R. I.
Smith, F. Ellwood, Somerville Electric Light company ..... West Somerville, Mass.
Solomon, John I., General Electric company ..... New York
Speer, J. S., Speer Carbon company ..... St. Marys, Pa.
Stieringer, Luther ..... New York
Sutter, F. C., Pittsburg Transformer company ..... Pittsburg, Pa.
Swan, G. W., John A. Roebling's Sons company ..... New York
Taylor, Frank H., Westinghouse Electric and Manufacturing company ..... Pittsburg
Taylor, Mrs. Frank H. ..... Pittsburg
Taylor, Albert, Electric Storage Battery company ..... New York
Terry, F. S., Sunbeam Incandescent Lamp company ..... New York
Thompson, Gaylord, New Castle Electric company ..... New Castle, Pa.
Tilden, P. S. ..... New York
Tilden, Mrs. P. S. ..... New York
Tingley, E. M., Westinghouse Electric and Manufacturing company ..... Pittsburg, Pa.
Titzell, W. W., United Electric company of New Jersey ..... Jersey City, N. J.
Titzel, C. Edgar, Edison Electric Illuminating company ..... Lancaster, Pa.
Tonkin, W. J., Ansonia Electrical company ..... Ansonia, Conn.
Townley, Calvert, Westinghouse Electric and Manufacturing company ..... Boston
Tremaine, H. A., Crouse-Tremaine Carbon company ..... Fostoria, Ohio
Tripp, George B., Cleveland Electric Illuminating company ..... Cleveland, Ohio
Tripp, George E., Edison Electric company ..... Savannah, Ga.
Turner, M. E., Cleveland Electric Illuminating company ..... Cleveland, Ohio
Vandewater, P. P., Standard Paint company ..... New York
Wagner, Herbert A., Edison Electric Illuminating company ..... Boston, Mass.
Wagoner, P. D., General Electric company ..... Schenectady, N. Y.
Wakeman, J. M., Electrical World and Engineer ..... New York
Wakeman, Mrs. J. M. ..... New York
Walden, A. E., Elmira Water, Light and Railroad company ..... Elmira, N. Y.
Walker, J. M., New Castle Electric company ..... New Castle, Pa.
Walker, Edward T., Electrical World and Engineer ..... Boston
Wallis, Louis R., Woburn Light, Heat and Power company ..... Woburn, Mass.
Walton, A. B., Lorain Gas company ..... Lorain, Ohio
Warner, R. L., Westinghouse Electric and Manufacturing company ..... Boston, Mass.
Watson, W. J., American Electrical Works ..... New York
Watts, Henry, Sawyer-Man Electric company ..... Buffalo, N. Y.
Wattson, A. S., General Electric company ..... Pittsburg, Pa.
Way, S. B., Imperial Electric Light, Heat and Power company ..... St. Louis, Mo.
Weaver, A. B., stenographer ..... Buffalo, N. Y.
Weis, August, Johnstown Electric Light company ..... Johnstown, Pa.
Wells, C. P., Towanda Electric Illuminating company ..... Towanda, Pa.
White, W. F., Cincinnati Edison Electric company ..... Cincinnati, Ohio
White, Mrs. W. F. ..... Cincinnati, Ohio
White, Frank R. ..... New York
Whiting, Charles B. ..... Hartford, Conn.
Whittemore, C. McK. ..... Elizabeth, N. J.
Wilson, J. L., American Circular Loom company ..... Boston
Wilson, Mrs. J. L. ..... Boston
Wolff, James, New York Insulated Wire company ..... Chicago
Wood, E. E., American Electrician ..... New York
Wood, Mrs. E. E. ..... New York
Wood, T. E., George M. Gest ..... Cincinnati and New York
Woodruff, E., Atlanta Railway and Power company ..... Atlanta, Ga.
Woodruff, Mrs. E. ..... Atlanta, Ga.
Wormley, James C., Shelby Electric company ..... New York
Wright, H. A., Lowell Electric Light Corporation ..... Lowell, Mass.
Wright, A. H., Otis Elevator company ..... Cleveland, Ohio
Wright, Peter, Norfolk Railway and Light company ..... Norfolk, Va.
Wyant, Robert E., Derby Gas company ..... Derby, Conn.
Wyant, Mrs. Robert E. ..... Derby, Conn.
Young, H. Wilson, H. W. Johns company ..... New York
Young, S. Marsh, Manhattan Electric Construction company ..... New York
Young, Mrs. S. Marsh ..... New York

Convention Notes.

About the interesting line of samples of the H. W. Johns company hovered A. Hall Berry.

Mr. Scofield of the Bossert Electric Construction company of Utica was at the convention.

One of the Sprague Electric Manufacturing company's representatives was Alex Henderson.

P. C. Ackerman of the Rhode Island Electric Works, New York, was, of course, on hand.

J. W. Godfrey of Habirshaw wire was accompanied by Mrs. Godfrey and Miss Pearl Godfrey.

Western Manager George C. Bailey of Roebling's Chicago establishment came early and stayed late.

General Manager Joseph Insull of the G. I. company's incandescent-lamp factory was in attendance.

Secretary Thomas R. Mercein, representing the Northwestern Electrical association, was in attendance.

John R. Cole, manufacturer's agent of San Francisco, came a long way, and was proportionately welcomed.

Lieutenant Cahoon made a prompt and energetic presiding officer and pushed the programme through in fine shape.

The Sprague Electric company of New York found an indefatigable representative in the person of Henry G. Issertel.

Carlisle, Pa., sent a handsome representative, in the person of Manager C. E. Ramsey of the Carlisle Gas and Water company.

The H. W. Johns Manufacturing company presented an interesting line of samples, handsomely displayed and backed by Joseph Sachs.

J. M. Hill of automobile fame could not resist the temptation to drop in at the Niagara meeting, and this time Mrs. Hill accompanied him.

The small number of exhibits at the convention was noticeable. Many of the usual exhibitors relied on their displays at the Buffalo exposition.

An interesting exhibit of the American Vitrified Conduit company was presented on the porch of the International Hotel by A. S. Barnard.

A. P. Moore, the courteous assistant of President Sprague of the Chase-Shawmut company of Boston, Mass., used his well-known smile to great advantage.

Sears B. Condit, Jr., was seen everywhere with Mr. "Dixon" of New Orleans; in fact, the two were inseparable; so much so that they soon were called the twins. Mr. "Dixon" will visit Boston with Mr. Condit.

The Sawyer-Man Electric company sent from New York C. S. Jennings, from Pittsburg Frank S. Smith and G. A. Nellis, and from Buffalo, Henry Watts.

W. B. Jackson and James E. Bibber of the Stanley Electric Manufacturing company came to the convention, respectively, from Pittsfield, Mass., and New York.

Was there ever a convention at which President McQuaide of the National Conduit and Cable company did not appear? Mr. McQuaide was at this one in full force.

Marcus Nathan of New York city, who has achieved such an enviable popularity as the manager of electrical and other technical exhibitions, was, of course, in attendance.

In proportion to the total attendance, the number of ladies present was large. The attractions of the Falls and vicinity furnished plenty of entertainment for visitors of the fair sex.

That genial member, J. H. Thompson, Jr., of the well-known machinery house of Thompson, Son & Co., New York, could not resist the temptation; he came early and stayed late.

President Samuel Insull, Comptroller W. M. Anthony and Purchasing Agent R. C. P. Holmes represented the Chicago Edison company. Mr. Insull was accompanied by Mrs. Insull.

John A. Roebling's Sons company showed its strength by the following list of names: G. W. Swan, George C. Bailey, H. L. Shippy, F. W. Harrington, D. F. Ivins, H. C. De Camp.

Philip H. Hover of New York and James Wolff of Chicago represented the New York Insulated Wire company, and made a good job of it. Both are popular and welcome convention attendants.

F. C. Sutter of the Pittsburg Transformer company of Pittsburg, Pa., stole a few days from his very busy factory in Pittsburg and "mixed" with those in the rotunda of the International Hotel.

Francis H. Wall, general sales agent of the Stanley Instrument company's New York office, was unable to attend, but his representative, Samuel O. Ochs, did the honors in his stead, and did them nobly.

The International Hotel was practically given over to the electric-light people during the three days of the convention. Manager Greenwood exerted every effort to make his guests comfortable, and he succeeded.

The Gould Storage Battery company of New York had another representative, in addition to Electrical Engineer Donaldson. R. H. Chamberlain aided Mr. Donaldson in presenting his interesting exhibit.

The American District Steam company of Lockport, N. Y., sent a good representative, in the person of Charles R. Bishop, who had no difficulty in explaining how his system turned waste steam into gold dollars.

F. W. Harrington of New York, an old hand at electric-light conventions, did not fail to mingle with the crowd at the International. Mr. Harrington is with the Roeblings company, and he was decidedly "in the push."

Among the carbon companies that realize the feature of advertising was the Standard Carbon company. Messrs. F. H. McDowell, J. C. Irvine and A. D. Spear left no stone unturned to further the interests of their company.

Manager of Advertising N. C. Cotabish, who deals out publicity in such skillful manner for the National Carbon company of Cleveland, Ohio, made good use of the present opportunity, in company with F. C. Park, F. H. Murray and A. E. Carrier.

Luther Stieringer, the artist in illumination, was there, of course. Mr. Stieringer rarely misses an important electrical convention, and this time he was a lion of the first quality, owing to his great success with the electric lighting at the Pan-American.

C. O. Baker, Jr., of Baker & Co., the well-known platinum men of New York city, earned his usual vote of thanks as master of transportation for the East. Mr. Baker was indefatigable in his attention to every inquiry relative to convention matters.

That experienced storage-battery man, Frank H. Clark of Chicago, made this, his first convention trip, on behalf of his new connection with the Helios-Upton company. Mr. Clark has recently accepted the position of western manager of this company.

Electrical Engineer Herbert A. Wagner came early and stayed late. Mr. Wagner, since devoting himself strictly to consulting-engineer work, has accumulated so large a clientage that the necessity has arisen for the establishment of a New York office.

General Manager S. Marsh Young of the Manhattan Electric Construction company of New York was early on hand, and this time had the forethought to bring with him Mrs. Young. As this was Mrs. Young's first convention, it not only gave her an opportunity to judge of the mysteries of these periods of work and play, but likewise gave her a

chance to take in the beauties of the Buffalo Exposition.

The Fort Wayne Electric Works did itself proud in the respective persons of A. E. Dresser of its Syracuse office and the eastern manager, J. C. Lott of the New York office. Messrs. Lott and Dresser were two of the most popular men at the convention.

President Pease of Hart & Hegeman was the only one that appeared from Hartford, Conn., but his ubiquitous western representative, George C. Searing of Chicago, looked out for the western contingent with the delightful urbanity for which he is noted.

Since one convention, about five years ago, Secretary and Treasurer A. C. Garrison of the Columbia Incandescent Lamp company of St. Louis, Mo., has never missed a convention, either National or Northwestern, and this occasion was no exception to the rule.

It was a matter of great regret that Manager of Sales Harris of the Manhattan Electric Construction company could not accompany General Manager S. Marsh Young. However, William C. Hubbard came on from New York city, accompanied by Mrs. Hubbard.

The Okonite company of New York sent one "leaf" of its good-luck clover spray to the convention in the person of Mr. George Manson. There were many inquiries for Mr. Candee. George A. McKinlock of the Central Electric company came in on Wednesday.

Manager W. J. Phelps of the Phelps company of Detroit talked Hylo lamps and the "baby filament" from noon until night. If that "baby" keeps on selling as has been the case lately, Mr. Phelps will have to get a new name, indicative of manhood, rather than infancy.

St. Louis came to the front in the person of President H. L. Parker of the Emerson Electric Manufacturing company. Mr. Parker has earned—by his courteous and kindly treatment—the good wishes of every man on the road that has occasion to visit his office in St. Louis.

James C. Wormley, manager of the eastern department of the Shelby Electric company of Shelby, Ohio, attended the convention with Mrs. Wormley. Mr. Wormley's office is in New York, but he forgot neither his old Chicago friends and acquaintances nor the extolling of the Shelby lamp.

Vice-president Charles W. Cobb of the Chicago Mica company was, of course, in attendance. For many years Mr. Cobb traveled the entire western country in the supply business, and he knows full well the advantage of mingling with old friends at a convention. Mr. Cobb was warmly welcomed.

Simplex electrical company of Boston, Mass., sent a weighty representative in the person of James I. Ayer. Mr. Ayer has now been East for a number of years, but there are still hundreds of electric-light men who can never forget his hospitality during the St. Louis convention of six or eight years ago.

The Standard Paint company and P. & B. came to the front in the persons of President Ralph L. Shainwald and F. F. Vandewater of New York. In addition to these gentlemen, Western Manager J. C. Shainwald came down with the Chicago contingent. Mr. Shainwald gave away a very pretty paper-cutter souvenir.

Ravenna, Ohio, was well represented in the person of Vice-president E. E. Nash of the Colonial Electric company and J. B. Estabrook. Incidentally, it may be said that the smile of the last-named gentleman has done much toward convincing the electrical trade of the fact that Colonial lamps are "of the very best."

Jesse Scribner, that energetic and indefatigable right-hand man to Western Manager B. E. Sunny of the Chicago office of the General Electric company, did very good duty on behalf of his chief, who was unavoidably prevented from being on hand by an absence in the East. Mrs. Scribner accompanied him.

The Standard Underground Cable company of Pittsburg was well represented in the persons of Vice-president and General Manager James W. Marsh, C. J. Marsh of New York, manager of the eastern and northeastern sales departments, and T. E. Hughes of the southeastern sales department of Philadelphia.

Naturally, J. G. Pomeroy of the Adams-Bagnall Electric company's Chicago office was early in evidence. Mr. Pomeroy had his laugh, as well as his lamp, with him, but only a select few heard anything of the former. It was a matter of regret that neither Mr. Adams nor Mr. Bagnall could find time to come from Cleveland.

Manager William M. Porter of the Lea Electric Manufacturing company came on from Elwood, Ind., and was accompanied by Mrs. Porter. Mr. Porter is one of the most experienced men in the electrical business. Realizing the kind of entertainment most appreciated by convention people, he brought with him a quartet of singers, which was much appreciated by music lovers. The quartet consisted of Raymond Hurst, Charles Hardting, Charles Kramer and Will H. Falls, from the Lea establishment in Elwood.

Of course Dr. William Habirshaw and General Sales Agent James W. Godfrey were on hand early from New York city, to do the honors for Habirshaw wire. Dr. Habirshaw came up on the Empire State Express Monday afternoon, reaching Niagara in time for supper. Mr. Godfrey appeared the following morning.

The American Circular Loom company put up a solid and handsome front, as is indicated by the following list of names of ladies and gentlemen that came on to take in the convention and likewise the exposition: Mr. and Mrs. A. T. Clark, Mr. and Mrs. J. S. Wilson, H. B. Kirkland, R. B. Corey, Thomas G. Grier, J. R. Cole.

Among the first arrivals were Secretary George F. Porter and Miss Harriet Billings, the assistant secretary. As usual, Mr. Porter was the mainspring of the working action of the convention, while Miss Billings, with gracious manner and cordial address, ably seconded the secretary's efforts to make all details of the meeting successful.

One of those ever welcome at every convention is B. C. Kenyon, general manager of the Diehl Manufacturing company of Elizabethport, N. J. Mr. Kenyon is well known as having done so much in the successful handling of the Diehl company's business; in fact, someone has remarked that Diehl and Kenyon are names practically synonymous.

Once a sunbeam, always a sunbeam, might be aptly applied to F. S. Terry, for the convention of 1901 found him once more pushing the trademark that he created so many years ago. Mr. Terry, as is now well known, is once more in the lamp business, and rumor says he is making himself felt in a manner that before long may startle the trade.

One of the most interesting little exhibits was made by the O. C. Little Pulley Coating company of Menasha, Wis. Mr. Little was on hand himself to explain things. The little mechanism consisted of a mechanical illustration of the comparative values of the Little pulley coating as compared with a belt drawn over the face of an ordinary cast-iron pulley.

A. Meyer of the Crescent Manufacturing company of Chicago made a very interesting exhibit on Wednesday. Mr. Meyer has had remarkable success with his Universal cord spools, and it is said that he has established relations with at least one foreign house to handle his specialty across the water. Mr. Meyer shortly expects to put on the market a new battery.

General Sales Agent Norman McCarty of the United States Carbon company was early in attendance. The United States Carbon company, under the receiver, is still pushing aggressively for business, and with the numerous connections which Mr. McCarty has already established among his host of acquaintances in the United States, it is safe to say he will continue to do a most excellent business.

Assistant General Manager C. H. Barney of the Monarch Fire Appliance company of New York did the honors and incidentally cast about the rotunda a little advertising "flyer" that gave a list of prominent electrical concerns that have realized the great merits of Kilfyre. Anyone that thinks that Kilfyre is not appreciated as a dry fire extinguisher should read this list; it will open his eyes.

To say that the General Electric company sent the following representatives is sufficient to indicate that company's interest in the convention: J. R. Lovejoy, railroad, light and supply department; W. R. Ernest, engineer, electric-light department; A. Page, manager, Edison lamp sales; F. W. Wilcox, home works; E. A. Carolan, assistant general manager, foreign department; N. A. Oudin, engineering department.

The sweet smile of H. C. Adams, Jr., that has been the means of mobilizing such a large business within the walls of the Phillips Insulated Wire company of Pawtucket, R. I., was, as usual, seen flitting through the crowd and hovering momentarily over the head of almost every convention delegate. In addition to the "smile," Mr. Adams brought with him this time another and greater attraction, in the person of Mrs. Adams.

That new specialty of the Electric Motor Equipment company of Newark, N. J., was explained by George E. Davis, who came on from Newark with a full line of samples. The specialty referred to is a new arrangement whereby lamp sockets can be linked together in a most convenient and flexible manner for the production of advertising signs. Those interested in such devices should get that company's descriptive circular.

Western Manager F. E. Donohoe of Chicago again proudly carried the flag for the American Electrical Works of Providence, R. I.; in his left hand, however, Mr. Donohoe gleefully waved a telegraphic message that announced his re-election as "mayor of Edgewater." Honors never come singly, for it is a fact that the American Electrical Works, during the last year, and under the management of Mr. Donaldson, have never done a larger business.

One of the best workers in the interests of his institution was C. W. Money of the New England Electric Manufacturing company of Boston. It is rumored that Mr. Money sold a large bill of goods to a "Mr. Dixon of New Orleans." The question is now asked whether Money got "Dixon" or "Dixon" got the "money," or was it that Money didn't talk and "Dixon" did. Any way you fix it, Money sawed wood, and doubtless his house has seen some of the sawdust.

Among those warmly welcomed was President A. O. Kuehmsted of the Gregory Electric company of Chicago. Mr. Kuehmsted's business in machines that are "not exactly new, but just as good," is now so well established that it is safe to say that there is no one in the electric-lighting business that has not, at one time or another, corresponded with the big Canal street establishment in Chicago. He has a host of friends that know how to appreciate the square dealings of his concern.

Among those skilled gentlemen who devote themselves strictly to the publicity departments of the electrical companies that graced the convention of 1901 should be mentioned Manager Frank G. Bolles of the Bullock Electric Manufacturing company, Cincinnati, and the Wagner Electric Manufacturing company of St. Louis. In addition to Mr. Bolles, the above companies were also represented by District Manager Francis B. Smith of Buffalo and Electrical Engineer Belknap of the same district.

President John T. McRoy of the McRoy Clay Works and manufacturer of the McRoy conduits, nowadays often referred to as "the" conduit man, appeared in the rotunda on Tuesday morning, accompanied by Mr. Kirkpatrick. Mr. Kirkpatrick has recently been appointed by Mr. McRoy as manager of his western department, and rumor has said that "Kirk" has already made as good a record for himself in the conduit market as he had already achieved in the field devoted strictly to electric lighting.

One of the most welcome visitors was General Manager Charles Blizard of the Electric Storage Battery company, Philadelphia. Mr. Blizard appeared at Niagara among the delegates early on Tuesday morning, but made no effort at presenting an exhibit of Chloride batteries. The Electric Storage Battery company now naturally feels that, with its tremendous installations throughout the United States, the necessarily comparatively small convention exhibit would not be of much moment.

President T. H. Gilmer and Secretary and Treasurer E. W. Gilmer of the Warren (Ohio) Electric and Specialty company ran in on Tuesday morning. A recent visit to the factory of the Warren company indicates that the institution is doing a most successful business. A visitor of a year ago would today be surprised at the factory extensions which have been executed in Warren. It is said that this company has a hard time keeping up with the demand for not only its lamps, but its high-grade fans as well.

Among those that might be termed as (strictly speaking) guests of the convention were Edward Bergtheil and H. Wilson Young of the firm of Bergtheil & Young, London, England. These two gentlemen, representing the above-mentioned firm, which is the European representative of the Bullock Electric Manufacturing company, were stopping at the Iroquois in Buffalo, but visited the convention at Niagara on Tuesday, in company with Manager Bolles of the advance department of the Bullock and Wagner companies.

The Westinghouse representatives at the convention may be classified as follows: From Pittsburg, H. P. Davis, H. C. Ebert, J. S. Peck, W. M. Probasco, C. F. Scott, F. H. Taylor, E. M. Tingley, A. J. Wurts; from New York, E. W. T. Gray, F. B. H. Paine, Calvert Townley; from Boston, W. F. Fowler, D. E. Manson, R. L. Warner; from Syracuse, Paul T. Brady; from Cleveland, N. S. Braden; from Detroit, W. C. Armstrong, C. F. Medbury; from Buffalo, E. A. Eames, T. C. Frenyear, C. W. Underwood; from Niagara Falls, L. E. Imlay.

President George A. McKinlock of the Central Electric company, Chicago, had pledged himself as one of the attendants at the Niagara convention, and he made good his word on Wednesday morning. Secretary Charles E. Brown, who had been seen a few days before in New York, had expected to be present, but two members of so busy a house as the Central Electric company cannot be absent at the same time, consequently President McKinlock did the honors. The Central Electric company has made itself felt to such a large extent around Buffalo and vicinity, and so many have read letters over the signature of McKinlock, that the president of the Central company found his hand shaken by many who had many times seen his signature, but never seen his face.

Electrical Manager William W. Donaldson of the Gould Storage Battery company, New York, had the foresight to plan, and the energy to present, a very interesting exhibit of his company's battery at the convention. Mr. Donaldson's long experience with electric-lighting and power men taught him the value of an opportunity, and a table with his exhibit, within the rotunda, made an advertisement of the Gould storage-battery plate that without doubt left an impression on several interested persons. Mr. Donaldson's exhibit revealed the fact that the Gould Storage Battery company had, during the last year or so, installed throughout the United States a surprising number of plants that were doing most

excellent service for well-known customers, as, for instance, the New York Central railroad, and for a lighting plant in one of the Vanderbilt houses in New York city.

Edward F. Seixas, general manager of the Niagara, St. Catharines and Toronto railroad, found many of his electrical friends at the convention, and they were all glad to see him when he dropped in Tuesday night. Mr. Seixas' company owns or controls a network of electric railways on the Canadian side of the Niagara Falls, with one terminus in Niagara Falls, N. Y. He is justly proud of his handsome 50-foot cars, with their 40-mile speed, baggage compartments and handsome fittings. Many of Mr. Seixas' friends found time to enjoy a ride in these fine coaches.

Henry L. Doherty, President National Electric Light Association.

Mr. Henry L. Doherty, the recent choice of the National Electric Light association for its presidency, is a man young in years, but experienced in the electric-lighting industry of the country. He has been intimately connected with important lighting plants in Columbus, Ohio, Madison, Wis., St. Paul, Minn., and Denver, Colo., all operated by the McMillin syndicate. Mr. Doherty is energetic, resourceful and presevering, devoted to work in hand and loyal to his associates. His enthusiasm and pleasing and persuasive manner, combined with his other character traits have brought him to a foremost position in the lighting business and made him eminently fitted for the honor which the association has just bestowed upon him.

Born on May 15, 1870, Henry L. Doherty spent his early youth in Columbus, Ohio. Being obliged to support himself, he started wage-earning by carrying papers, and at the age of 12 years obtained employment with the Columbus Gas company. The superintendent of this company, and afterward its manager and president, was Emerson McMillin. Since Mr. Doherty first entered Mr. McMillin's service he has been (with one or two short exceptions) continuously connected with the McMillin interests, holding various positions of trust.

On account of his health Mr. Doherty moved to Madison, Wis., early in 1896 and became general manager of the Madison Gas and Electric company, afterward becoming president. The plant was threatened with municipal opposition, which he successfully averted. His determined opposition to municipal ownership, at all times and places, has brought him into prominence and stamped him as an active and effective worker. His exposition of the municipal-ownership question before the League of American Municipalities is still fresh in the memories of many.

Mr. Doherty is a prominent member of all of the large gas associations, and has been a frequent contributor to gas literature and an inventor of many gas appliances. He is credited with giving the first public lecture and exhibition ever presented in the United States on calcium carbide and acetylene gas. He has not alone applied himself to a study of gas problems, but has equally educated himself in chemistry and steam and electrical engineering.

Always alive to the advancement of electrical science, Mr. Doherty has been foremost in furthering the objects and plans of the Northwestern Electrical association and the National Electric Light association. In January, 1899, he was elected president of the Northwestern association, a position which he held with credit to himself and the society. His presidential address at last year's annual meeting of the association attracted much attention. In this address he dwelt at some length on methods of charging and equitable rates, a general subject upon which Mr. Doherty presented a paper to the National Electric Light association in Chicago a year ago, and also one before the Northwestern association last January. He has given this topic close and efficient study and has been putting his system into operation in different McMillin plants. He is now conducting a rate war in Denver, where he is acting president of the Denver Gas and Electric company. Although he devotes considerable of his time to the Denver plant and also looks after the Madison and other plants as Mr. McMillin's assistant, Mr. Doherty spends much of his time in New York city.

Mr. Doherty's connection with the National association has been an active one from the start. At the time of his election to the presidency he was chairman of the executive committee. The new president is also a member of the American Institute of Electrical Engineers and of several other engineering associations.

The South Haven (Mich.) and Lake Shore Railroad company has filed articles of incorporation, with $176,000 capital stock. The company will build a line from South Haven to Saugatuck, Mich.

THE NEW EDISON STORAGE BATTERY.[1]

By Arthur E. Kennelly.

[*By telegraph to the Western Electrician.*]

I take pleasure in bringing to the notice of the Institute this evening a novel type of storage battery, recently invented by Mr. Edison. It is well known that the history of the storage cell is essentially that of the lead cell, discovered by Planté in 1860, in which lead peroxide is the depolarizing substance. An enormous amount of labor has, in the aggregate, been expended upon the improvement of this cell in the hands of experimentalists. As a result of that labor, the storage battery has at last become a recognized adjunct to direct-current central stations, but it has limitations that seem to withstand further attempts toward improvement. Of recent years hardly any success has been met with in the direction of reducing its weight for a given energy of storage capacity without detriment to endurance, and this weight is the great drawback of the storage battery in electric storage-battery traction, and has been the principal obstacle to its advance in this direction for the last 20 years.

In practice the storage energy per unit mass of the modern lead battery is from four to six watt-hours per pound of battery (8.8 to 13.23 watt-hours per kilogram). Expressed in another way, a battery weighs from 124.5 to 186.5 pounds per horsepower-hour at its terminals (75.5 to 113.4 kilos per kilowatt-hour), or, if its stored energy available at terminals were all expended in gravitational work, a battery could raise its own weight through a vertical distance of from two to three miles (3.2 to 4.8 kilometers).

While it is possible to increase the energy per unit mass by making the electrodes very light, yet this is always found to be followed by a very heavy deterioration. Many attempts have also been made to perfect storage cells of the alkaline-zincate type, but the great difficulty of depositing zinc in coherent form from the solution, as well as the lack of a depolarizer that shall be insoluble in the electrolyte, has stood in the way of this cell's success.

Mr. Edison set himself the task of finding a cell which should possess the following advantages: (1) Absence of deterioration by work; (2) large storage capacity per unit of mass; (3) capability of being rapidly charged and discharged; (4) capability of withstanding careless treatment; (5) inexpensiveness.

Mr. Edison believes that the cell now shown may claim the advantages in a very satisfactory degree. The negative pole, or positive element, corresponding to the zinc of a primary cell, or the spongy lead of a secondary cell, is iron. The positive pole, or negative element, corresponding to the carbon of a primary cell, or lead peroxide of a secondary cell, is a superoxide of nickel, believed to have the formula NiO_2. The cell is therefore a nickel-iron cell, a name which suggests the structural material, nickel-steel.

The electrolyte is potash, viz., an aqueous solution containing from 10 to 40 per cent. by weight, but preferably 20 per cent., of potassium hydroxide, the freezing temperature of which is 20 degrees below zero F., or —30 degrees C. The initial voltage of discharge after recent charge is 1.5 volts. The mean voltage of full discharge is approximately 1.1 volts. The normal discharging current rate per unit area of active element (positive or negative) is 60 milliamperes to the square inch, or 80.64 amperes to the square foot, or 0.93 ampere to the square decimeter. The storage capacity of the cell per unit of total mass of the cell is 14 watt-hours per pound, or 30.85 watt-hours per kilo. Expressing the same statement in another way, the weight of battery per unit of electric energy at terminals is 53.3 pounds per electrical horsepower-hour, or 32.4 kilos per kilowatt-hour. Or the battery gives energy at its terminals sufficient to lift its own weight through a vertical distance of approximately seven miles, or 11.26 kilometers.

The mean normal discharging power rate per unit mass of total cell is 4 watts per pound, or 8.82 watts per kilo, corresponding to a normal discharge period of 3½ hours. The cell may, however, be discharged at a relatively high rate, or approximately one hour, corresponding to a discharging power rate per unit of total cell mass of 12 watts per pound, or 26.46 watts per kilo.

Charging and discharging rates are alike; that is to say, the cell may be charged at the normal rate in 3½ hours, or it may be charged at a relatively high rate in one hour, with no apparent detriment beyond a somewhat lowered electrical charge efficiency. In other words, the cell does not appear to be injured by overcharging or discharging, and only suffers in electrical efficiency under such treatment.

The positive and negative plates are mechanically alike, and can scarcely be distinguished by the eye. They differ only in the chemical contents of their pockets. The samples exhibited were intended for automobile batteries, and illustrate the construction. Each plate is formed of a comparatively thin sheet of steel, 0.61 millimeter in thickness, in which rectangular holes are stamped so as to leave a grid or frame somewhat resembling a window frame. In the plate shown there are three rows of eight such restangular holes or recesses, or 24 recesses in all. Each opening or recess is filled with a pocket or shallow box containing the active material. These boxes correspond to the panes of glass in the window-frame analogy. The panes, instead of being thinner than the frame, as in an actual window, are thicker than the frame, or project slightly beyond the surface of the steel grid. They are perforated with numerous small holes to admit the electrolyte, but entirely conceal the contained active material from view. All that meets the eye, therefore, in any of the plates is the steel frame and its embedded "windows" of perforated steel.

The active material is made in the form of rectangular cakes or briquets, and one such briquet is lodged in each pocket or "window pane" of the plate. Each of the plates therefore supports or contains 24 briquets of active material, all in rigid contact with its own substance. Each briquet is placed in a shallow, closely-fitting, nickel-plated box of thin, perforated, crucible steel, cut from a long strip of that material, 0.003 inch (0.075 millimeter) thick. A cover or lid of the same material is then laid over it, so that the briquet is closely enveloped by the sides and walls of its perforated steel box. The boxes are then placed in the openings or holes in the nickel-plated steel grid, and closely fit the same. The assembled plate is then placed in a hydraulic press, and subjected to a total pressure of about 100 tons. This pressure not only tightly closes the boxes, but it also forces their metal sides over the adjacent sides of the recesses in the steel grid, thus clamping the whole mass into a single solid and rigid steel plate, with the hollow "window panes" full of active material. The nickel-plating of both grids and boxes aids in securing good, permanent electric connections between them. The finished plate has a grid thickness of 0.024 inch (0.61 millimeter) and a "window" or pocket thickness of 0.1 inch (2.5 millimeters). This is the maximum thickness of the plate at any point, but, being of steel, the plate has ample rigidity.

The positive briquets (zincs of a primary cell) are made by mixing a finely divided compound of iron, obtained by a special chemical process, with a nearly equal volume of thin flakes of graphite. The graphite does not enter into any of the chemical actions, but increases the conductivity of the briquets. The graphite is divided into very thin laminæ by a chemical process, and these are passed through sieves or screens so as to leave a size or area of flake that is much larger than the area of the perforation in the steel windows. The mixture is then pressed into briquets in a mold under a hydraulic pressure of about two tons per square inch. The briquets have a surface area of nearly three by ½ inch on each face. The negative briquets (carbon of a primary cell) are made by similarly mixing a finely divided compound of nickel, obtained by special chemical means, with nearly equal bulk of fine flakes of graphite, and solidifying the mixture in a mold into briquets of the same size as above. A suitable number of positive and negative plates are assembled together, being separated from one another only by a thin sheet of perforated hard rubber.

The assembled plates are placed in a vessel, or external containing-cell, of sheet steel, containing the potash solution, which, of course, does not attack steel. There was, however, much difficulty from the action of the potash on the soldered seams of the steel containing-vessel. After many trials, however, Mr. Edison found a solder which seems to be entirely unaffected by the alkali. In charging, the current is, of course, sent into the positive pole and its attached negative nickel plate, through the electrolyte, and into the positive plate of the iron compound which carries the negative pole.

This current deoxidizes or reduces the compound to spongy, metallic iron and carries the oxygen through the film of electrolyte to the nickel compound, oxidizing it to the hyperoxide of nickel, NiO_2, a higher oxide than the peroxide. In other words,

1. A paper presented at the annual meeting of the American Institute of Electrical Engineers in New York on May 21, 1901.

the charging current simply carries oxygen in the opposite direction against the forces of chemical affinity, from the iron to the nickel, and stores the energy in the reduced iron, which is, of course, unaffected and passive in the presence of the potash solution. On discharge, the current passes from the positive pole through the external circuit to the negative pole, and its attached iron or positive plate, and then through the solution to the negative or superoxide plate. In so doing, the oxygen moves back against the current and partially reduces the nickel superoxide, NiO_2, while oxidizing the spongy iron. The energy of burning of the iron and oxygen, which would be developed as heat in the ordinary chemical process, is now liberated in the circuit as electrical energy.

The cell is an oxygen-lift. Charging pulls the oxygen away from the iron and delivers it temporarily to the nickel. The condition is then stable, until the circuit of the cell is completed. Discharge then allows the oxygen to fall back from the nickel to the iron with the natural affinity of iron and oxygen.

This action is very different from that which takes place in the lead storage cell. Here, neglecting complications, the action is usually regarded for practical purposes as being represented by the equation, $PbO_2 + 2H_2SO_4 + Pb = PbSO_4 + 2H_2O + PbSO_4$ + 100 watt-hours, where the left-hand side represents the condition of charge, and the right-hand side the condition of discharge. Here oxygen is not simply transferred in discharge from the peroxide to the spongy lead, but the solution is changed (theoretically) from an aqueous solution of sulphuric acid to plain water. Of course the discharge could not practically be carried to the point of denuding the solution of all sulphuric acid, and a surplusage of acid must be used. The equation gives a more theoretic outline of admittedly very complex reactions. In other words, the specific gravity of the sulphuric acid solution falls during the discharge, and the solution enters into the chemical combination. Theoretically, for every 445 grammes of active material on both plates, 196 grammes of sulphuric acid are required to effect the combination, or 44 per cent. by weight of the active elements, and in practice it is usual to allow a weight of sulphuric acid nearly equal to half the weight of the elements or about one-quarter of the total weight of the cell.

In the new Edison cell, on the other hand, the theoretical action of the potash solution is merely to provide the proper channel through which the oxygen ions may travel in one direction or the other —positive plate to negative plate in charge, and negative plate to positive plate in discharge. Consequently, the amount of solution needs only to be sufficient to fulfil mechanical requirements. It is believed that the weight of solution will in practice be only about 20 per cent. of the plate weight, or about 14 per cent. of the cell weight. In fact, the cell may be worked in the same manner as the so-called primary (dry) cells. Moreover, if the solution should escape, or be carried away by gasing in charging, the only detriment seems to be the loss of active surface thereby occasioned, and it will only be necessary to fill up the cells to the proper level with water from time to time, as evaporation or gasing may lower the level. For the same reasons the specific gravity of the electrolyte does not appreciably vary during charge and discharge.

The briquets of active material slightly expand on receiving oxygen, and slightly contract on delivering it; that is to say, the iron briquets contract and the nickel briquets expand during charge, while on discharge the iron briquets expand and the nickel briquets contract. The expansions and contractions of the briquets appear to be well within the elastic limits of the spring steel containing-boxes, and consequently the electric contact is always secure. The covers or sides of the window pockets merely approach to, or recede from, each other slightly during charge and discharge. Fortunately, steel is the metal which possesses this mechanical elasticity in a marked degree.

The action of the charging and discharging current upon the briquets seems to be transferred from their external surfaces inward in a manner similar to the transfer of carbon and oxygen in the process of making malleable cast iron in the furnace, on the principle of cementation. No active material has been found to be ejected from the briquets through the window perforations, even under deliberate overcharging and discharging. Such gas as is thereby produced makes its appearance on the external surface of the windows. If the nickel compound had no affinity for oxygen, so that energy was neither developed nor absorbed in the deoxidation or further oxidation of that substance, then the energy would be entirely that due to the energy of combination of oxygen and iron, stated to be 79.7 watt-hours, and representing an electromotive force theoretically obtainable of 1.47 volts. If the combination of oxygen with the nickel compound be exothermic or energy-releasing, then the watt-hours delivered (and the electromotive force) will be lessened by the energy necessarily paid back to break up the combination. If, on the other hand, the combination is endothermic or energy-absorbing, then the watt-hours delivered (and the electromotive force) will be increased by the energy restored on breaking up the combination.

Since the superoxide seems not to have been known hitherto, no information concerning its energy of combination is obtainable. The electromotive force of the cell seems to be so near to that of the union of iron and oxygen as to suggest that the nickel superoxide is not far from being neutral, or that the nickel compound has but little affinity for oxygen, although the superoxide appears to be quite stable in the cell.

The new cell does not seem to be appreciably influenced by changes of temperature, and should stand a very low temperature without detriment. The electrolyte—potash—does not attack any of the ingredients of cell, nor are any of the ingredients soluble therein. No local action occurs in the cell so far as has yet been observed, since the electromotive force is below that necessary to decompose water. The cell may be fully discharged to the practical zero point of electromotive force without detriment. In fact, a cell has not only been completely discharged, but recharged in the reverse, or wrong, direction, and after bringing it back to its originally charged state by proper restoration of direction of charging current, the storage capacity remained unaffected. It would seem, therefore, that the cell should be capable of withstanding much abuse.

Mr. Edison states that "the negative plate (nickel) either charged or discharged, can be removed from a working cell, and dried in the air for a week, without appreciably injuring it, and when the plate is finally replaced in the cell its charge is practically undiminished." The positive (iron) plate, if similarly removed from the cell would be likewise uninjured, but it soon loses its charge by the oxidation of spongy iron with accompanying liberation of heat and appreciable rise of temperature extending over a period of several hours. On replacing the electrode, however, in the cell, the storage capacity is unaffected on recharge.

As regards cost, Mr. Edison believes that after factory facilities, now in course of preparation, have been completed, he will be able to furnish the cells at a price per kilowatt-hour no greater than the prevailing price of lead cells.

Having now considered the action and properties of the cell, a brief description may be given of the difficulties encountered in developing it.

The phenomenon of passivity has probably kept inventors from finding this cell in the past. Mr. Edison believes that of all the very numerous compounds of iron, and of which he has tried many hundreds, the particular compound which he prepares is perhaps the only one capable of being used.

If the dried hydrates or oxides of iron, native or artificial, are subject to electrolytic reducing action in any alkaline solution, they remain inert and unaffected. On the other hand, if finely divided iron obtained by reducing a compound of iron under the action of a reducing agent, such as hydrogen or carbonic monoxide, is subjected to electrolytic oxidation in an alkaline solution, it is inert and cannot be oxidized. It assumes the well-known passive state. The same difficulty of passivity affects the use of nickel or the negative element. Finely divided nickel, reduced from a nickel compound, remains inactive when subjected to electrolytic oxygen in an alkaline solution. The monoxide and the black oxide or peroxide are also inert. No oxide of nickel is active or can be made active by electrolytic action, and the peroxide does not act as a depolarizer.

Reported Consolidation of Chicago Elevated Roads.

The report has been current for a number of days that the Metropolitan West Side, the Northwestern, the Lake Street and Union Elevated Railroad companies of Chicago are soon to be consolidated. The three roads last named will probably be consolidated at once and the Metropolitan will be absorbed later. It is reported that the Metropolitan company wants $175 a share for its preferred and common stock, and Blair & Co., who are the financial backers of the other roads, it is said, are not disposed to pay the price, preferring to consolidate the other three roads first. After the consolidation and adjustment of stock they think they will be in better shape to deal with the Metropolitan interests. No decisive steps have been taken toward the absorption of the South Side line. It is said that the majority of the holdings of the South Side company is in the hands of heavy stockholders of the Chicago City Railway company, and that they will keep out of a consolidation in order to preserve the patronage of the surface traction lines.

COMMUNICATIONS.

Stanley Transformer Decision.

To the Editor of the Western Electrician:

Concerning the decision in the Stanley self-regulating transformer case (the full title of the case is Westinghouse Electric and Manufacturing company vs. Saranac Lake Electric Light company), I desire to call your attention to some inaccuracies expressed in the interview with Mr. Charles A. Brown in a recent issue of your paper.

It is evident that Mr. Brown did not have before him the text of the decision filed by Judge Coxe April 26th, for he could not have made the statements he did if he had. So far from Judge Coxe not considering the alleged Great Barrington public use, he devotes no less than six pages out of the 19 in the printed copy before me of his opinion to this one question, and decides specifically that the Great Barrington use was not a public use within the statute, for several reasons:

First—Because the transformers were not exposed to the public and their construction was kept secret.

Second—Because the use was experimental.

Third—The use was not a successful one, in the sense of a commercial use.

Other reasons are given, but these would seem to be conclusive.

As to the interference with Slattery, it ought to be sufficient to say that the Patent Office decided it in Stanley's favor, and certainly the decision is not open to collateral attack now.

As to the contention that the Great Barrington experiment did not embody the invention because converters with different lengths of wire were used, it is enough to say that the very object of going to Great Barrington was to test the invention and see what was the best construction. There could hardly be a test from which any substantial information could be obtained if all the converters were of the same construction. Nor is this inconsistent with the idea that the inventor had a definite conception of just what he wanted to do; for in an experience of many years, with a great many different inventors, I have found that, though they conceive an invention definitely and absolutely, those who are of any account always try any modification that occurs to them in the search for the best form.

T. J. JOHNSTON.

New York, May 16, 1901.

The above letter was shown to Mr. Charles A. Brown, who submitted the following in answer to Mr. Johnston's criticism. As Mr. Brown says, the report of the decision of Judge Coxe presented in the Western Electrician of May 11th did not include the statement that the question of public use at Great Barrington was considered. Mr. Brown's letter is as follows:

To the Editor of the Western Electrician:

Mr. Johnston charges that there were "inaccuracies expressed in the interview with Mr. Charles A. Brown in a recent issue of your paper."

The extract from the opinion of Judge Coxe which you published did not show that the question of public use at Great Barrington was considered. This is what your report of the interview said, as Mr. Johnston admits was evident. There was no inaccuracy in that, therefore.

I have carefully read your report of the interview, and I am not able to find any contradiction by Mr. Johnston of any statement therein contained. When Mr. Johnston is prepared to show that Stanley, prior to the issue of the Slattery patent, "had in mind the single broad feature of the length of the primary wire, as alone controlling the counter-electromotive force, which is now adjudged to be the one essential feature upon which the patent is sustained," then his criticism will be entitled to receive consideration. At present his charge of inaccuracy rests wholly upon his voluntary ipse dixit, and I do not care to enter into a discussion of a subject which I referred to only in response to your courteous request for information.

CHARLES A. BROWN.

Chicago, May 20, 1901.

Engine Builders' Association.

The Engine Builders' Association of the United States will hold a meeting at the Denison Hotel in Indianapolis, Ind., on May 27th and 28th. On the afternoon of the first day an address of welcome to members and visitors will be made by President J. E. Sweet and papers will be presented by Professor J. B. Stanwood of Cincinnati on "Experience with Throttling Engines" and by Charles G. Armstrong of Chicago on "The Engine, the Heart of the Modern Building." On Tuesday morning papers will be presented by Samuel H. Brubaker of Indianapolis on "The Relationship of Architects to the Engine Builder" and by Edward H. Burdick of Syracuse, N. Y., on "Conditions and Warranties of Construction Contracts." An informal smoker will be held in the rooms of the Commercial Club on Monday evening, and on the following evening the association banquet will be held. W. M. Taylor of Indianapolis is chairman of the committee on entertainment.

The electric-light plant at Longview, Texas, was recently destroyed by fire. The loss was $2,500.

DEVELOPMENT OF THE TELEPHONE FIELD.

Telephone News from the Northwest.

P. E. Thompson and Charles R. Oliver contemplate establishing a local exchange for Barnesville, Minn.

The Fox River Telephone company, Appleton, Wis., has awarded contracts for placing its wires underground.

The Northwestern Telephone company seeks an entrance to Brainerd, Minn., and offers to cut the prices of the present company.

The city of Minneapolis has lost its case against the Northwestern Telephone Exchange company, to compel the latter company to remove its poles from the streets. The Supreme Court of Minnesota holds that a franchise granted the company in 1883 becomes a contract, and that, under the general laws of the state, telephone companies are given the right to erect poles and wires within the urban ways and streets of the state, as well as upon the rural highways. The charter of Minneapolis confers upon the city no authority to order arbitrarily a removal of poles and wires, but only the authority to regulate the placing of the same in its streets and to compel the telephone companies to place wires in sub-surface conduits when reason, convenience or good government of the municipality require. This case was on a demurrer, and will now go to court on its merits.

E. C. Fahrney and brothers of Chicago recently bought farms eight miles from Oshkosh, Wis., and have erected handsome homes and other buildings. They want long-distance telephone connection to communicate with Chicago, and will therefore build a copper-metallic line from the farm to the nearest toll connection with Oshkosh, at a cost of $300. Then they will pay the regular subscriber's rate of $36 per year and $24 additional for every mile beyond the city limits, a total of seven miles. This will make the total cost of the connection about $180 a year.

A telephone line is projected from St. John, N. D., to Dunseith, Willow City, Omemee, Bottineau, Richburg, Sergius and Towner.

A telephone line is being built from Kimball to Maine Prairie, Minn.

The Comfrey Telephone company has been formed to establish a local exchange in Comfrey, Minn.

The Duluth and Iron Range Telephone company will install an exchange, with 25 or more connections, at Tower, Minn.

The council of Le Sueur Center, Minn., has applications for a local franchise from the Cannon Valley Telephone company and from James Bennett of St. Peter, Minn.

The Le Roy (Minn.) Telephone Exchange company will at once extend a line to Chester.

The Southern Telephone company recently increased rates on service in New Ulm, Minn., for office and business use, 50 cents, making it $2 per month. There is considerable dissatisfaction over the advance.

The Osseo Telephone company of Osseo, Wis., has bought the telephone exchange at Mondovi, Wis., from the owner, Paul Huefner of Fountain City. The sale includes considerable toll lines. The company plans a number of extensions, including a line to Eau Claire, where application has just been made for admission.

The Prescott Telephone company has 82 connections in use at Prescott, Wis., and demands for more.

The Automatic Telephone company has applied for a local franchise at Whatcom, Wash.

The Harlan and Avoca Telephone line has been completed from Avoca to Oakland, Iowa.

A rural telephone line is being built from Wilton to Sweetland, Iowa.

The Wagner lines will be constructed at once from Iowa City, Iowa, to Coralville, Tiffin, Oxford and Williamsburg.

O. F. Blasier has been granted a local franchise for Rockford, Iowa.

The Iowa Telephone company has ordered a new switchboard for its office at Davenport, Iowa, from the Western Electric company of Chicago. It will have a capacity for 1,200 connections, and an ultimate capacity for 3,500 connections.

The Western Telephone company is making extensive improvements to its system at Albia, Iowa. About 2,500 feet of cable is being strung.

The Western Electric Telephone company of Britt, Iowa, has secured control of the Greene and Western Telephone company's system in Northern Iowa and Southern Minnesota, and exchanges at Mason City, Charles City and Osage, Iowa. This gives the Western Electric company a system covering every town in the northwestern 26 counties of Iowa. Three hundred miles of toll line will be built in Minnesota and South Dakota during the present season.

A mutual company has been formed at Mount Ayr, Iowa, to establish a local exchange or to purchase the present system.

Edward Farrell, manager of the Wisconsin Telephone company's office at Appleton, Wis., has tendered his resignation.

The Jasper County Telephone company of Newton, Iowa, has bought the toll system of the Central Telephone company of Des Moines. The purchase includes 31 telephone stations.

Stock is subscribed for the construction of the proposed toll line across Iowa from Davenport to Council Bluffs.

Representatives of 10 Independent telephone companies of Northeastern Iowa held a meeting recently in Waterloo, Iowa, to arrange for connections between the various lines and for the division of the toll rates. R.

Ohio Telephone Notes.

For several months the Cuyahoga Telephone company of Cleveland has had construction gangs at work stretching wires into the country in all directions. The exchange at Rocky River is being reconstructed and the company has decided to build an exchange at Dover Center. Ten miles of right-of-way have already been obtained in the township and the employes of the company are putting up wires as rapidly as possible. The company will begin business in Dover with 75 telephones and expects to get 200 before another year. A number of telephone exchanges are now in operation throughout the country, and more are being arranged for.

This advancement of the Independent telephone movement among the farmers is not alone true of the Cuyahoga Telephone company, but of all the larger exchanges over the state. They are not all working under the name of the companies which operate in the cities, but are generally owned and managed by the same people, hence there is very little difference, so far as the service is concerned. Farmers will soon have an excellent service at Columbus, and even at as small a place as Gallipolis, in the southern part of the state, lines are being run out several miles for the accommodation of farmers, and later, when the need becomes apparent further away, they will be extended. Nearly all the companies in the state are considering this matter very seriously, and although there is a difference of opinion as to rates that should govern the business, there will eventually be a uniformity, governed by the distance and the character of the service.

Major R. B. Hoover has resigned as manager of the Springfield office of the Central Union Telephone company. He will go to New York as secretary of the Magnet Electric company, of which Dr. L. E. Niles of Springfield is the head. Major Hoover has been a very strong man in the interests of the Central Union in this state and has taken part in many of the severe contests with the Independent companies, in which he was generally worsted, but his qualities as a strong opponent were well known, and the Independent people rather dreaded to see him come on the scene. His successor at Springfield has not been announced.

The Village Council of Clarksburg, W. Va., has passed an ordinance taxing telephone and telegraph companies 50 cents each for poles erected within the corporate limits, with a penalty of $25 if the correct number is not reported. The companies interested there will test the legality of such an ordinance.

F. G. Frese has resigned as manager of the Akron People's Telephone company, Akron, and has accepted a position with the Cleveland Construction company of Akron. His successor is Will F. Laubach of Akron, a well-known business man, in whose hands the affairs of the company will rest well. Mr. Frese's new duties will be to look after big deals in which the construction company is interested or desires to be.

The carpenters' strike has stopped work on the enlargement and improvement of the offices of the Citizens' Telephone company at Columbus.

E. G. Bickel, who has been in charge of the Mansfield Telephone company during the period of construction work, has gone to Canton, where he will be associated with the management in the construction work of the plant of the Stark County Telephone company. Mr. Bickel is one of the best telephone men in the state, and occupies a rather unique position with the telephone interests of Ohio.

It is stated that the Central Union Telephone company will overhaul its plant at Portsmouth and improve it in such a manner as to give much better service.

John J. Gordon has been elected president of the Union Telephone company at Glouster, and Father Ross has been made secretary and manager. These two gentlemen purchased the stock owned by Dr. A. B. Allen and William Dusz; hence the change.

The Cuyahoga Telephone company of Cleveland has 31 private telephone exchanges in operation and orders for 14 more, which will be installed as soon as they can be reached. Cleveland's large firms are taking advantage of the service offered for the private-exchange business.

The Central Union Telephone company and the Findlay Telephone and Message company have both been granted franchises at Arcadia.

A telephone company is being organized at Colerain, Ohio.

F. B. Hopkins of Garrettsville has been granted a 25-year franchise to operate a telephone exchange in the village of Windham.

The Springfield Home Telephone company, Springfield, Ohio, has been incorporated, with a capital stock of $300 000. The incorporators are Samuel F. McGrew, George H. Carson, C. D. Juvenal, P. E. Montanus, Robert R. Mills and James B. McGrew. The articles of incorporation authorize the company to build an exchange in Springfield and toll lines throughout the county, as well as exchanges in the smaller towns. This is the second company to be incorporated there within a few weeks. O. M. C.

Indiana Telephone Items.

That the development and spread of the telephone business continues in this state is evidenced by the following articles of association and incorporation with the secretary of state: The Wakarusa Telephone company of Wakarusa, capital stock, $10,000, and the Lett's Corner Telephone company, capital, $1,675, divided into shares of $75 each. The companies will operate telephone exchanges and lines in the respective towns and surrounding communities, the latter in Decatur and Bartholomew counties, its officers being: President, John R. Swope; secretary, John G. Evans.

The New Telephone company of Indianapolis has installed a new exchange at Broad Ripple, and has already a good line of patrons.

The trustees of the town of Mitchell have granted a franchise to the Hoosier Telephone company of Salem for the erection of a modern telephone exchange. The board also granted L. W. Spencer of Georgia the right to build a line connecting with his Georgia and Huron system, which will give Independent long-distance connection with the outside world.

The City Council of Hartford City has revoked and rescinded the franchise of the Central Union Telephone company, which has a long-distance station there and a service to many factories. The franchise held by the company was granted 15 years ago, and at that time a local service was established. It was afterward abandoned, and only the long-distance service remained. The company recently announced its intention to re-establish a local service, in competition with the Independent company, which had invaded the field left vacant by the Central company. Poles and wires have been sidetracked there by the Central company, which now is without authority to install them.

The telephone plays an important part in court at Noblesville. Mrs. Nagle brought suit for divorce, with James M. Fippen of Tipton as her attorney. On divorce day, May 17th, Mr. Fippen could not attend, and he called Judge Neal of the Noblesville court, by telephone, and explained the circumstances, suggesting that the case be tried by telephone. Judge Neal consented, the witnesses were assembled in the telephone office of the Noblesville court and their testimony submitted in reply to questions by Mr. Fippen, 36 miles away. Mr. Fippen then delivered his argument, talking into the judge's ear, by telephone, and concluded by saying: "My client is a lady of refinement, while her husband, as shown by the evidence, is unfit to have a wife. I ask that she be granted a divorce." It was granted. F.

TELEPHONE MEN.

F. P. Fish of Boston has been elected a director of the New England Telephone and Telegraph company, vice John E. Hudson, deceased.

John I. Sabin, who was recently elected president of the Central Union Telephone company, will take with him to Chicago, from the Pacific States Telephone company, Chief Engineer A. J. Steiss, Electrician F. W. Alston, Auditor John A. Mallon, Chief of Canvassers C. E. Nestor and District Manager G. B. Bush of Spokane, Wash.

John D. Winstandley, chief operator of the Chicago station of the American Telephone and Telegraph company, was drowned by the capsizing of a rowboat during a storm on Saturday afternoon, May 18th, in Lake Michigan. The accident occurred off the harbor entrance to Jackson Park. Mr. Winstandley entered the employ of the American Telephone and Telegraph company two years ago as an operator and had risen to the position of chief operator at the time of his death. His immediate superiors considered him to be a promising young man, and his hopes for the future were bright. Mr. Winstandley was a Yale graduate and his home was at 5241 Cornell avenue, Chicago. Up to the time of going to press the body had not been recovered.

MANUFACTURERS AND DEALERS.

R. H. Leavitt of Capron, Ill., has just purchased a large, portable sawmill for ripping oak logs, to manufacture his telephone pins and brackets.

The Standard Construction company of Chicago states that the increase in its business has obliged it to seek larger quarters and better facilities for the accommodation of its patrons. The company is now located at 90 to 98 Market street. The demand for Standard special telephones is said to be rapidly increasing. The company has recently issued a circular and other printed matter descriptive of its switchboards and telephones.

It has been officially announced that the telephone rate in Paris will be reduced from $80 to $60 a year. The Paris-Lyons rate on the long-distance lines will be reduced from 25 to 15 cents for each three minutes.

A Station-load Diagram.[1]

By C. R. Van Trump.

In the present day of great development in all lines of station apparatus, no detail has been so neglected by the average manager as the taking and development of station data; often despised by managers of plants of certain magnitude, some are apparently successful without it, but the station log cannot but bear fruit in many ways.

Important among these is the encouragement it gives to the operatives—firemen and engineers, and other station men, who, it must be remembered, are not like "dumb, driven cattle," but do their best work when they know the results of their efforts are recorded to their credit. It is a most healthful sign when the operatives evince great interest in the records.

On the other hand, central-station records are avoided, because of cumbersome methods, of the expense of collecting a mass of data, and the work of putting it into intelligent shape; and, further, unless the work is carried to the greatest detail the story it unfolds is generally of very doubtful value.

It is the object of the writer to point out a simple and effective method of tabulating these data in a station of great variety of loads, which, for the last two years, has taught a valuable lesson of waste and how to prevent it, of leaks and how to choke them a bit, and has, on the whole, certainly been of material advantage in the operation of one of the smaller stations.

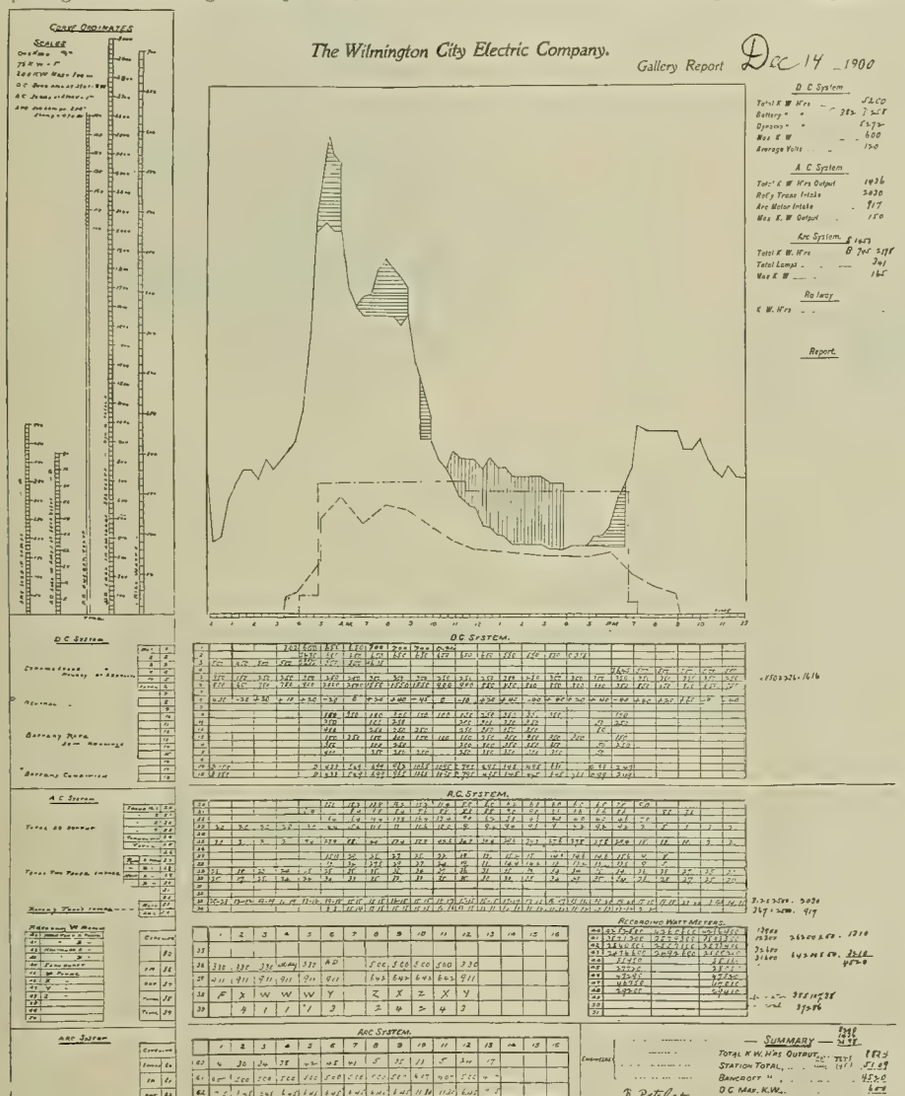
The simplicity of taking load charts depends altogether upon the character of the load. In the smaller central stations, where we find all the different characteristics of arc and incandescent and motor loads, and both alternating and direct current, the task becomes somewhat complex, and requires some ingenuity to get a load diagram that is at once simple and intelligible.

Automatic recording instruments have certainly attained a marked efficiency, and in large stations, and where the output is of one class, especially on railway power plants, will soon be as essential a part of the plant as the indicating instruments, but where the variety of loads is great and the number of instruments consequently multiplies, and the output is small, the cost of recording instruments becomes extremely large and puts them beyond our reach.

The common methods of recording the output of a plant are:

First—To put down the readings on the indicators by figures. These convey no idea of the character of the output without being again plotted into curves and integrated into the mean values, which requires an enormous amount of clerical labor, and for this reason many times they are not worked up. Again, they do not indicate immediately the character of the load chart, which is essential, because the facts that are to be shown are just as important to the engineer operating at the time as to the manager of the plant.

Second—The cross-section load diagram plotted at the switchboard. This tells its story at once, and the integrated values may be computed by planimeter. The disadvantages of such a chart are, the expense of the cross-section diagrams, that any changes in the character of the load require new diagrams, and the difficulty of arranging them with a common ordinate, because of the different loads to be plotted.



A STATION-LOAD DIAGRAM.

In the load diagram to be described, a degree of accuracy and completeness is claimed with only ordinary facilities and without expense, and kept by the regular station force.

In this station we have divided the data into two classes: First, the load diagrams, which show the output of the station, and, second, the subdivisions of the diagrams or loads on the different dynamos and circuits; in other words, the distribution of the load within the station. The latter data are set down in figures as not sufficiently important to be plotted on the load curves, or to be integrated, but quite useful in determining the sequel to results shown in the diagram.

The general arrangement of the apparatus consists, first, of a board with parallel slide ruler, operated by means of cords on wooden pulleys. The sheet is fastened in position by means of small spring clamps. On the left side the whole length of the sheet is the index or scale. The sheet is of light bond paper, sufficiently thin, so that blue-prints can be taken directly in case reproductions are desired. The top half is left vacant for the load curves; across the middle is the datum line, divided into 24 parts, and numbered from 1 to 12 p. m. and from 1 to 12 a. m. These parts are subdivided into three parts each, for 20-minute readings.

In the bottom half, vertical rulings at each hour below the datum line divide the horizontal rulings, numbered from one to 36, into hourly spaces for the individual dynamos, and other hourly readings to be taken, and marked in the squares, as shown.

Below these are spaces to record number of arc lamps on each circuit, and the machines on which the circuits are run; also for municipal incandescent-service circuits and the dynamos on which they are run, together with the time the different circuits are lighted. We further have a schedule for the several wattmeter readings that are taken on the gallery.

To the right hand is the space to be filled out with the mean readings and maximum loads on each system, and the remarks of trouble or other reports to be made by the engineer. Below, on the right-hand corner, is the résumé of the total loads, etc., of the station, the signatures of the engineers, firemen and gallerymen, and lastly, the date. The last is convenient in turning over a number of diagrams to find any particular date or any particular load.

The index is fastened to the side of the board, under a piece of transparent celluloid, to avoid wear. Above the datum line there is a scale of ordinates for each load on the station. These scales are laid out in proportion to the common ordinate of kilowatts at the lamps, which is shown in the last scale. For instance, first is the scale that is figured at 470 watts for each arc lamp; next is the alternating-current load in amperes at 2,500 volts; lastly, the low tension, which is figured at 236 volts at the lamps. Below the datum line and to the left is the explanation of each line, numbered the same as on the sheet, and the hourly readings on the different dynamos and loads on the different circuits to be therein recorded.

Should any changes be made in the plant arrangement and provision made therefor on the load chart, a new scale of indexes may be made and old sheets used. The parallel ruler is laid off exactly as the datum line, in 24 hourly divisions, and subdivided into 20 minutes.

In operation the galleryman lays the sheet on the board, puts the ruler on the datum line of the index and places the sheet so that the datum line and hours on the sheet coincide with the top of the ruler. He clamps it in position with the spring clamps. He reads the loads to be recorded every 20 minutes on the several systems, runs his ruler to the point indicated for the load, on the proper index, makes a point and circumscribes it with the figure representing that curve—a circle for the total incandescent load, a cross for the total direct-current dynamo loads, a square for the alternating load, and a triangle for the arc load. As these points are recorded he connects them with a light line, and cross-sections the output from the storage battery horizontally and the intake vertically.

At the end of the 24 hours the load sheet is duly signed and sent into the office; the mean loads are calculated by means of a planimeter and duplicate board. To make all the calculations on any one of the sheets, including meter records on a number of wattmeters, the intake of rotary transformers and the receiving boards from a waterpower-transmission plant, requires considerably less than one-half hour of one of the clerks in the office.

The load diagram shown is taken at random, and includes the heaviest loads on the station during last fall. The index on the side of the board has been reproduced, and may be folded to read off the various loads. The fuel and water consumed on each day's run are indicated, and the pounds of coal per kilowatt-hour are also noted on the sheets.

The engraving for the lower half or secondary cross-section part of the diagram cost about $15, and the printing and complete sheets on thin bond paper, through which reproductions by blue-printing may be made, cost about $3 per thousand.

The time required in recording is very slight, as the attendant has many other duties. It is also of great value, as it insures the station of the constant services of the attendant, who must keep wide awake for this service, which it is difficult for him to reproduce unless taken regularly from the instruments. All of the work is done mechanically, and requires no expert or supervision whatever after the clerk in the office has been drilled in the use of the planimeter by which she does the averaging. The benefit of the work has certainly many times exceeded the cost in arranging instruments and devising methods to take these data.

The station, it will be seen, is far from an economical plant; but even in such stations great saving is shown by the careful scrutiny of their records and the knowledge of the employes that these records are carefully taken, and bad work is condemned, while good work is recorded to their advantage.

1. Read before the National Electric Light association at Niagara Falls, N. Y., on May 23, 1901. Mr. Van Trump is chief engineer of the Wilmington City Electric company, Wilmington, Del.

Traction and Lighting Consolidation in Philadelphia.

Official announcement of the plan of merger of the Electric Company of America with the American Railways company of Philadelphia has been made. According to this plan, a new company will be formed which will acquire, by purchase, the securities of the existing companies. It will have a total capitalization of $22,500,000, divided as follows: Common stock, $5,000,000; preferred stock, $2,500,000, and $15,000,000 of four per cent. bonds. The American Railways company controls the traction

lines at Bridgeton, N. J., Joliet, Ill., Dayton and Springfield, Ohio. Among the plants operated by the Electric Company of America are those of the Camden (N. J.) Light and Heating company, the Atlantic City (N. J.) company, the Jamaica (L. I.) company and the Scranton and Dunmore (Pa.) companies.

Stilwell-Bierce Turbine Plant in Northern California.

The McCloud River Electrical company of San Francisco, Cal., is now installing four units of Victor turbines with cylinder gates, mounted on horizontal shafts, each unit to develop 790 horsepower under a 36-foot working head of water, and running 270 revolutions per minute. One of these units is shown in Fig. 1. Each unit consists of two 30-inch Victor turbines, mounted in a steel flume, and discharging into one central draft tube. The flumes are 15 feet nine inches long and nine feet six inches in diameter, and are constructed of heavy steel plate, with cast-iron heads and covers.

The gatework is of the patented draw-rod type, which places all gears on the outside of the flume, where they can have attention and where they can work in oil, doing away with the old style of gatework, where the gears run in water, and where they

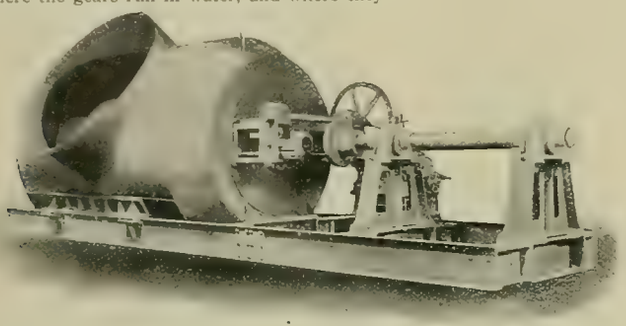


FIG. 1. STILWELL-BIERCE TURBINE PLANT.

were continually causing trouble. The patents on this style of gatework are completely controlled by the builder of the turbines, the Stilwell-Bierce & Smith-Vaile company, Dayton, Ohio.

The plant is being installed in the northern part of California. The wheels are set on top of concrete arches, the draft tubes reaching through to the tailwater below. Each unit is equipped with a large rope pulley, and the dynamos are driven by means of rope drives, the dynamos being located at a higher elevation than the waterwheels. The feeder pipes come through the foundations upon which the generators set, and the whole forms a very substantial and complete plant.

There are also two exciter wheels (one being

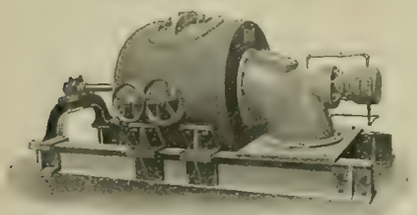


FIG. 2. STILWELL-BIERCE TURBINE PLANT.

shown in Fig. 2) which will develop about 40 horsepower each, under a 36-foot head. The exciters are also driven by means of rope pulleys. The large units are each equipped with a Giesler electro-mechanical governor for regulating their speed.

College City Electric Clock Switch.

An electric clock switch for automatically turning out electric show-window or display lights at any time after the store is closed is illustrated in the accompanying picture. This device, in its construction, conforms to the rules of the National Underwriters' association. It is said to be durable and always in order. No expert is needed to operate it, and it is perfectly safe. A Hill all-copper, double-pole switch is connected by a trigger to the alarm end of the clock, so that when the alarm goes off it pulls the trigger, which releases a spring and catch holding the switch closed. When these are released the spring opens the switch and the lights go out. The spring is strong and durable, causing the quickest kind of a break in the switch. The clock has but little to do, and the strain on it is very light, all the work falling on the spring. All the working parts are open and easily reached for inspection and adjustment. The clock switch is manufactured by the College City Electric company of Galesburg, Ill. The company will send a switch to anyone on trial for 10 days.

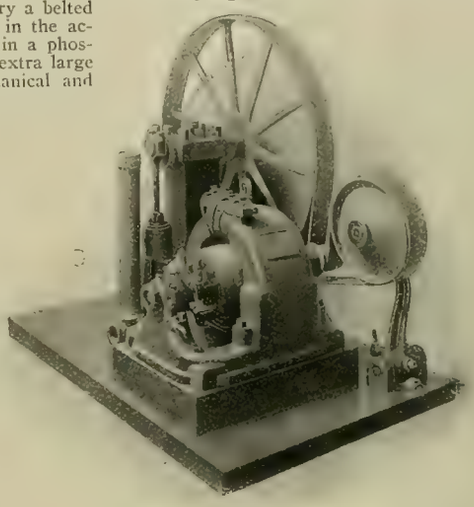
The project which involves the construction of an electric railway between Rome and Naples and which was agitated some time ago but abandoned, has been revived. The projected plan is to build a double-track road between the two cities, a total distance of 135 miles.

Wagner Electric Pumping Outfits.

The demand for motor-driven pumping outfits has been increasing recently. The Wagner Electric Manufacturing company of St. Louis makes a single-phase, alternating-current motor which is well adapted for direct coupling to centrifugal and to high-speed rotary pumps, as well as to the more common type of triplex pumps. An electric pumping outfit of this class is valuable for city pumping, where an electric plant is kept in operation all night. In a plant of this kind the pumping for the city can frequently be done between midnight and morning, thus furnishing a very satisfactory income to the lighting company without additional investment and with small increase in operating expenses.

Sometimes lack of space makes necessary a belted arrangement with idler pulley, as shown in the accompanying illustration. The shaft runs in a phosphor-bronze, self-oiling bearing, with an extra large oil reservoir. The construction is mechanical and durable. A differential duplex pump is used. It has no gears and is practically noiseless. The pumps are supplied in sizes of 250 and 500 gallons per hour for house service. Small triplex house pumps are also furnished without gears.

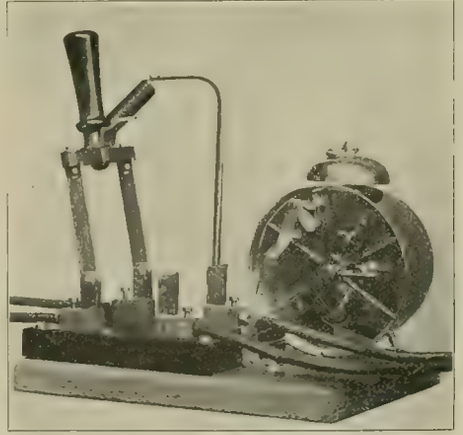
The Wagner company supplies slow-speed, alternating and direct-current motors, geared to triplex pumps, and also motors suitable for direct connection to deep-well, rotary and centrifugal pumps. The company is prepared to furnish on short notice complete outfits within limits of its motor capacities for any kind of pumping.



WAGNER ELECTRIC PUMPING OUTFITS.—SINGLE-PHASE BELTED MOTOR.

American Society of Mechanical Engineers.

The forty-third meeting of the American Society of Mechanical Engineers will be held in Milwaukee, Wis., from May 28th to 31st. The headquarters of the association will be at the Plankinton House, and the sessions will be held there also. On Tuesday evening the first session will be opened with an address of welcome by Professor Warren S. Johnson, chairman of the local committee, with response by Samuel T. Wellman, president of the association.



COLLEGE CITY ELECTRIC CLOCK SWITCH.

A total of 26 papers will be presented at the different sessions. The local committee has arranged an interesting programme for the entertainment of the members and guests. On Wednesday afternoon visits will be made to some of the engineering plants in the city, and an officers' reception will be held in the evening. An excursion by electric cars to Waukesha and Mineral Springs will be made on Thursday afternoon and evening, and on the following afternoon several of the interesting institutions of Milwaukee will be visited. Special excursions and other entertainments have been provided for the ladies. Reduced rates have been secured on the railroads, and a large attendance is looked for.

CORRESPONDENCE.

New York Notes.

New York, May 18.—Cable cars will soon have disappeared from this city. All cable cars, except for the short line running between the Brooklyn City Hall and the Wall street ferry, will be taken off Saturday, May 25th, and by the following Monday the entire Broadway system will be operated by the underground system.

Eighteen members of the Automobile Club of America, with a party of friends and guests, drew up in front of the club headquarters at Fifth avenue and Fifty-eighth street a little before noon to-day in their 18 machines, and started on a club run to Morris Park. The route from the clubhouse was through Central Park across Macomb's Dam Bridge and up Jerome avenue to Morris Park. On Saturday, June 1st, the club proposes to hold its big run to New Haven. The members participating in the run will remain in New Haven over night. This will be the longest run of the season.

The Brooklyn Rapid Transit company contemplates building an emergency hospital for the immediate aid of persons injured on the lines of the company. An unused building at Fifty-second street and First avenue will be fitted up with a receiving dormitory, cots and medicine, and the best medical attendants will be provided. Everything that pertains to a well-equipped hospital will be placed in the building and an ambulance service by trolley will be provided.

Three thousand rock drillers, engineers, tool sharpeners and mechanics employed in the rapid-transit tunnel threaten a general strike for an advance in wages and an eight-hour workday. Delegate Green of the Rock Drillers' Union says the contractors refused the demands of the tunnel workers for higher wages.

There is every prospect that before many weeks are past the Union Railway company, which controls the surface traffic in the Borough of the Bronx, will lay tracks, and operate cars across the Central Bridge, spanning the Harlem River, at One-hundred-and-fifty-fifth street. The residents in the vicinity of High Bridge have been petitioning the company to do this for some time.

The Brooklyn Rapid Transit company will operate a through elevated-train service from Broadway Ferry, Brooklyn, to Rockaway Beach this summer.

A protest has been made against street and elevated-railroad companies holding franchises in the Borough of the Bronx and refusing to build new lines in accordance with their agreements. This is looked upon as the beginning of a crusade against the Manhattan Railroad company and the trolley companies to force them to extend their lines or surrender their franchises and allow other companies to carry on the work of extension.

The executive committee of the Municipal Assembly has reported in favor of the rapid-transit commissioners' Brooklyn tunnel plan. The report will be presented at the meeting next Tuesday, and it will probably be approved, as only a majority vote is needed.

The progress of the work on the rapid-transit tunnel is most favorable. Until a few days ago Broadway formed the westerly limit of operations on the first subdivision of Section 5, but now there is a hole in Long Acre Square, straight to the north of the triangular building behind the Pabst Hotel. There will be a station at Broadway and Forty-second street. After leaving Forty-second street the subway is to slant across Broadway and the southerly end of Long Acre Square to Seventh avenue, reaching the latter at Forty-third street, thence along the avenue to Forty-fourth street, where there will be another turn to the northwest, after which the tunnel will remain under Broadway all the way to the separation of the east-side line at One-hundred-and-fourth street. A great deal of difficulty

is experienced in excavating along this route, as it is almost entirely solid rock, and the progress is necessarily very slow. There are now 425 men working on this division of Section 5, most of whom work in the daytime. G.

New England News.

Boston, May 18.—The stockholders of the Consolidated Lynn and Boston, and Lowell, Lawrence and Haverhill street-railway companies will soon meet to vote on a name. It is suggested that the corporation be known as the Boston and Northern Street Railway company. Henry C. Paige of Lynn will be the general superintendent of the road, Franklin H. Woodman, who has been superintendent of the Lowell, Lawrence and Haverhill railway, will be superintendent, and Alex. MacRae will be assistant superintendent of the Haverhill division. Mr. Woodman was allowed to choose his division. Thomas Lees of Nashua will be transferred to Lowell as division superintendent. M. N. Nash will be master mechanic of the company, with headquarters in Lowell.

Wallace D. Lovell, Warren Brown, Rufus N. Elwell, Albert E. McReel, Charles A. Williams, Joseph W. Fellows and Albert O. Brown have petitioned the mayor and aldermen of Manchester, N. H., for a franchise for a railway from the heart of the city to Lake Massabesic, and a hearing will be held June 10th. Wallace D. Lovell, who is to build the Manchester and Haverhill electric railway, has leased nearly all of the desirable land about the lake, and his object was undoubtedly for the purpose of giving the Haverhill line an entry into Manchester by means of the Massabesic Horse Railway company's charter, which was granted many years ago. The granting of the petition would seriously affect the business of the Manchester Traction, Heat and Power company, which runs a line to Lake Massabesic. It looks as though the Lovell syndicate and the Manchester Traction company were on the eve of a contest.

Forty members of the Massachusetts Electric Lighting Club met at Young's Hotel, this city, on May 10th. Charles L. Edgar, president of the Edison Electric Illuminating company, occupied the chair. After a luncheon, those present informally discussed various topics relating to the management of electric-lighting plants. B.

Canadian Intelligence.

Ottawa, Ont., May 18.—Manager Walbank of the Lachine Rapids Hydraulic and Land company, Montreal, announces that it is the intention of his company to tender for the contract for lighting the streets of Montreal. This contract is worth $250,000 per annum, at present, but the Lachine Electric company will tender at a lower figure than ever before attempted, in order to secure the contract. The company will shortly commence the erection of a steam power house in the center of the city, to provide against contingencies and insure electricity for lighting purposes the year around.

Boston (Mass.) and Kingston (Ont.) capitalists are interested in a proposed electric railway, to radiate east and west from Kingston, and ultimately to cover the territory between Toronto, Cornwall and Ottawa. The cars which the company proposes to operate on this projected road will be 60 feet long and divided into three compartments, one for smoking, one for passengers and the third for small freight.

There is now pending before the Montreal law courts a suit to determine the ownership of a large block of the Shawinigan Water and Power company's stock. The suit is brought by E. C. Whitney of Manchester, N. H., against John J. Joyce of Boston, Mass., and J. N. Greenshields, K. C., of Montreal. It is for stock to the amount of $2,000,000 and cash to the amount of $33,333. Mr. Whitney says that he undertook the promotion of the Shawinigan Falls company, and employed Mr. Greenshields as his attorney. He invited Mr. Joyce to come into the deal, and the proposition finally resolved itself into an understanding by which each of the three was to have one-third interest. The charter was obtained on January 15, 1898, and business was commenced. Mr. Whitney claims, however, that his stock was never issued to him, and he got no payment in cash. Mr. Greenshields, president of the company, claims that when they were required to make a payment of $50,000 to the Quebec government for the property, Mr. Whitney could not put up his share, and accordingly dropped out of the scheme.

Edgar Tripp, Canadian commercial agent in Trinidad, reports, under date of May 3d, that Charles H. Cahan, the representative of the Canadian syndicate backed by Sir William Van Horne, which has so successfully established itself in Jamaica and Demerara, has obtained the legislative authority necessary, and has completed his arrangements for the purchase of the electric-light and tramway companies of Port of Spain. The transfer will probably be completed before the end of the present month. The undertakings and special privileges for a term of years acquired by the syndicate are very valuable, covering, as they do, exclusive rights to supply electric light and power in the large and fast-growing city of Port of Spain. The capital of the new company is stated to be $1,000,000, of which over $200,000 has been subscribed locally.

The stockholders of the Ottawa Electric company, which suffered so severely by the disastrous fire in April of last year, which destroyed nearly all the company's power houses and much of its plant in the streets, have displayed the greatest courage in a further purchase of a new issue of stock of the company, to enable it to reconstruct its power houses and plant in a modern fashion. These, when completed in September next, will cost about $350,000. The company expends, in salaries, wages, etc., in the city of Ottawa, over $120,000 annually, and to the civic treasury it contributes $4,000 a year in taxes. Upon completing the improvements now under construction, the company will have expended $1,500,000 in the development of the electric-lighting system in Ottawa. The Ottawa Electric company has now in operation over 100,000 lamps of 16 candlepower each—a number which is said to be more than double that of any other city of equal population on the North American continent. A. V. W.

Southern Developments.

Charlotte, N. C., May 18.—It is understood that the Cape Fear Power company, located on the Cape Fear River, near Fayetteville, N. C., has contracted with four cotton mills to furnish a total of 2,000 horsepower, at $17.50 per horsepower. A three-phase alternating current, at a potential of 2,000 volts, is to be supplied.

A $250,000 electric-lighting plant is to be built on the first level of the Augusta Canal, Augusta, Ga., and competition in electric lighting is promised.

The work of electrifying the steam dummy line of the Atlantic Coast Line railway, which is leased by the Southside Railway and Development company of Petersburg, Va., has been nearly completed. The line extends out three miles from Petersburg.

The Southern Electric company of Charlotte, N. C., has gone into voluntary bankruptcy; liabilities, $8,300; assets, $6,500. The ill health of Captain J. J. Gormley, the president, is the reason assigned for the failure.

The Atlanta Railway and Power company has received two carloads of conduits for its new electric-light system in Atlanta, Ga. L.

Northwestern Notations.

Minneapolis, Minn., May 18.—Employes of the Seattle Electric company recently asked for an increase in wages from 22 to 25 cents an hour for the trainmen employed in Seattle, Wash. The company felt unable to grant the raise, but did offer to pay wages twice a month hereafter, which has long been desired by the employes. Each trainman with a family will also be allowed 60 tickets a month for the use of the members of his family. The company's offer was accepted.

The Electric Light and Power company of Omro, Wis., has made a proposition to sell its plant to the city. The authorities have the offer under consideration.

The Electric Light, Heat and Power company of Pipestone, Minn., has been incorporated, with a capital stock of $50,000.

Adolphus B. Nelson has been granted authority by the state of Wisconsin to dam the Wood River, in Burnett County, to develop power for an electric-light and power plant for Grantsburg.

The Illinois Central Railway company has awarded contracts to the Mechanical Equipment company of Chicago, to install an electric-light plant for the shops at Waterloo, Iowa.

The Fargo Edison company was awarded a contract to furnish street lighting for Fargo, N. D., at $7.45 per month per light, until August 31st.

The Wisconsin Valley Electric Railway company has accepted the franchise tendered by the council of Wausau, Wis., for the proposed interurban line which is to run from Wausau to Merrill.

An electric-car line is projected from Omaha to South Omaha, Fremont, Plattsmouth and Blair, Neb.

The Citizens' Electric Light company has applied to the council of Jamestown, N. D., for a 20 years' franchise.

The street-railway company of La Crosse, Wis., has settled the differences in the matter of wages by offering its men $45 per month, applying to all who had been in the service for more than three years.

The county commissioners at Seattle, Wash., have granted the request of the Seattle-Tacoma Interurban Railway company for a right-of-way through White River Valley.

The town of Steilacoom, Wash., wants better street-car connection with Tacoma. The citizens have pledged themselves to raise money to erect a car barn there, so that the last car may be housed there, and thus give an early-morning car for the first trip. The barn is somewhat unusual, being erected in the street and across the tracks.

The Duluth-Superior Traction company is doing considerable work in both Duluth and Superior, to improve its lines. Many of the lines are to be rebuilt and curves reduced, to enable the use of double-truck cars.

A. C. Miller, an Illinois inventor, explained in detail his device for additional protection to railway trains, before the railroad-conductors' convention, held lately in St. Paul. The device consists of an automatic system of red and white electric lights, which burn in the engine cab and warn the engineer if anything is wrong.

The street cars of Great Falls, Mont., are being fitted with illuminated signs. R.

Information from Indiana.

Indianapolis, May 20.—The Martinsville electric-railway fight is growing interesting. During the week J. C. Tarkington, chief promoter of the Indianapolis and Martinsville Traction company, forsook his companions, and, in company with J. E. Lowes, Ralph DeWees and J. E. Feight of Dayton, Ohio, R. E. Field of Cincinnati, Ohio, and several local capitalists, organized and incorporated the Indianapolis and Southwestern Traction company, for the purpose of building an electric line to Martinsville from this city. The new company was formed after trouble arose among the members of the old company and injunction proceedings were filed in court. The new company began a survey immediately and the surveyors are following exactly the same line as the Charles Finley Smith company has surveyed and has had appraised by the court, under the law of eminent domain. As soon as it was known that the Tarkington company had begun a survey the Smith company began the work of grading along the route at intervals where Mr. Smith had obtained a private right-of-way, a large force of men and teams being employed. Here are two lines to be built, practically over the same route, by equally determined and ample financial men, and present indications point to trouble over the supremacy of the right-of-way at conflicting points.

The final transfer of the right-of-way for the traction road that is to run from Muncie north to Fort Wayne took place at a meeting held in Muncie on May 17th. F. G. Brownwell, owner of the right-of-way, formally gave over to S. M. Hexter, S. A. Scheuer and A. Lewenthal, Cleveland (Ohio) capitalists, and others, the road he has been at work on for years. A stock company has been formed, with a capital of $1,500,000. Part of the stock will be taken by wealthy men in the cities, towns and country through which the road will pass. Three-quarters of a million dollars will be in the name of two Cleveland capitalists. The road will be known as the Eastern Indiana traction line.

Charles Perry, general superintendent of the Union Traction company at Anderson, has tendered his resignation, to take effect June 1st. No explanation is offered for his unexpected retirement. Mr. Ferry has been connected with the local and interurban lines even since their establishment, nine years ago, and was regarded as Charles L. Henry's right-hand man from the beginning. Mr. Perry's retirement is universally regretted.

The announcement is made that the Southern Ohio Traction company, controlled by Cleveland capitalists, will connect the two branches at College Corner, and thence build into Indiana, ultimately connecting Indianapolis with Ohio cities.

The proposed ordinance to prohibit street and interurban cars from using arc lights for headlights in the city of Indianapolis is generally commended by people and the press. F.

ELECTRIC LIGHTING.

An electric-light plant is being erected at Holstein, Iowa.

J. M. Westcott of Richmond, Ind., will lend that city $100,000 to build an electric-light plant.

Ravenswood, W. Va., has voted $7,000 in bonds for the erection of an electric-light plant.

The capacity of the electric-light plant at Estherville, Iowa, will be doubled this summer.

The West Nashville (Tenn.) Power and Light company is erecting a new electric-light plant.

The Clarendon (Texas) Electric Light and Power company has been organized, with $6,000 capital stock.

An electric-light plant, to cost $16,000, will be built by the Richmond (Ky.) Water and Light company.

J. M. Cheney of Orlando, Fla., wants an electric-light plant for furnishing 28 2,000-candlepower arc lights.

Rockingham, N. C., wants bids and specifications for electric lighting. H. L. Ledbetter can be addressed.

The Consumers' Light and Power company, Redding, Cal., has been incorporated, with $15,000 capital stock.

The Orlando Water and Light company, Orlando, Del., has been incorporated, with a capital stock of $100,000.

The Consumers' Electric Lighting company has been organized at Middletown, N. Y., with $25,000 capital stock.

It has been decided at Gastonia, N. C., to issue $10,000 of bonds for the extension of the present electric-lighting system.

B. J. Macdonald has purchased the Bristol (Tenn.) Gas and Electric Light company's plant, and will make extensive improvements.

The Fox River Electric Railway and Power company, Green Bay, Wis., is about to make a number of improvements in its power house. The addition

of new apparatus and the change of generators are among the important alterations.

The Delta Electric Light, Power and Manufacturing company of Greenville, Miss., has been incorporated, with a capital stock of $50,000.

W. F. Little and R. A. Corell have incorporated the Paris (Texas) Transit, Light and Power company, with an authorized capital of $250,000.

Sioux Falls, S. D., has taken steps toward municipal lighting, and the City Council has authorized the expenditure of $12,000 to provide a plant.

A charter has been applied for by the recently organized Clarendon (Texas) Electric Light and Power company. The capital stock will be $6,000.

Judge W. O. Harris, B. K. Marshall and Alonzo Walker have incorporated the People's Electric company at Louisville, Ky., with a capital stock of $25,000.

A power plant, with a capacity of 6,000 horsepower, is being installed by the Keswick Electric Power company, about 40 miles southeast of Redding, Cal.

The Citizens' Light and Power company of Sullivan, Ind., has sold its plant to the Sullivan Light, Heat and Power company. The two systems will be consolidated.

On June 1st the mayor and aldermen of Dyersburg, Tenn., will receive bids on granting a 20-year franchise for a water and light plant, to be built in the city of Dyersburg.

T. V. Hall has been appointed consulting engineer, to design and supervise the proposed $15,000 electric-light plant at Ellisville, Miss. The contract will be let on June 15th.

At the meeting of the Commonwealth Electric company of Chicago, held May 20th, the old directors were re-elected and they will re-elect the same officers. No other business was transacted.

Extensive additions are to be made to the Mattoon (Ill.) Heat, Light and Power company's plant; new machinery will be installed. The proposed improvements will cost about $25,000.

The Bedford Heat, Light and Power company, Bedford, Ind., has been organized, with A. C. Norris, president. The company will build an electric-light plant to cost about $35,000.

The Indian Bureau has about completed plans for the new heating and electric-lighting plants to be erected at the Fort Totten (N. D.) Indian school, for which Congress appropriated $18,000.

About $50,000 will be expended by the Oshkosh Electric Light and Power company, Oshkosh, Wis., in rebuilding its entire plant. Work will be commenced as soon as the city-lighting contract is awarded.

An electric-light plant will be erected at Kenton, Ohio, by the People's Heat and Light company, which was lately incorporated, with a capital stock of $100,000. This company will compete with the Kenton Gas and Electric company.

ELECTRIC RAILWAYS.

Surveys are about completed for the extension of the Huntsville (Ala.) electric-railway line.

Work has begun on the survey for the trolley line to run between Augusta, Ga., and Aiken, S. C.

The Wisconsin Traction, Light, Heat and Power company has been given the right to construct tracks on certain streets in the city of Kaukauna, Wis.

The West Liberty (Ohio) council has granted a franchise to the Urbana, Bellefontaine and Northern Railway company, permitting it to run through that place.

Citizens of St. Elmo, a suburb of Chattanooga, Tenn., are negotiating with the Chattanooga Rapid Transit company to extend its trolley system to St. Elmo.

Thomas N. Kerr, treasurer of the Union Electric Railroad company, has been granted a 25-year franchise to operate an electric road through Marysville, Ohio.

W. V. Coons, C. C. Barr and W. H. Boys are the incorporators of the People's Light and Railway company at Streator, Ill., with a capital stock of $150,000.

The Fairport Electric Railway company has been incorporated, with a capital stock of $110,000, to construct an electric road, 11 miles long, between Fairport and Rochester, N. Y.

Right-of-way has been granted to the Lafayette Street Railway company of Lafayette, Ind., over the Riverside and Battle Ground road from West Lafayette to the town of Battle Ground.

H. W. Knight, representing eastern capitalists who are promoting the proposed electric railway to run from Lexington to Decatur, Ill., by way of Clinton, Ill., is arranging to secure a franchise to run through Clinton.

The county commissioners at Jefferson, Ohio, have granted a 50-year franchise to the Pennsylvania Railroad company, to construct an electric line from Cinnecut village to the east state line. The company is building a road from that village to Ashtabula.

The Charleston-Mattoon (Ill.) Electric Railway company has given the Chicago Title and Trust company a deed for $200,000. The latter concern will sell bonds to raise the money with which to build the road.

The Los Angeles (Cal.) Suburban Railway company has been incorporated, with an authorized capital stock of $1,000,000. An electric railway will be built between Los Angeles and Fullerton. G. Hanna, E. Hardy and J. H. Spires are the incorporators.

The Bluegrass Traction company, Paris, Ky., has been incorporated, with $10,000 capital stock, with the privilege to increase it to $1,000,000. The company contemplates the building of an electric line between Paris, Georgetown, Richmond and other central Kentucky towns.

The Wilkesbarre and Hazleton Railroad company of Wilkesbarre, Pa., contemplates the construction of an electric railway between Hazleton and Wilkesbarre and also with Scranton. The proposed line will be about 25 miles long, or one-half the distance covered by the present steam roads, and will reach all the Wyoming Valley coalfields.

The American Light and Traction company has filed an amended charter with the secretary of state of New Jersey, increasing its capital stock from $2,000 to $40,000,000, of which $25,000,000 is preferred stock. It is thought that a merger of North Jersey lighting and trolley interests is being provided for by this incorporation.

A party of engineers and other experts connected with German street railways will arrive in this country some time in June, to study the electric-railway systems of this country. They will gather data for submission to their respective executive officers, which, it is anticipated, will result in substantial orders being placed in the United States.

Building is reported nearly completed on the Pittsburg, McKeesport and Connellsville Electric Railway company's line which is to run from Pittsburg to Buena Vista, West Newton, Ruffsdale, Tarr, Scottdale and Everson, to Connellsville, with branches from Connellsville to Uniontown, Masontown and the Monongahela River. The road will be ready for operation about June 10th.

The early construction of the Waukegan (Ill.) and Fox Lake electric railway appears to be a surety. The Industrial Trust company of New York will supply the money on the company's bonds as soon as a clear right-of-way is secured, and this has almost been accomplished. If the right-of-way is secured soon, the work will commence in 60 days, and the road will be put in operation by fall.

The Metropolitan underground railway which was recently completed in Paris has made such a decided improvement in transportation that the project of constructing another system which will cross the city in another direction is well under way. There is much speculation among the several American companies in Paris regarding the distribution of the contracts for the proposed road.

Another link in the line from Albany to Buffalo has been secured by the Cleveland syndicate. The line just purchased is the Herkimer, Mohawk, Ilion and Frankfort street railroad, seven miles long and well equipped. The purchase of this line is considered an important move in the scheme to parallel the New York Central railroad from Albany to Buffalo with a double-track electric line.

Surveys are reported completed as far as Middletown, Ohio, for the Dayton, Germantown, Hamilton and Cincinnati Electric Railroad company's line from Dayton south through Middletown, Germantown and Hamilton to Cincinnati. It is stated that contracts will be let at once for grading on the Dayton end of the line. J. O. Arnold of Dayton is president, and T. C. Lindsay, secretary, of the company.

The committee which has been inquiring into the vibration on the underground railway in London has made a report to the effect that this annoying vibration is undoubtedly caused by a large proportion of the weight of the locomotives not being borne on the springs and also by the rails lacking in rigidity. The company has ordered a new type of locomotive and will try to employ stiffer rails.

The International Rapid Transit Ferry company, Buffalo, N. Y., was incorporated and has taken over the property and franchises of the International Ferry company and Fort Erie Ferry Railway company, and will build a system of electric lines connecting Buffalo and Fort Erie with Crystal Beach, the Fort Erie racetrack, Niagara Falls and Toronto, T. C. Fenyear is president of the company.

AUTOMOBILES.

Rev. H. M. Spickler and James A. Starkweather, two students at Shurtleff College, Upper Alton, Ill., expect to start in June on a trip around the world. The young men will make the trip in an automobile and will work their way, starting without a cent.

The Automobile Street Sweeper company has filed articles of incorporation with the secretary of state of Maine, and its certificate has been approved. Its capital amounts to $1,500,000. C. L. Dunn of Portland, Me., is president, and C. J. Hastings of the same city is treasurer.

The Connecticut Legislature has adopted regulations for automobiles, limiting their speed to 12 miles per hour in the city and 15 miles per hour in the country. The law provides that the vehicles shall decrease their speed or come to a stop when near a frightened horse, and speed must be reduced to complete control at street crossings. The penalty for violating the law is a fine of $200.

Alexander Winton and Charles B. Shanks have started from San Francisco to make the trip to New York in an automobile. This is the longest trip of the kind ever attempted in the United States, and its progress will be watched with interest. The trip is being made under the auspices of a newspaper, and the fastest time possible will be maintained over the entire route, which will measure possibly 4,000 miles.

Mr. and Mrs. Robert Shaw of Chicago, Ill., who left New York on May 8th to make the trip to Chicago in their gasoline automobile, arrived at their home on Ashland avenue, Saturday, May 18th, having accomplished the trip in 10 days, 11 hours and 25 minutes. The run was the result of a challenge made to the Shaws that they could not make the run in 12 days. The total time spent on the road was 97 hours and the distance covered was about 1,100 miles.

PUBLICATIONS.

"Who Uses Mechanical Draft" is the title of a recent publication of the B. F. Sturtevant company of Boston. It gives a list of many of the users of Sturtevant apparatus.

The Boston Electric Heating and Power company of 153 Milk street, Boston, has issued a folder descriptive of its noiseless centrifugal electric cooling fans for ceilings, dining tables, desks, etc.

The 1901 edition of the rules and requirements of the National Board of Fire Underwriters for the installation of automatic sprinkler equipments has just been issued by the Underwriters' Laboratories, 67 East Twenty-first street, Chicago. Copies may be obtained by addressing Secretary W. H. Merrill, Jr., at the above address.

The telephone department of the Western Electrical Supply company of St. Louis has just issued a number of bulletins covering its new telephones, switchboards, etc. These are bound up in catalogue form, and embrace everything pertaining to the complete equipment, construction or maintenance of a telephone line or exchange. They contain a large number of absolutely new devices for the economical operation of lines and exchanges which, it is said, have never been shown before. Among the new things noted are loud-ringing extension gongs, developed in response to a demand for an extension bell to be used on telephone lines in noisy places, adjustable arms, long-distance transmitters, with solid backs, and Ideal bridging telephones, claimed to be the highest grade long-distance telephones ever produced. The company also shows an attractive-looking receiver, with a covered diaphragm. Anyone contemplating installing a new exchange, or making additions and improvements of any kind, might profit by obtaining a copy of these bulletins.

SOCIETIES AND SCHOOLS.

The next annual meeting of the Ohio Electric Light association will be held at Hotel Victory, Put in Bay, on Lake Erie, Ohio, on August 20th, 21st and 22d.

The subjects of the theses to be presented by the candidates for the degree of electrical engineer at the Lehigh University this spring are: "Theory and Calculations of the Induction Motor," "Induction Wattmeter Tests," "Theory and Calculations of Alternating-current Transmission Lines," and "Conductivity Tests of Copper."

Entrance examinations to the Massachusetts Institute of Technology will be held at the Rogers building, 491 Boylston street, Boston, Mass., on Thursday and Friday, June 27th and 28th. A second series will be held on September 24th and 25th. For the convenience of applicants in Chicago, Dr. H. H. Belfield will hold examinations at the Chicago Manual Training School, Michigan avenue and Twelfth street, on June 27th and 28th.

An electrical exhibition will be held at the Royal Aquarium, Westminster, London, S. W., from December 16, 1901, to January 26, 1902, inclusive. A synopsis of the intended features may be obtained from the organizer, M. J. G. Ritchie. The hall is to be specially fitted for machinery in motion, and for the generation of current. A special feature is to be made of electric-lighting-plant material and accessories. The Aquarium is well situated for the exhibition and the management is well known.

On the evening of Tuesday, June 4th, the Chicago Electrical association will hold its annual banquet, which this year will be made the occasion of a decennial celebration, the society having been organized in 1891. All of the details have not yet been arranged, but the banquet promises to be a very successful one. A number of prominent Chicagoans connected with the electrical industries will respond

to toasts. The committee, of which W. Clyde Jones is chairman, is preparing a very interesting programme.

SPACE TELEGRAPHY.

Rev. C. H. Tyndall, Mount Vernon, N. Y., employed wireless-telegraphy apparatus to illustrate several points in a sermon which he recently made.

The Atlantic Wireless Telegraph and Telephone company, Baltimore, Md., has been incorporated, with $5,000,000 capital stock. This company is said to control the rights for the Marconi system in Maryland, the Virginias and the Carolinas.

Mr. Marconi has announced that he has successfully installed his system of wireless telegraphy in a steam motor car. He is thereby able to communicate with a receiving point while traveling. The British war-office officials plan to witness a test of the system.

MISCELLANEOUS.

Sealed proposals for the installation of an electric-conduit and wiring system for the postoffice at New Brighton, Pa., will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 2 p. m., June 17th. Drawings and specifications may be obtained by addressing James Knox Taylor, supervising architect.

It has been proposed to erect a monument over the grave of James Bowman Lindsay at Dundee, Scotland. Mr. Lindsay taught electricity, magnetism, etc., in Dundee over 40 years ago. In 1834 he made the prediction that "houses and towns will in a short time be lighted by electricity instead of gas, and machinery will be worked by it instead of steam." In 1854 he transmitted telegraphic signals through the water electrically, and in 1859 he demonstrated the success of his method, before the British Association, by sending signals across the harbor at Aberdeen. He also read a paper entitled "Telegraphing Without Wires." He died in Dundee in 1861.

TRADE NEWS.

The St. Louis Electrical Supply company has moved from 911 Market street to a new address at 1118 Pine street, St. Louis, Mo.

The Statesboro Manufacturing company of Statesboro, Ga., is in the market for machinery for electric-lighting purposes. D. P. Averett may be addressed.

The Allis-Chalmers company has formally purchased the holdings and improvements of Frazer & Chalmers and of the Gates Iron Works of Chicago, paying $2,875,000 for the former and $410,000 for the latter.

Davis & Davis, patent lawyers, have opened an office in the St. Paul building, corner of Broadway and Park Row, New York city. Mr. W. R. Davis will be in charge of the New York office and Mr. C. D. Davis will remain in charge of the Washington office of the firm.

The Wirt Electric company of Philadelphia, manufacturer of rheostats, theater dimmers, speed controllers, dynamo brushes, etc., is distributing to the trade a very useful folding celluloid rule. There are inch and centimeter scales and on the back of the rule are given a Brown & Sharpe wire gauge and other information useful to the electrical engineer.

The Jandus miniature, enclosed, three-ampere arc lamp is a new aspirant for honor in the arc-lamp world. It has the following features: Length, 20 inches; weight, 10 pounds; steadiness of burning equal to a five-ampere lamp; parts, single solenoid, rheostat and upper carbon sheath; any desired finish. The design is along the lines of grace and beauty. The sale of the lamp is reported as large by the Jandus Electric company of Cleveland, Ohio, the manufacturer. The Chicago office of the company, 1537 Monadnock building, will supply all desired information. A stock of miniature arcs is carried at Chicago.

The value of a battery of Chloride accumulators as a reserve power in case of emergency was forcibly illustrated on the evening of May 11th at Philadelphia during the severe electrical storm which visited that city at that time. A portion of the generating machinery at the Union Traction company's Ogontz sub-station was disabled by lightning, and the battery station at Erie and Germantown avenues carried this section of the load for almost a half hour, while connections with the Beach street power house were being made. Without the battery this section of the road would have been forced to suspend operation for a considerable time.

The Stanley Electric Manufacturing company of Pittsfield, Mass., has found it expedient, in order to take better care of its large southern trade, to establish another sales office in the South, this one at Winston Salem, N. C., with F. A. Barr as district manager. The Stanley company's other southern office is at Rock Hill, S. C., in charge of F. C. Whitner. The Stanley company now has, besides the two mentioned above, branch sales offices located at follows: 71 Broadway, New York city; Equitable building, Boston, Mass.; 26 South Fifteenth street, Philadelphia; 31-33 New Montgomery street, San Francisco, Cal.; Pioneer building, Seattle, Wash.; Madison, Wis.

The Westinghouse Electricitäts-Aktien Gesellschaft of Germany has been organized. This company will manufacture and install the same class of apparatus as that manufactured by the Westinghouse Electric and Manufacturing company at Pittsburg, Pa. The capital of the company is placed at 1,000,000 marks. The founders given in the list of incorporators are: The Westinghouse Electric company, Limited, London; the head of the company, Lemuel Bannister of London; the head of the Russian company, William E. Smith of St. Petersburg; Frederick Hessenberg, London; Charles Maynard Owen of London; Engineer Felix Singer of Berlin, and F. Hessenberg of London, are named as the executive committee.

BUSINESS.

The Norfolk Coal and Coke company, Maybeury, W. Va., has purchased two 450-horsepower engines from the Ball Engine company, Erie, Pa.

The Peru Electric Manufacturing company of Peru, Ind., reports success for its new baby knife switch. The trade in general apparently approves this new switch as readily as has the National Board of Fire Underwriters.

W. N. Matthews of St. Louis says that he was too busy attending to Stombaugh guy-anchor business to attend the electric-light convention. The Western Electrical Supply company of St. Louis is about to issue a very attractive bulletin on Stombaugh guy anchors.

The Buckeye incandescent lamp is said to be in good demand among consumers desiring a high-average service. The lamp is manufactured by the Buckeye Electric company, Cleveland, Ohio. A stock of 50,000 lamps is carried by the Chicago office of the company, 1537 Monadnock building.

The Manhattan Electric Supply company of New York and Chicago is receiving an exceedingly heavy demand for the specialties manufactured by the company, as well as its general-supply line. It calls attention to its own make of battery fan motor, an article that can be used where there is no day electric-light circuit.

The American Bridge company will furnish the steelwork for the Rogers Hotel, to be erected at the corner of Seventh avenue and Fifty-fifth street, New York city. The company will also furnish the Atchison, Topeka and Santa Fe Railroad company with a red-rock cantilever bridge over the Colorado River, and two deck plate girder spans for the Nacozari Railroad company of Mexico.

The Central Electric company of Chicago has issued a new price-list and discount sheet, dated May 1st, applying to its general catalogue. These lists have been distributed to all its customers who are in possession of a general catalogue, and any who did not receive a copy should let the Central company know, in order that it may be traced. The company is desirous of keeping its customers well posted in regard to the latest prices.

The steel-arch bridge at Niagara Falls, which is represented by the steel engraving on the five-cent stamps of the commemorative Pan-American series, was built by the Pencoyd Iron Works, now the Pencoyd plant of the American Bridge company. It spans the Niagara River immediately below the Falls, and connects Niagara Falls, N. Y., with Clifton, Canada. The bridge is 46 feet wide and 840 feet long, and carries two electric railways, two driveways and two sidewalks.

The Belknap Motor company of Portland, Me., has, with the persistency for which it is well known, and by continuously improving, experimenting and redesigning, brought its Belknap or W. H. C. regulator up to what is believed to be the highest possible point of efficiency. The company is receiving orders from all parts of the world, it says. The company was awarded first prize at the Paris Exposition. Enamel units are used almost entirely in the resistance of the regulators, and they are built for both alternating-current and direct-current generators, from 2½ kilowatts to 1,000 kilowatts.

Some idea of the magnitude of the works of the B. F. Sturtevant company of Boston can be gathered from the fact that the engine and electrical departments, covering over an acre of floor space, which were recently damaged by fire, represented only about one-quarter of the total floor area of the plant. It was therefore possible by a process of compression in the blower and heater departments to provide within these walls sufficient space to re-establish the damaged departments. This has now been done, the offices are again occupying their old quarters, and work is progressing much as before the fire.

The International Specialty company claims unequaled facilities for the turning out of high-grade special work in wood and metal, both for electrical and mechanical purposes. The company does not manufacture any standard line of specialties, and it is the intent and purpose of its organization to have it better prepared and equipped to fill any order for a special kind of goods than any other concern in the country. The factory of the company now employs over 200 people, who are engaged in the filling of orders for various kinds of special metal and wood work. The business ranges from the manufacture of cabinet work, telephone work, tables and furniture, to the making of all kinds of telephone parts, coils, stampings, formings, plating, screw-machine work, etc. The company claims to have the largest and best equipment, devoted solely to this kind of business, in the United States, and it is its intent and purpose to offer its facilities to anyone desiring them at the lowest possible rates and with the quickest possible delivery. Correspondence may be addressed to its Chicago sales office at 1005 Monadnock block, to G. Hallett Johnson, manager, Chicago, or to the factory at Adrian, Mich.

The American Electric Fuse company of New York, Chicago and San Francisco calls attention to the fact that its factory has been removed to Adrian, Mich., where larger and better facilities for turning out work are afforded. The company is now employing over 100 people, and a demand for its goods has been so unprecedented that it has been for some time considerably behind on its orders. The great difficulty of securing porcelain in the large quantities required by the company has compelled it to lose several orders by reason of its inability to fill them. The company has, however, just made new arrangements, doubling its former capacity for supplying porcelain, and it has now on hand a large stock of its standard sizes. It is expected there will be no further delay in filling orders on this score. The company has recently closed contracts with several of the largest telephone companies of the United States for the furnishing of its standard lines of protectors, connectors, fuses, etc. The company is also doing a very large jobbing trade as wholesalers, and jobbers have found it an advantage to them to carry a complete stock of the American company's goods always on hand to supply the constant demand for them.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 14, 1901.

673,900. Electric Battery. David H. Darling, Jr., New York, N. Y., assignor to the United States Battery company, New York, N. Y. Application filed October 11, 1899.

A containing jar or vessel has an enlarged upper end which is provided internally with a grooved shoulder. Means are provided at the bottom of the vessel for holding or securing the lower end of one of the electrodes. These features are combined with a sealing cover that sustains the upper end of the electrode and rests, when in position, upon the shoulder. A second electrode is sustained against the inner surface of the jar or vessel. One or more vent tubes extend through the cover, and an adhesive medium is located in the groove between the cover and the shoulder and is adapted to seal the upper end of the jar or vessel and secure all of the parts in permanent position.

673,903. Electric Cable. John D. Gould, Brooklyn, N. Y. Application filed April 6, 1898.

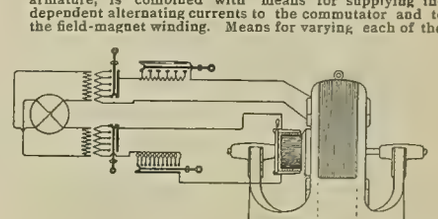
This device involves a working-current conductor and a thermostatic conductor. The thermostatic conductor consists of a fusible core and a wire coiled around the core but insulated from it and also insulated from the working-current conductor. A single-thickness covering is provided for the cable. The thermostatic conductor engages the inner surface of the covering.

673,910. Controller for Motors. Christian W. Kragh, Madison, Wis., assignor to the Northern Electrical Manufacturing company, Madison, Wis. Application filed April 14, 1900.

A series of conductors is coiled about a supporting part in planes substantially at right angles to it and are secured at one end to the supporting part. There is a commutator part which carries a brush. An electrical connection is made from each of the coils to its associated commutator strip. Another electrical connection is made from each of the coils to the next coil.

673,911. Polyphase Alternating-current Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed January 30, 1899.

This motor which has a completely laminated field magnet and means for commuting the currents supplied to its armature, is combined with means for supplying independent alternating currents to the commutator and to the field-magnet winding. Means for varying each of the



NO. 673,911.

applied electromotive forces are provided and there is a variable inductive resistance in the armature circuit and a variable non-inductive resistance in the field-magnet circuit. (See cut.)

673,912. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed July 14, 1900.

A rotary converter is electrically connected between two circuits, a direct-current and an alternating-current circuit, each of which supplies its own translating devices with energy. An exciter, which is provided for the converter, has means for being driven in synchronism with the converter. (See cut.)

673,913. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed July 14, 1900.

A system is described in which alternating-current energy is converted into direct-current energy for supplying translating devices. A rotary converter which has a shunt field-magnet winding is combined with a circuit-breaker for the circuit supplied by the converter. This circuit-breaker has a locking coil in series with the shunt winding of the converter.

673,935. Electric-lighting System. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 21, 1899.

A glower composed of rare earths or a mixture of earths is the incandescing body. An electric heater is included in the low-potential secondary of a converter, and an electromagnetic device is in circuit with the glower. This electromagnetic device is operatively connected with a circuit-breaking switch in the heater circuit. (See cut.)

673,936. Magazine Glower Lamp. Alexander J. Wurts, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed April 25, 1900.

This device comprises a number of glowers or sets of glowers and a heater in separate branch circuits. Means operated by the current traversing one glower or set of glowers are provided to cut out the heater and the other glowers or sets of glowers.

673,951. Electric Arc Lamp. John Herricht, Cleveland, Ohio, assignor of one-half to Gustav Walther, Cleveland, Ohio. Application filed December 25, 1900.

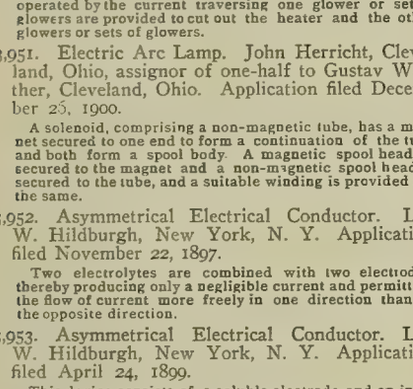
A solenoid, comprising a non-magnetic tube, has a magnet secured to one end to form a continuation of the tube and both form a spool body. A magnetic spool head is secured to the magnet and a non-magnetic spool head is secured to the tube, and a suitable winding is provided for the same.

673,952. Asymmetrical Electrical Conductor. Leo W. Hildburgh, New York, N. Y. Application filed November 22, 1897.

Two electrolytes are combined with two electrodes, thereby producing only a negligible current and permitting the flow of current more freely in one direction than in the opposite direction.

673,953. Asymmetrical Electrical Conductor. Leo W. Hildburgh, New York, N. Y. Application filed April 24, 1899.

This device consists of a soluble electrode and an inert electrode in an electrolyte which produces no more than a negligible current. In this the substances carried to either or both electrodes by a current flowing through it in one direction are immediately removed. The substances carried to either or both electrodes by a current flowing through it in the opposite direction are allowed to remain.



NO. 673,912.

673,980. Electromagnet Motor. Louis H. Engelhardt, Everett, Mass., assignor of one-half to Harry M. McNelly, Everett, Mass., and Mark Gallert, Waterville, Me. Application filed June 22, 1900.

In this motor there is a group of fixed magnets, the alternate groups being of opposite polarity. An armature is made up of two groups of magnets separated from and out of contact with the fixed magnets and arranged to traverse the fields of the latter. The alternate magnets of each group in the armature are of opposite polarity to the other magnets of the group, and also with the magnets of the two groups alternating. A commutator controlled by the armature is provided for reversing the direction of the current through the magnets of one group of armature magnets independently of the other group as the former pass the fixed magnets and while the magnets of the other group are between the fixed magnets.

673,985. Illuminating Device for Gun Sights. Edwin H. Hollister, Westpoint, Neb. Application filed August 3, 1900.

This device consists of a detachable member which has a hinged portion. Electric lamps are adjustably carried thereby, one near each end. Means whereby the lamps may be adjusted with relation to the sights are provided.

674,018. Electrical Contact Device. Miner Robinson, Newton, Mass. Application filed January 31, 1901.

Two broad resilient conducting metal plates have an insulating member between them. Two metal strips are interposed between the conducting plates and insulating member and have projecting ears provided with holes. Binding screws engage with the ears and with the insulating material.

674,027. Sparker for Gas Engines. John G. Snyder, Green Island, N. Y. Application filed March 9, 1901.

A fixed piece, provided with an insulated conductor and a sparking lever having one arm heavier than the other and pivotally supported by a piece which is adapted to have a reciprocating movement in relation to the contact end of the insulated conductor, is combined with a source of an electric current. A return wire is connected with the source of the electric current. There is a suitable receiver of the current. A current-supply wire connects the insulated conductor with the source of electric current, whereby a single spark is produced.

674,029. Igniter or Circuit-breaker. William G. Stolz, Brooklyn, N. Y. Application filed February 5, 1901.

The component parts of this device are a contact point or points, a circuit-closer, and a rotatable wheel or disk which has two corrugated or serrated surfaces extending respectively on a plane above and below the plane of the periphery of the wheel or disk. Means are provided upon the circuit-closer to operate in connection with the corrugated or serrated bearing surfaces.

674,030. Electric Igniter for Explosive Engines. William G. Stolz, Brooklyn, N. Y. Application filed February 5, 1901.

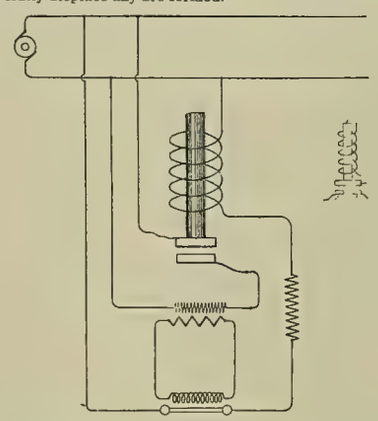
There is a suitable insulating disk and an insulating wheel. A conductive ring with a cam is connected to the wheel, and there are suitable brushes operating in connection therewith. A pin or contact device is in circuit with the igniter and brushes and is located in the path of one of the brushes so as to form the circuit should either or both of the brushes fail to act.

674,067. Electric Arc Lamp. William H. Northall, Elwood, Ind., assignor to the Lea Manufacturing company, Elwood, Ind. Application filed January 18, 1900.

This lamp consists of a current contact, a carbon guide and a cut-out, which is composed of a flat circular part, a cylindrical solid piece and a cylindrical tube fitting and surrounding the solid piece and extending beyond it. There is one or more slots in the tube extending beyond the end of the solid piece, and one or more spring fingers are supported from the end carrying the circular piece and adapted so as to be free to spring laterally outward.

674,076. Electric Switch. Cummings C. Chesney and Herbert W. Smith, Pittsfield, Mass., assignors to the Stanley Electric Manufacturing company, Pittsfield, Mass. Application filed July 23, 1900.

Two relatively movable terminals are located in a line considerably out of the vertical. A fuse connects the terminals and holds them relatively stationary. A receptacle of non-conducting material surrounds and confines the fuse and is held in position thereby. Means are provided for releasing one end of the fuse and retracting one of the terminals, thereby permitting the receptacle to fall and laterally displace any arc formed.



NO. 673,935.

674,105. Battery Cell. Edward Tiquet, Romford, England. Application filed January 9, 1901.

This device comprises a main body of wood or the like and an enclosing envelope having portions wrapped around the lateral walls of the main body and united thereto by an elastic, waterproof and insulating medium. There is also a bottom piece of greater size than the bottom of the main body, united thereto by the insulating medium, and having its edges folded upon and united to the lateral portions of the envelope by the insulating medium. The interior of the main body and the exterior of the envelope is coated with the insulating medium.

674,108. Electric-railway System. Benjamin W. Tucker, Newark, N. J. Application filed January 30, 1901.

A continuous feed wire in an electric rail has at suitable intervals along its length expansible portions forming parts of the continuous conductor and which are adapted to take up longitudinal expansion and contraction in the conductor. A lighter conductor is provided on the feed wire and also has at intervals along its length the expansible portions which form parts to take up longitudinal expansion and contraction.

674,109. Electric-railway System. Benjamin W. Tucker, Newark, N. J. Application filed February 9, 1901.

A longitudinal body of non-conducting and non-magnetizable material has an open-top groove. The line conductor is placed in the groove. These are combined with the sectional exposed conductor on the body and which depend at the sides thereof. Longitudinal side-securing means engage the body and the depending portions of the conductor.

674,110. Electric-railway System. Benjamin W. Tucker, Newark, N. J. Application filed February 7, 1901.

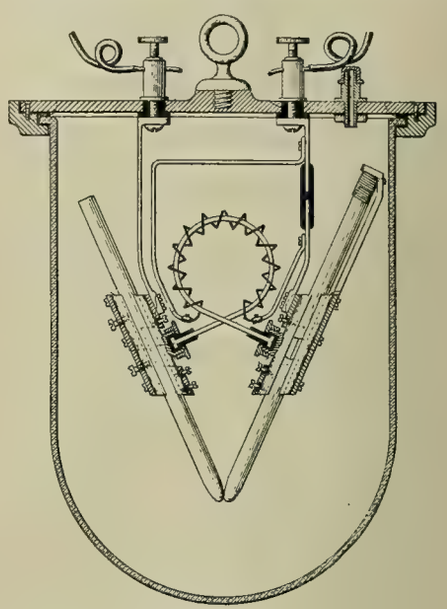
Parallel rail bodies each has a longitudinal groove or conduit in its upper portion. The supply and return conductors are placed in the grooves or conduits. Combined with these are the normally dead exposed sectional conductors for the bodies. The bodies have downwardly diverging side surfaces, and the sectional conductors have downwardly diverging longitudinal edge flanges to encompass the upper portions of the bodies.

674,124. Electric Heater. Conway Robinson, Baltimore, Md. Application filed April 17, 1899.

An ordinary electrode has an automatically operating feed mechanism. A good heat-conductive electrode has an extension for receiving the article to be heated. Means are provided for supporting the article to be heated within a surrounding shell. There is heat-insulating material within the shell and surrounding and insulating the heat-conductive electrode.

674,130. Electric Arc Lamp. Tapley W. Young, Washington, D. C., assignor of one-half to Annie Campbell, Washington, D. C. Application filed August 4, 1900.

This lamp combines spring hangers, inclined sleeves for guiding the carbons convergently, the sleeves are supported by the hangers. Clutch mechanisms are borne by the sleeves and are adapted to grasp the carbons or to release them. Electrically actuated devices are constructed and arranged to first operate the clutch mechanisms and then to separate the sleeves by bending the spring hangers outwardly when current is applied and to reverse those movements when the current diminishes or ceases. (See cut.)



NO. 674,130.

674,207. Electric Switch. Joseph C. de Janisch, Paris, France. Application filed April 27, 1900.

A sliding switch member has a contact adapted to be engaged thereby. A rocking switch member is fulcrumed on the sliding member. Contacts are adapted to be engaged by the rocking member, and means are provided for operating the switch members.

674,280. Electric Clock-winding Mechanism. Victor Odquist, Chicago, Ill., assignor to Albert Tuerk, Chicago, Ill. Application filed June 25, 1900.

In this invention the main shaft, ratchet disk and motive spring forming the intermediate operative connection between the same are combined with a series of lateral studs on the side of the ratchet disk. An oscillating arm carries a dog or pawl adapted to engage the studs. The arm extends to the side of the ratchet disk farthest from the pivot axis of the arm. The pawl has a widened face formation. An intermediate shaft carries the arm. An oscillating armature is carried by the shaft, and there is an electromagnet for operating the armature.

674,283. Electric-lamp Socket. John D. Pierce, Philadelphia, Pa. Application filed May 21, 1900.

This device consists of a shouldered insulating block, a lamp socket and binding post, which is secured thereto by a headed pin terminating in a threaded coil. An insulating washer is placed between the binding post and the head of the pin. Setscrews, one carried by the binding post and the other by the threaded coil, serve to secure the conducting wires to the insulating block. An enclosing casing comprises a shouldered base block, and a tubular casing projects therefrom. An insulating sleeve is interposed between the casing and the socket, and a ring bears on the shoulder of the base block and has projecting arms outside of the tubular casing. These arms carry screws passing through the casing and these engage with the insulating block.

674,336. Coin-controlled Electromedical Battery. Jacob G. Hartman, Baltimore, Md. Application filed January 24, 1900. Renewed October 17, 1900.

A suitable case has conducting external handles, one of which is rotatable but normally locked. This is combined with a battery within the case which is arranged to make circuit through the handles. Means are provided whereby rotation of one handle may make and break the circuit. An induction coil has its primary helix in the battery circuit and its secondary terminals connected with the handles, respectively. Means are provided whereby a coin unlocks the rotary handle, and devices are arranged to break the secondary circuit automatically at a fixed interval after the closing of the battery circuit.

674,338. Electric Arc Lamp. John Herricht, Cleveland, Ohio. Application filed August 27, 1900.

A solenoid comprises a non-magnetic body and lower head. A conical upper head of magnetic material is adjustably mounted on the body, and a tubular core is adjustably mounted in the upper end of the body. A carbon guide tube of magnetic material is adjustable in the core. The lower end of the guide tube projects below the core.

DESIGNS.

34,502. Case for Electrical Measuring Instruments. Frank W. Roller, New York, N. Y. Application filed March 30, 1901. Term of patent, seven years.

34,503. Insulating Block for Electric Lamps. Irving E. Brown, Providence, R. I., assignor to Providence Gas Burner company, Providence, R. I. Application filed April 5, 1901. Term of patent, 14 years.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, JUNE 1, 1901. No. 22

Electrical Features of the Chicago National Bank.

With the completion of the Chicago National Bank building there has been finished an interesting and thoroughly well-executed job of electrical construction and equipment. The building itself is a very handsome one, and it is beautifully appointed. It is located at 148 to 154 Monroe street, Chicago. Entering the building through massive oxidized-bronze doors, one finds himself in a hall constructed entirely of white Italian marble in Pompeiian-Ionic style. White-marble stairways lead to the floors above and to the safety-deposit vaults in the basement. Illumination for the vestibule is supplied by two two-light fixtures, mounted with half-globes, while the hall is lighted by three bronze electroliers, each supporting six 16-candlepower lamps.

Passing through heavy, highly polished bronze gates of special design, one enters the main banking room, a view of which is given in Fig. 1. This room extends practically to the rear of the building. It is a magnificent room, with marble walls running almost to the full height of the building. The working rooms of the officers and clerks extend along two sides and across the rear, leaving a very commodius space in the center for the use of the patrons of the bank. The counter in front of the cages is of Georgia green marble, while the furniture is of mahogany. Italian Pavanozzo marble is used for the wall panels, which are 24 feet in height. No windows are provided in this room except in the rear, the light of day coming through a beautifully designed stained-glass ceiling, which in turn is lighted from skylights in the roof, directly above.

The general electric illumination of the main banking room is supplied by means of eight large electroliers, suspended from the main roof trusses, each provided with 20 16-candlepower lamps. Ten of the lamps in each electrolier are enclosed in a large pendant globe, while the other 10 are mounted on the circular edge of the fixture. Seven of these beautiful clusters are shown in Fig. 1, which is a view of the room looking toward the main entrance.

The electroliers are of specially designed heavy bronzework. Their handsome and artistic appearance may be judged from the detailed view, shown in Fig. 2. The raising and lowering of these fixtures are accomplished by means of winches and steel cables from walks built between the ceiling of the banking room and the skylights. The electroliers are also provided with positive fastenings, so that when lifted into position they are prevented from turning, and the cables are relieved of all weight. Each electrolier is divided into two circuits of 10 lights each, and is connected so that the lower half may be lighted while the upper lamps remain dark, or vice versa. The upper and lower halves of the two chandeliers on each roof truss are controlled by separate switches.

Additional general illumination in the main banking room is furnished by 29 32-candlepower lamps, placed on standards on top of the main banking counters, and by eight four-lamp fixtures, mounted on the check desks in the center of the main lobby. One of the 32-candlepower standards is seen at the right in Fig. 3. This picture, which was taken in one corner of the president's outer office, also illustrates a type of single-lamp wall fixture and a cabinet board. For special illumination of the cages, bookkeepers' desks, etc., single-lamp fixtures are provided. The lights on the bookkeepers' desks are connected to the system by detachable plugs, making it possible to move the desks for cleaning purposes.

Above the wall panels of the main banking room are oil paintings, 16 in number, which are handsome works of art, depicting the history of Chicago from the early days of Fort Dearborn down to the beginning of the twentieth century. Each picture is illuminated by 24 16-candlepower lamps, placed immediately below it in a troughlike construction, being screened from public view by plaster cornice-work. Each lamp has an independent reflector.

To the left of the entrance to the bank is located the smaller banking room of the Home Savings Bank. General illumination in this room is provided by four chandeliers, each of eight 16-candlepower lamps, and five 32-candlepower lamps on standards above the cages. Various styles of chandeliers and fixtures, all of them handsome, are used in the president's office, directors' room and in the offices, dining rooms, kitchen and lavatories on the upper floors, as well as the rooms in the basement.

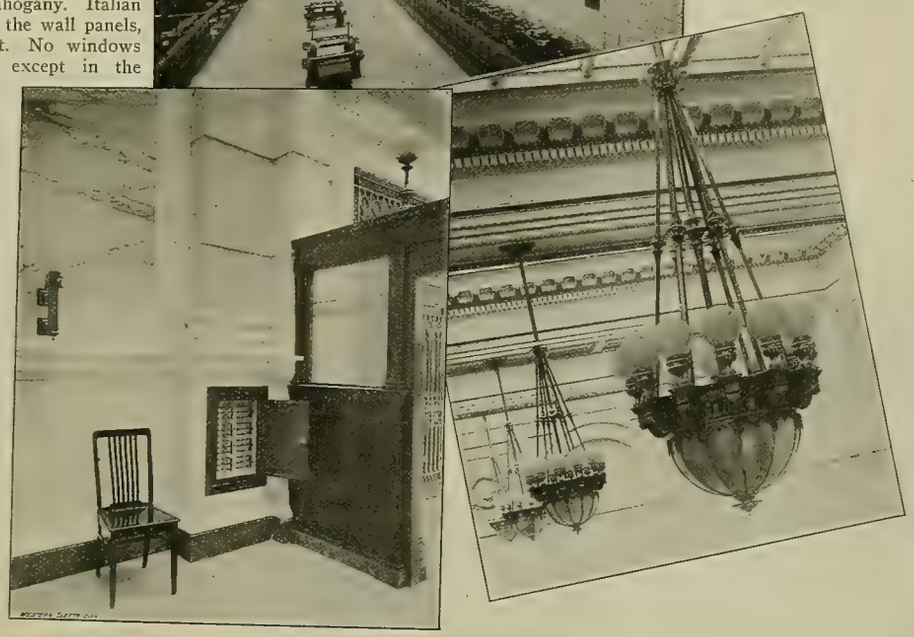


Fig. 1. View of Main Banking Room, Showing Electroliers.

Fig. 3. Glimpse of President's Outer Office, Showing Two Styles of Fixtures and Cabinet Board.

Fig. 2. Bronze Electroliers for 20 Lights.

ELECTRICAL FEATURES OF THE CHICAGO NATIONAL BANK.

The illumination of all the vaults throughout the building, except the money vaults in the main banking room and the safety-deposit vaults in the basement, is by electroliers. The conduit is carried through the walls, the circuits being provided with switches at the entrances. The money and safety-deposit vaults have special plug connections on the faces of the vaults, while cabinets controlling the circuits are placed inside the steel linings. These cabinets are connected to the plug receptacles by means of flexible cables, which are detached and placed inside the vaults when the latter are closed.

All of the electric-lighting fixtures were specially designed by the architects of the building. They are constructed of solid statuary bronze where castings are used, and are all of hand-chased and tooled work, thus presenting a very elaborate and highly ornamental appearance.

All the current used for light and power is obtained from the Chicago Edison company, no generating plant being provided in the building. The circuits enter from the alley in the rear, coming from the Edison company's Adams street station, directly opposite. They are carried to a marble service board, upon which are mounted one 400-ampere, three-pole switch for lighting, and one 300-ampere, two-pole switch for power, both switches being provided with fuse blocks. All lighting is carried on the Edison three-wire system, with 110 volts between the neutral and the outside wires. The power is cared for by 220-volt, two-wire circuits. From the service board cables are run to the main switchboard in the power room in iron-armored conduit under the basement floor. These cables consist of 350,000-circular-mil wires for the lights and 250,000-circular-mil wires for power.

Mounted on the main switchboard, which is shown in the view of the power room in the basement (Fig. 4), are four three-pole distributing switches for light in 100 and 200-ampere sizes, and four two-pole distributing switches for power, ranging in size from 75 to 150 amperes. Two recording voltmeters are connected on the main lighting circuit and one on the power circuit. The switchboard is constructed of English-veined white Italian marble on angle-iron framework. All connections to and from the switchboard are made so as to lead from near the top of the board into the wall directly in the rear. These cables, where they are exposed, are to be covered with a wooden casing.

From the switchboard the circuits radiate throughout the building to seven cut-out boxes, which are constructed of plate steel and fitted with white Italian marble linings. On the panels are placed polished metal clips for receiving the fuses. All connections are made from the rear of the panels. Circuits radiate from the cut-out boxes to cabinet boards or to switches in case of house circuits.

The cabinet boards are of the same general construction as the cut-out boxes, but in addition are supplied with the necessary knife or snap switches for the lighting circuits. The snap switches in all cases are of the Hart type, with copper-plated covers, indicating whether the current is "on" or "off." Three-pole knife switches are placed on the boards controlling the main electroliers and picture lights. The cabinet board shown in Fig. 3 controls half of the picture lights and the large electroliers in the main banking room. All lights in the main banking room, corridors, Home Savings Bank, Equitable Trust company's quarters and the retiring rooms in the basement are controlled from cabinets. Except in the public hallways, where lock switches are used, all house circuits are provided with Hart push switches. Enclosed fuses of the Noark type are used throughout.

Iron-armored conduit is used exclusively in the electrical construction. Where the circuits enter or leave the cabinet boards or cut-out boxes the conduits are fastened to the steel boxes with lock-nuts, making continuous metal raceways from the switchboard to the lamp outlets. The faces of all cut-out boxes and cabinet boards consist of solid statuary bronze mats about four inches wide supporting doors of the same material. The design of these boxes is neat and artistic and carries out the general scheme used throughout the rest of the fixtures.

Electric power is used in connection with the heating, ventilating and sewerage systems. Two 30-horsepower motors are installed, each belted to a large steel-plate ventilating fan, one for exhausting foul air, the other for circulating fresh and hot air through the building. The motor driving the circulating fan is shown at the left in Fig. 4. The sys-

tem of ventilation is complete in every detail. The air which is drawn from above the roof is thoroughly washed by an elaborate spraying system.

There are two two-horsepower motors belted to air compressors for use in connection with the Shone ejector for raising sewage to the street level. These motors are automatically controlled from a white-marble switchboard, upon which are mounted pressure gauges, starting rheostats, a controlling switch, etc. The system is adjusted to maintain an air pressure of from 20 to 25 pounds.

In the foreground of Fig. 4 are shown two two-horsepower motors, which are belted to pumps in the pit in the center of the power room. These pumps are used to return to the boilers the water of condensation from the heating system.

As all steam for heating is supplied from outside the building, the only fire that is necessary is that used under the hot-water boilers which supply water for the toilet rooms. The motors just referred to are automatically controlled from starting boxes placed on a switchboard at one side of the room and connected to a float in the return tank in which all the condensation is collected.

In the front of the building is a Winslow electric elevator, running from the basement to the fourth floor. It is driven by an 18-horsepower motor placed at the top of the shaft. The elevator is automatically governed by a magnetic control. The car and the cages at each floor are of bronze.

The auxiliary electrical systems installed in the building form very interesting features of its construction. In the rear of the main banking room is placed a 30-drop annunciator board of the Knapp type, mounted in a solid-mahogany case. This board is for summoning office boys, and connections are made to it from each of the cages, as well as from each of the officers' desks. In addition to these calls, there are buzzer calls connecting the president's and vice-president's desks directly with those of the secretaries and stenographers. The offices and banking rooms on the floors above are also equipped with the necessary buzzer calls. All these circuits are run in iron-armored conduit.

The telephone system, which also is installed in conduit, is quite extensive, as telephones are provided on each of the officers' desks in the three banking institutions housed in the building, in the officers' dining room and also in a number of the cages, these latter instruments being connected for local service only. There is placed in the savings bank a public telephone. The total number of instruments in the building is 27, and they are connected, through a private exchange, with the Chicago Telephone company's service.

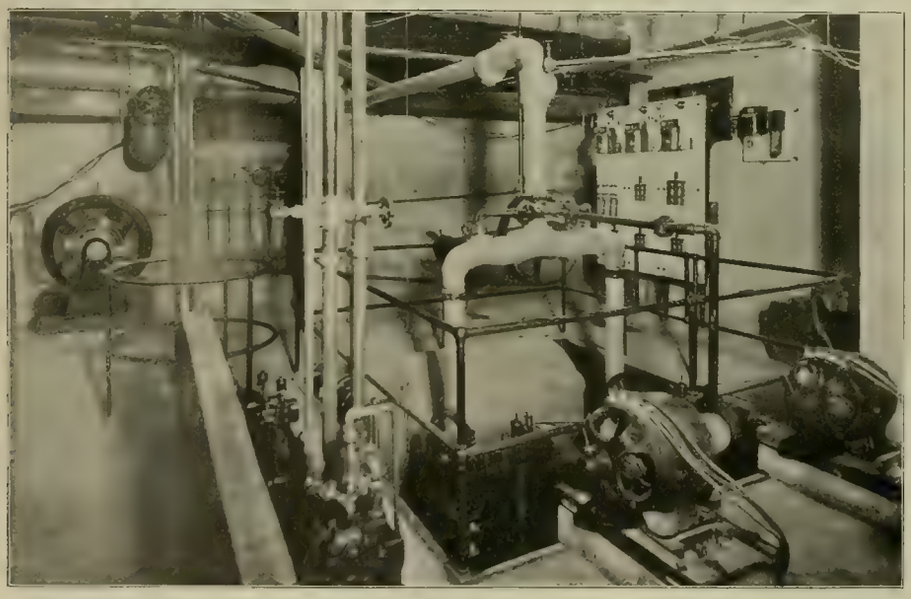


FIG. 4. ELECTRICAL FEATURES OF THE CHICAGO NATIONAL BANK.—POWER ROOM.

In addition to the intercommunicating and exchange telephones, the bank has a direct wire to the office of the Chicago Electric Protective association. Police boxes and alarms on the vaults are also installed and connected to the protective association's service.

Special wires are provided by the Western Union and Postal Telegraph companies, and two sets of instruments are installed for handling the bank's business. Both of these companies also have messenger call boxes in the different departments. The Western Union company, in addition to its special-wire service, has four tickers installed, giving the latest reports on stock and grain transactions. The same company also provides an electric clock service. All connections for these various systems are installed in iron-armored conduit.

Every detail in the electrical equipment, even to the smallest push-button, has been looked after with great care, in order that uniformity of design and material may be provided throughout. The result is a fine example of the highest class of electrical construction. The architects for the building were Jenney & Mundie of Chicago and the electrical engineering features were looked after by Charles A. Chapman, who acted as the architects' consulting electrical engineer. The Chicago Edison company had the contract for installing the electrical work.

Chicago Electrical Association.

In view of its decade of useful existence, about to be appropriately celebrated, a brief review of the history of the Chicago Electrical association will be of interest. Born on April 2, 1891, when a few ambitious young men met in the rooms of one of their number to organize an "Amateur Electrical Club," this society has passed through all the struggles incident to the young life of such an organization, until now it has reached an assured and honorable position. To-day, the Chicago Electrical association, with a membership of nearly 100 electrical engineers and men of allied professions, is the leading electrical society west of the Alleghanies. It counts among its active members many prominent engineers of the city, while its honorary members include Professor D. C. Jackson of the University of Wisconsin, Professor H. C. Carhart of the University of Michigan, Arthur Vaughan Abbott and others.

As individuals many of the association's members are prominent in the advancement of their profession, while as a body the society is responsible for the adoption by engineers all over the world of systems which have tended greatly to reduce complications in electrical work. As an instance of the latter may be mentioned the society's handbook of "Standard Diagrams for Uniformity in Electrical Engineering and Patent Office Drawings," which, published in 1898, has since been adopted by most of the leading enginering societies in the world and which has received universal commendation.

The meetings are held on the first Friday of each month from October to May, inclusive, in the rooms in the Monadnock building, and many young college graduates, starting out in their chosen work, take advantage of this chance to meet men who have trod the path before them and who gather here to discuss the new developments in their profession or to show their colleagues the result of personal experimenting along special lines.

The papers presented at the meetings, most of them illustrated by experiments or by stereopticon views, are generally prepared by the members, though often the society is favored by engineers of note from other cities. Whenever a subject of more than technical interest is presented and illustrated by popular experiments, the social feature is made prominent in the form of a "ladies' night," at which time the members' wives and women friends are welcomed.

It has ever been the aim of the members to keep abreast of the field, and this, as all know who follow the news from the electrical world, means going at a rapid pace. With the energy so characteristic of Chicagoans, this pace has been easily kept, and the society is favorably known throughout the country for its progress.

In its lists of officers during the 10 years of its existence the association has drawn representative young men from many different branches of electrical work. The past presidents of the society have been as follows: J. F. Conner (deceased), E. G. Hovey, Albert Scheible, W. Clyde Jones, S. G. McMeen, F. S. Hickok, Thomas G. Grier and J. M. Hollister. At present the association is presided over by R. F. Schuchardt, a '97 graduate of the electrical engineering department of the University of Wisconsin. Mr. Schuchardt is employed in the testing laboratory of the Chicago Edison company and was formerly associated with Professor F. B. Badt. W. J. Warder, Jr., of the electric-light engineering department of the Western Electric company, is secretary of the society. Mr. Warder received his technical education at the Lewis Institute, Chicago. The other offices are filled by the following-named gentlemen: Vice-president, Harold Almert; treasurer, H. G. Dimick; auditor, George M. Mayer; librarian, W. B. Hale; board of directors, L. G. Bassett, J. R. Cravath and H. P. Clausen.

R. F. Schuchardt, President. W. J. Warder, Jr., Secretary.
CHICAGO ELECTRICAL ASSOCIATION.

The annual banquet of the society will this year be made the occasion of a decennial celebration. It is to be held in the Grand Pacific banquet hall on the evening of Tuesday, June 4th, and a very interesting programme is being arranged for the occasion. Among the speakers for the evening will be Professor D. C. Jackson of Madison, Wis., Professor Philip B. Woodworth of Lewis Institute, Chicago, and C. E. Scribner of the telephone-engineering department of the Western Electric company. Other prominent speakers are being arranged for, and it is expected that the members and their guests will make the banquet a very successful one. The committee in charge of the arrangements consists of W. Clyde Jones, Professor F. B. Badt and W. J. Warder, Jr.

Design and Construction of Electric Plants.[1]

By Bion J. Arnold.

The lecturer systematically stated and discussed the constantly recurring questions which confront the engineer in this field.

The first items in the design and erection of an electric power plant are kind and cost of fuel and its accessibility; water, the quality and quantity required; location, so as to have a good water supply; character of the soil on which the building is to be erected (should be good, uniform, hard clay or sand), and the kind of building required, which when erected would be a firm and substantial structure. Other features of almost equal importance are the cost of the real estate on which the power plant is to be erected and the character of the electric-supply service which it is to render.

The location of the power house should be, in general, as near the center of distibution as possible. High-potential, alternating-current generating plants may be located at almost any convenient point for fuel and water supply, with transmission at high voltage to sub-stations. If the soil is all clay or all sand, it may be made entirely satisfactory, and piles are used with alluvial soil. In many cases the location of the power house is a problem of real-estate values and reduces to the question of how to build with the least amount of money.

The kind of service required may be direct current, alternating current, or both. Central stations for electric supply to immediate neighborhood are chiefly required to supply direct current at 110-220 volts, or 250-500 volts for lighting, power and traction service. Earlier difficulties with arc and incandescent lamps on the same direct-current circuit have been largely overcome. An auxiliary storage-battery plant is now almost universally used in the United States for equalizing and balancing the direct-current supply by the three-wire system, as well as to carry the load peaks.

The development of sub-station electric supply has made possible the extensive introduction of alternating-current generating plants, located on a water

1. Abstract of an illustrated lecture delivered May 8, 1901, before the Engineering College, University of Illinois.

front for fuel and water supply and condensation. The question of direct or alternating-current distribution from the sub-station is one of great importance, and can only be answered after most thorough examination of all service required. For general supply in the heart of a city, the direct current has many advantages. For transmission to outlying districts and interurban traction work, the alternating current has shown itself to be the most suited. Whether for direct or for alternating-current supply, the use of direct-connected generating units is to be preferred in plants of some magnitude.

Coal and ash-handling devices and accessories are necessary in large steam-generating plants, depending somewhat upon the kind of electric service supplied. They soon pay for themselves, and are to be recommended if more than four boilers are used.

From 15 to 25 per cent. in fuel may be saved by the condensing of the exhaust steam, which is now practicable, even with a limited supply of water by the pond and self-cooling condensing systems, and cooling towers. With a surface condenser, it is important to extract the oil from the condensed steam by some of the well-known devices, as the water is to be used over and over again. The surface-condensing system is especially recommended with impure supply. Steam separators are required in every plant where satisfactory arrangement of steam piping is sought. Further economy in fuel, of from eight to 10 per cent., may be effected by an economizer, for heating the feed water by the escaping chimney gases, which may be reduced in temperature from 700 to 380 degrees. Economizers should not be installed with a low chimney stack. Mechanical draft is advised for variable load service, as in railway power stations. Condensing systems, economizers and mechanical draft must be carefully planned to meet the specific requirements of each given case, and in no case are they to be introduced and used indiscriminately.

The efficiencies of the several parts of the steam power plant may be generally stated as follows: Steam boilers, with Illinois coal, from 58 to 65 per cent., and with Pennsylvania coal, from 70 to 72 per cent.; mechanical efficiency of steam engines, from 85 to 92 per cent., according to type and manufacture. The auxiliary machinery will require from 12 to 18 per cent. in steam of the total horsepower load on the plant, but this in many large plants may be reduced by electrically driven auxiliaries, which are to be preferred as being most efficient in large installations. Electrically driven mechanical draft fans have not been uniformly satisfactory, owing to difficulty of speed regulation.

The planning of switchboards is now an intricate problem in large central stations. Modern switchboards have attained to great perfection of design and of detail, and in the best types of installations they leave little to be desired. In some installations they are arranged so that the main switches are controlled by pilot motors and small switches from one small, centrally located board. The control of engines is best accomplished by an electric governor, manipulated from the switchboard, for slowing or speeding the engine when throwing generators into or out of service.

The specifications for all installations should cover the conditions under which the parts of the plant are to be operated. Specifications must state exactly and concisely the character and amount of the work required to be done, the limitations to be placed upon the electric machinery installed, such as the heating limits and overload conditions, and should have accompanying guarantees from the builder for specific performance. In general, the supervisory engineer should allow the manufacturer to conform to his standard designs and construct the machines according to the best experience he can command, rather than to design the boilers, engines, dynamos, etc. Specifications should be sent out to all manufacturers at the same time, and all bids should be required to be in by a certain day, to give each manufacturer a fair chance. In the preparation of contracts it should be borne in mind that the contract should preferably be a separate document from the specifications, but should have the specifications attached to it, so that both become legally binding.

The New Edison Storage Battery.

Great interest continues to be manifested in the new storage battery of Thomas A. Edison, described in the Institute paper of Dr. Arthur E. Kennelly, which was read in New York on the evening of Tuesday, May 21st, and telegraphed in full to the Western Electrician for insertion in last week's issue. The description of the battery thus presented in this journal (pages 360 and 361) is a clear and lucid one, and it is now supplemented by the accompanying illustrations, which should be considered in connection with Dr. Kennelly's paper. Figs. 1 to 6, inclusive, show details of the grid, box for active material, briquet of active material, completed plate and containing cell of the new battery. Figs. 7 and 8 are discharge curves of a small experimental cell. The lines under the cuts give the needful information for a clear understanding of the illustrations.

If all reports are true, Mr. Edison's friends are very enthusiastic over the new battery and are confident that, with its strength, lightness, durability, and ability to withstand rough usage, the nickel-iron cell will revolutionize the storage-battery business. The great inventor himself is said to regard his new battery as one of his most important achievements. Many alleged interviews with him on this subject have appeared in the daily papers, but many of them, no doubt, are greatly exaggerated or else entirely apocryphal. However, the following sounds as though it might be authentic, and is at any rate interesting:

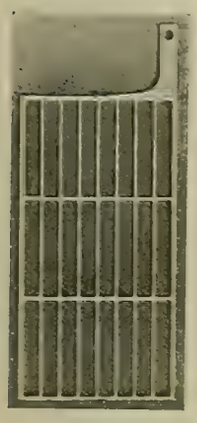


Fig. 1. Nickel-plated Steel Grid for Either Positive or Negative Plate.

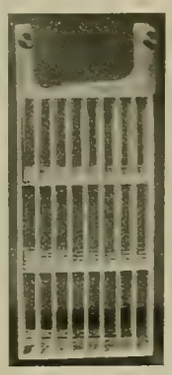


Fig. 2. Assemblage of Grids.

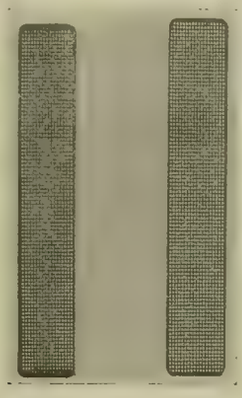


Fig. 3. Perforated Nickel-plated Steel Box to Contain Active Material.

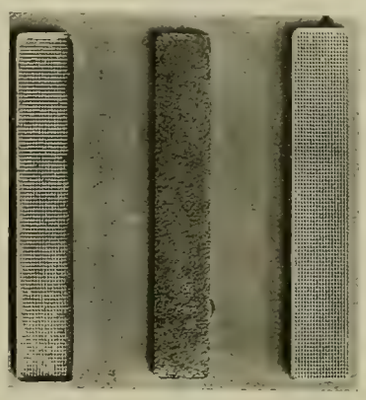


Fig. 4. Steel Box, Briquet of Active Material and Lid of Box.

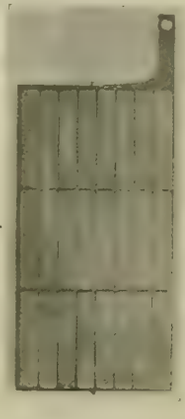


Fig. 5. Completed Plate with 24 Briquets.

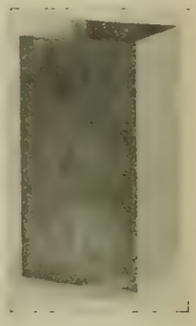


Fig. 6. Containing Cell of Sheet Steel.

THE NEW EDISON STORAGE BATTERY.

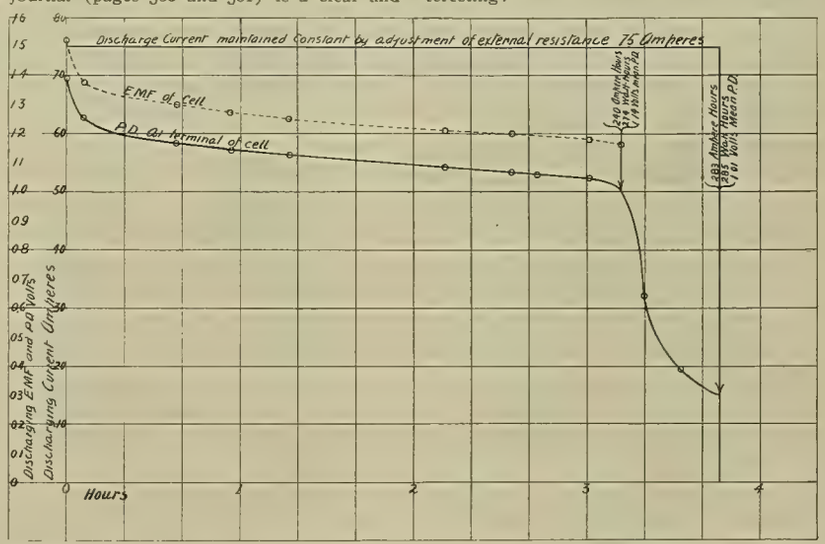


FIG. 8. NEW EDISON STORAGE BATTERY.—DISCHARGE CURVE OF SMALL EXPERIMENTAL CELL WEIGHING 21 POUNDS (3.75-HOUR DISCHARGE AT CONSTANT CURRENT).

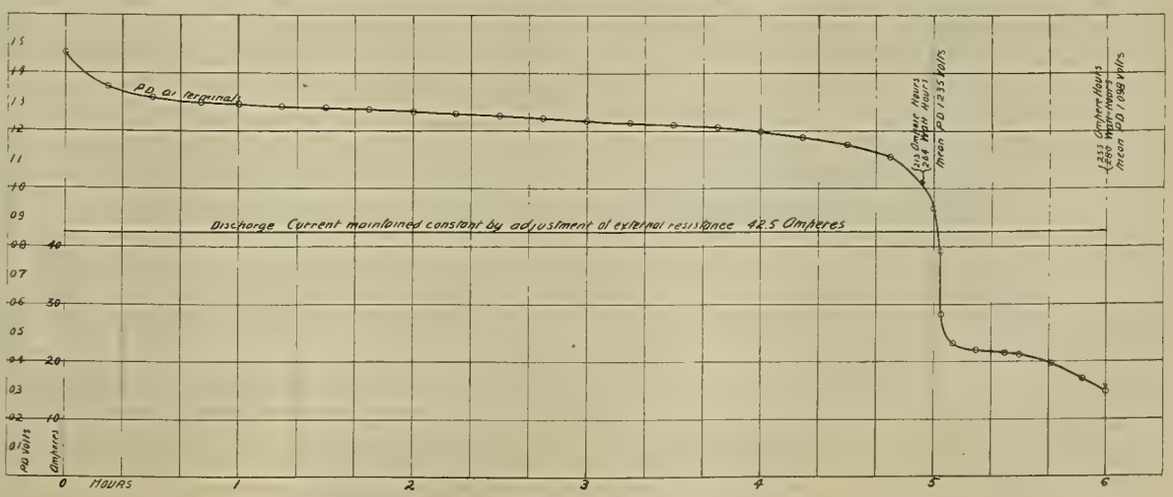


FIG. 7. NEW EDISON STORAGE BATTERY.—DISCHARGE CURVE OF EXPERIMENTAL CELL WEIGHING 21 POUNDS (SIX-HOUR DISCHARGE AT CONSTANT CURRENT).

"I've worked over two years on this thing," Mr. Edison said, "and I perfected it some time ago, but

I have been waiting a little so as to settle the question of deterioration. Now I'll give them all they want. Let them bring on their automobiles.

"The expense of furnishing power will be no more than that of the lead batteries now in use. Besides all this, the elements are composed of commercial material easily procurable. Iron and nickel, you know, can be had anywhere very cheap. Its staying power is good. Why, a man traveling in an automobile can go much farther with the same weight of battery. I should estimate that an automobile equipped with these batteries ought to travel 75 miles on one charge. The main things to be overcome are deterioration and excessive weight. Weight is of particular importance in automobiles. I propose to institute a series of tests with regard to its adaptability to use on automobiles. In fact, we have tested it a little over some rough roads. This battery solves the trucking problem. You can send your truck out in the morning and it will stay out all day, and still have enough surplus energy left in the batteries to get home on. I think this is the best feature of the battery."

On the other hand, some of the old-time lead-battery men are disposed to be skeptical in relation to the merits of the new nickel-iron cell, refusing to believe that the lead accumulator is destined for the scrap-heap. For instance, Mr. J. K. Pumpelly of Chicago says: "It can be shown in practical daily work on an electric vehicle, and by tests made by such well-known experts as Pierce & Richardson of Chicago, that a light battery, made especially for vehicle work, will give from 14 to 16 watts to the pound, and when such a battery is connected up in series of 40 cells, every 60 pounds of battery in the assemblage will give an output in work of one electrical horsepower." This is in answer to Dr. Kennelly's statement that "in practice the storage energy per unit mass of the modern lead battery is from four to six watt-hours per pound of battery." Mr. Pumpelly insists that there is no novelty in using nickel in a battery. He says that "if there is novelty in the battery described, it may be in the use of iron as one of the electrodes with nickel." He also points out that, with the new battery, twice the number of cells will be required as compared with the familiar lead battery.

It is noted that the copper-cadmium cell described in an English patent of Mr. Edison has seemingly been abandoned.

The New York Sun of May 26th says:

"A million-dollar company was incorporated in Newark yesterday for the manufacture and sale of storage batteries. It takes the title of the Edison Storage Battery company and will have its first factory at the old brass rolling mill at Glen Ridge, between Bloomfield and Montclair, adjoining the Bloomfield branch of the Lackawanna railroad. The object of the company is to make and exploit the new storage battery, which Mr. Edison says is less than half the weight of previous batteries. Mr. Edison says also that it will work longer and exert much more power than any secondary battery in existence. He also says that he will retain control of it. This is only an initial or parent company, and it is proposed to form a general corporation with a capital of $20,000,000 or $30,000,000. Howard W. Hayes is counsel for the company, and the articles of incorporation were filed for him yesterday in the County Clerk's office by John E. Helm, who said that Mr. Edison regarded the present project as more far-reaching than anything he had ever engaged in, and that Mr. Edison intended to erect one-story buildings upon the general plan of those devised and erected by Professor Edward Weston for the Weston Electrical Instrument company at Waverley Park, N. J., which are regarded as the model factory structures of the world."

The Practical Side of the Incandescent Lamp.[1]

By Francis W. Willcox.

At this, the first National Electric Light association convention of the twentieth century, we greet the incandescent lamp on its majority, tried and improved by 21 years of marvelous growth.

As pointed out by Mr. John W. Howell, the incandescent lamp was practically a perfect invention. It has to-day the same essential parts, no more and no less, and the same general appearance as when first put in service in lighting Menlo Park 21 years ago. During this period numerous modifications have been proposed, patented and tried, but none have survived the test of time, and the lamp stands to-day practically identical with the early type. Marked improvements have been made, but these have all been in detail and have not altered the appearance of the lamp. In central-station service and lighting work we find the lamp has held its own under all conditions. It has survived all changes of lighting systems, has thrived equally well with alternating and direct current, has increased its range of voltage to 200 volts and beyond, has proven satisfactory with all the reductions of frequency down to 25 cycles, and can even be adapted for as low as 15 cycles, and deservedly forms to-day the mainstay of central-station service.

The growth of the incandescent lamp is a striking one, and forms an excellent index of the growth of the practical application of electricity. This is clearly shown in the consumption of incandescent lamps per year, as given by the accompanying curve, Fig. 1.

The lamp is the peak, so to speak, of a very tall pyramid whose base is the station. The accompanying diagram, Fig. 2, graphically expresses the relative position of the lamp. Here we see how the losses increase and the pyramid base grows with

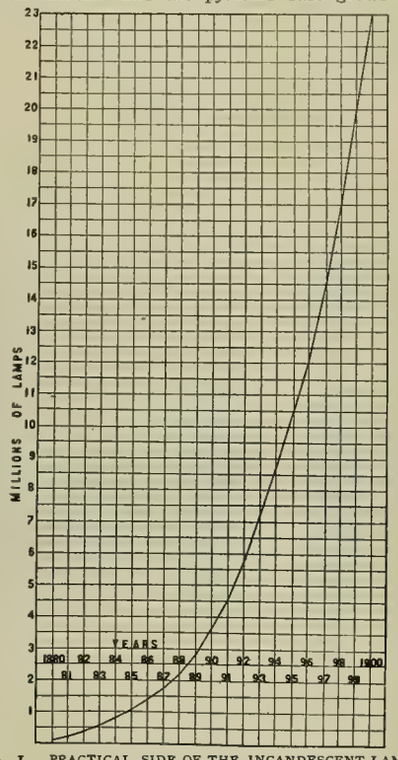


FIG. 1. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CURVE SHOWING ANNUAL CONSUMPTION.

the slight change in efficiency from three to 3.5 and from four to five watts per candle.

The subject in hand can be conveniently divided and advantageously discussed under the headings: Lamp types, lamp quality and lamp use.

Lamp Types.

The question of lamp types involves consideration of efficiency, voltage, base, candlepower, type of filament, etc.

Efficiency.—If we examine the normal results

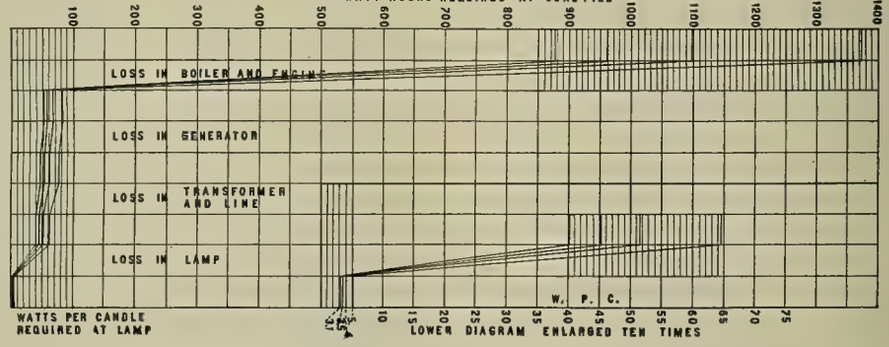


FIG. 2. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—DIAGRAM OF LOSSES.

given by a good lamp during life, it will be noticed that while the candlepower declines 20 per cent., the total watts do not decline over five per cent. The result is that the watts per candlepower change considerably and the initial efficiency of 3.1 watts per candle is not maintained, but is reduced to 3.7, and averages for the period 3.31. Initial efficiency is the term generally used and the one here considered.

As is well known, there are three standard initial efficiencies in use—3.1, 3.5 and four watts per candle. Fig. 3 gives the useful life of a 16-candlepower, 110-volt lamp when burned at each of these initial efficiencies. The four-watt lamps are deservedly but little used to-day outside of street-railway lighting, as the improvement in quality of the 3.1 and 3.5-watt lamps and the better regulation of modern plants have largely made them obsolete. The question lies to-day between the 3.1 and 3.5-watt lamps.

As a general rule, a central station uses the highest efficiency lamp permissible with its regulation. The high-efficiency lamp is desirable for the very obvious reasons that it secures a greater capacity of machinery and conductors and a lessened cost of light to station, permitting for the same net profit a lower cost of light to consumer. It is well, however, to deduce the actual relative value of the 3.1 and 3.5-watt lamps. The cost of lighting can be figured as the cost for power consumed by lamp plus the cost of lamp. As the cost of lamp has been largely reduced of late years, and brought to quite a low figure, the use of high-efficiency, 3.1-watt lamps is rendered possible in many more cases than formerly, or, as Mr. John W. Howell has expressed it, "the lower the cost of the lamps the hotter they can be burned."

The 3.5-watt lamp consumes 56 watts totally, and has a useful life (to 80 per cent. point) of 800 hours. The 3.1-watt lamp consumes 49.6 watts totally, and has a useful life of 400 hours. It will require, therefore, two 3.1-watt lamps to give the same lighting service as one 3.5-watt lamp. The 3.1-watt lamp saves 6.4 watts per hour; or, for the period of 800 hours, a total saving of 5,120 watt-hours. This saving is balanced against the cost of an additional lamp. Figuring price of lamp at 18 cents, we can see at once the figure per kilowatt-hour at which the two lamps are equal in cost by simply dividing 18 cents by 5,120.

This gives a cost of 3½ cents per kilowatt-hour. Below this figure the 3.5-watt lamp gives the lowest cost; above it, the 3.1-watt lamp. It must be noted, however, that this cost does not consider the value of the increased capacity of apparatus and lines resulting from the higher efficiency lamp.

Aside from the mere question of cost, there are several practical features that recommend the high-efficiency lamp. One of these is the self-renewing character of the 3.1-watt lamp. It is found that such lamps practically renew themselves by burning out on an average just beyond the useful life period. A large number of lamps, on test, instead of being taken down when the 80 per cent. of candlepower point was reached, were continued until they broke; and it is to be noted that the nucleus of such breakages is about the 400 or 500-hour point. The 3.1-watt lamp would seem, therefore, to compel its own renewal, and thus serve automatically to keep the lamps bright and prevent them running below their limit of useful light.

Another feature of advantage in high-efficiency lamps is the better quality of the light, its greater brilliancy and whiteness and its attractive appearance. The candlepower, as is well known, does not completely express the value of an illuminant. Candlepower affords a satisfactory measure of light for use in reading in the illumination of black and white, but the power of light to bring out colors increases with the temperature of the filament out of all proportion to the candlepower. Therefore, the high-efficiency lamp has the advantage as an illuminant against a low-efficiency lamp in modern lighting service of show windows, stores, picture galleries, hotels, and all public buildings, in giving fuller illuminating value to all colors. Finally, a high-efficiency lamp, although giving same candlepower, always looks brighter to the eye on account of its higher temperature, and on this account is more popular.

Voltage.—The use of lamps of lower voltages than 100 is decreasing rapidly, and it is safe to say that such lamps for central-station service will be obsolete in a few years. The causes for this are well known, and need not be discussed here.

In the selection of a voltage the so-called standard voltages of 100, 104, 110, 115 should be carefully avoided and some special point taken, like 107, 108, 113, 117, 122, etc. The demand for lamps of the standard voltages is many times the supply, and that purchaser is wise who changes his voltage to the special point and thereby secures a close selection and protection against "culls."

The limits of voltage have of late years been

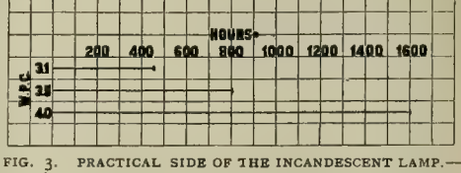


FIG. 3. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—DIAGRAM OF USEFUL LIFE AT VARIOUS EFFICIENCIES.

extended beyond the 100-volt range to 200 and 250 volts, and these high-voltage lamps have been very successful. There are over 500,000 of them annually supplied to consumers in this country, and their use is being rapidly extended.

Such lamps have, however, been limited to low efficiency, averaging four watts per candle. At this efficiency they give a useful life about 1½ times as good as the 100-volt, 3.1-watt lamp. They require, therefore, about 20 per cent. more power and station capacity for the same lighting result, and this has been a great drawback to their use. The better distribut-

1. Abstract of paper read before the National Electric Light association at Niagara Falls, N. Y., May 21, 1901.

ing advantages of the 200-volt system and the demand for these lamps has, as it was natural to expect, caused earnest efforts to improve their efficiency, and I am glad to be able to inform you that such efforts have during the last year been successful. There can now be had a 200 to 250-volt lamp of an initial efficiency of 3.4 watts per candle for the 16 and 20-candlepower, and 3.1 watts per candle for higher candlepower, that will give an average useful life as good as the 100-volt, 3.1-watt lamp; that is, between 400 and 500 hours. These lamps have been in satisfactory service on the circuits of one of the large central stations for four to five months, and can be safely considered as a commercial

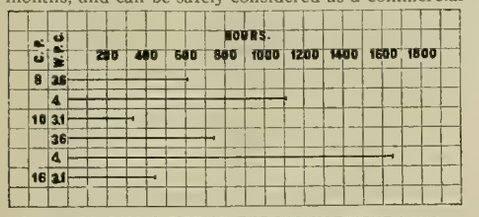


FIG. 4. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—DIAGRAM OF USEFUL LIFE AT VARIOUS CANDLEPOWERS.

lamp. Such a lamp naturally demands better regulation, but such demands can be complied with through the improvements in apparatus and distributing systems.

Close selection to voltage is a requisite on the manufacturer's part, but the degree in which this can be complied with depends upon the purchaser's avoiding such voltages as 220 and adopting some other special voltage. This point should be carefully borne in mind by everyone operating or installing the 200-volt system.

Bases.—In early days every manufacturer had a special base, and the styles and types of lamps were thereby most undesirably multiplied. These have been gradually reduced in this country to three types in general use, viz., Edison, Thomson-Houston and Westinghouse. The proportion of each type in use is given in the following table:

Edison	60 per cent.
Thomson-Houston	20 per cent.
Westinghouse	15 per cent.
All other types	5 per cent.

The tendency is strong toward a still further reduction to one, and that the Edison, which has become the standard of the world.

Lamps have suffered to a greater or less extent from exposure to moisture, due to the use of plaster of paris in basing. This has been a source of much trouble, particularly with the increased use of lamps for outdoor illumination, sign lighting, etc.

It has been difficult to get rid of plaster of paris, but I know you will be interested to learn that a substitute has been in practical use for over six months, and that a real moisture-proof base is now obtainable. Tests made show that lamps based with this new cement can even be soaked in water without damage.

Candlepower.—While the 16-candlepower lamp still remains the standard of service in this country, there has been in the last few years a large and constantly increasing use of the lower candlepower lamps of 10, eight, six, four and two candlepower. This has been caused by the adoption of meters by enforced competition with gas, which is largely used turned down, by the introduction of electric lighting in residences and by the great increase in sign and decorative lighting.

For sign and decorative lighting a small unit of light is all that is generally needed, and an eight or four, or even two-candlepower lamp serves satisfactorily and with marked advantage in point of economy of current.

The lower we go in candlepower with the same efficiency, the more delicate becomes the filament, and for equal results in useful life, low-candlepower lamps must necessarily be used of lower efficiencies than the 16-candlepower lamp.

The diagram (Fig. 4) gives information on

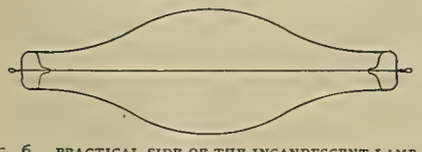


FIG. 6. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—LAMP WITH STRAIGHT FILAMENT.

this point, showing the useful life of the different candlepowers at the various commercial efficiencies. The use of low-candlepower lamps should be more general than it is, and they are to be recommended to the consideration of all central-station managers who desire to increase their business, especially among residences.

The use of lamps of higher candlepower than 32 is not favored by practice. When large units of light are wanted, the improved arc lamps of the day are preferred. Besides, a given power consumption will secure more uniform and better lighting when a number of 16-candlepower lamps are used than when the equivalent in power of 100-candlepower lamps are tried.

The use of frosted-glass lamps should be more general in the interest of effected and agreeable lighting. Frosted lamps improve the diffusion of light to marked advantage. Contrary to general impression, the amount of light lost through frosting is really very small, averaging totally only about three per cent.

The use of miniature lamps for store and house decorations, for Christmas-tree illumination, etc., should be encouraged, as they serve in the best way to demonstrate the superiority of the electric light, its desirability, safety and beauty. Stations should find it profitable to carry a stock of miniature lamps, plain and colored, with sockets and receptacles, for rental at a nominal figure to customers. This plan works well, as such lamps are generally wanted promptly and for only a short period, so that while the user might not buy, he would rent on the occasions of balls, parties, weddings and other festivities. Besides the special accommodation given the user, which teaches him the value of electric lighting, the returns from the rentals of the lamps (all broken or burned-out being paid for in full) and the sale of current can be made profitable.

Types of Filaments.—The accompanying illustrations (Fig. 5) present the curves of candlepower distribution taken in horizontal and vertical planes of the various commercial types of filaments now on the market. These curves speak for themselves.

As regards the end-candlepower question, the extreme position taken by some people is as unwise as it is undesirable. Electric light is in competition with oil and gas flames, which can be tested but in one position, the vertical, and therefore by horizontal candlepower. To enforce an end-candlepower requirement not applicable to oil and gas is most impractical, and imposes an unnecessary hardship upon the electric light.

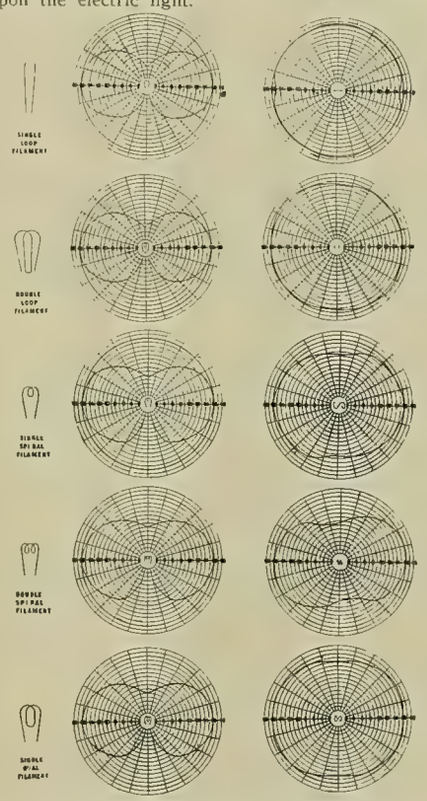


FIG. 5. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CURVES OF CANDLEPOWER DISTRIBUTION IN HORIZONTAL AND VERTICAL PLANES.

We do not always need an end candlepower equal to the horizontal, because such a condition causes very bright spots of light beneath each lamp instead of a uniform lighting effect between lamps as well as beneath them. Good lighting demands the latter condition, and it is the guiding principle to-day on all street lighting, and forms one of the marked advantages of the modern arc lamps as against the old types.

To give full 16 candlepower, both vertically and horizontally, necessarily means an increased strain upon the filament and involves for equal initial efficiency a sacrifice of both life and maintained candlepower.

A filament shaped to give a large end candlepower necessarily wastes much of the light which is thrown up into the lamp base and lost.

Lastly, a lamp in connection with a shade will give results surpassing those possible with any special form of filament or bulb.

On the other hand, the end candlepower given by different forms of filaments must not be ignored.

It is good to avoid extremes in the other direction, and to insist upon a minimum requirement in end candlepower.

It is evident that if a lamp were constructed as shown in Fig. 6—simply a straight length of filament in a tubular bulb with connections at ends—such a lamp by horizontal candlepower only could be made to give results at 2½ watts per candlepower equal to standard types at 3.1 watts per candlepower. The old loop filament, as now supplied in 50-volt lamps, has, when thus considered, a decided advantage over the standard oval filament now in use for 100-volt types.

The most desirable filament would seem to be one giving the most uniform horizontal distribution with a satisfactory minimum of tip-end candlepower, and should be a filament that will not droop against sides of bulb, either from weight of filament when burned horizontally, or from other causes, and should be able to withstand the vibration in most effective manner and retain a symmetrical position in center of bulb. All things considered, the oval form of filament seems to meet all those requirements most successfully and can safely be decreed the standard type.

Such a filament is anchored; and in answer to the objections sometimes raised to anchors, it can be said that for an anchor placed as it is in the standard oval filament, the advantages gained far outweigh the objections and secure results that are not otherwise possible.

Lamp Quality.

Poor Vacuum.—This result is the production of what is known as "slumpers," which are lamps suffering a rapid decline of candlepower within a very short time—a most undesirable result. The well-known test by induction coil will reveal this fault.

Spotted Filaments.—Such a filament has a thin spot or point of high resistance in the filament. This is a weakness in carbon, and results in breakage of filament, causing short life. By burning the filament at dull red under reduced voltage such spots can be detected as bright points.

Discolored Carbons.—A properly treated filament has a bright, steel-gray surface. When discolored, the surface shows up sooty, black or brownish in color, either partly or wholly. This causes a rapid loss of candlepower, and can be detected by careful examination under strong light while not burning.

Correct Initial Rating.—The importance of this has only been appreciated in the last two or three years. In this time the use of the well-known target diagrams has made the question a familiar one to all. It has, perhaps, been overdone in making it appear as a final test of quality. It is merely an indication of careful methods, and does not insure quality any more than correctly weighed goods insure it.

The full reasons for a necessity of close initial rating are perhaps not known to all. An underrated lamp is generally more undesirable than an overrated one. Lamps sold for 16 candlepower run all the way from 12 candlepower to 27 candlepower. The installation of these extremes in a row of lamps, or on an electrolier, would cause most unsatisfactory contrasts and complaint from user. Lamps sold for 56-watt lamps run from 56 to 68. Here is trouble for the meterman and complaints from users; or if light be sold by contract, the station loses this excess wattage with no return. Lamps sold as 3.5-watt lamps turn out to be of various efficiencies from four to 2½ watts per candle. The result is necessarily short life and rapid loss of candlepower for the high-efficiency, 2.5-watt and three-watt lamps, and satisfactory service only from those lamps that come about or below the diagonal 3.5-watt line. Thus, for three important reasons, is correct rating essential, namely, to secure uniform lighting with satisfaction to users, to avoid excessive meter bills and the necessity of allowances to customers, and to insure the maximum of uniform life and candlepower performance. As showing the bad effects of lamps running above their correct rating, I present here a set of curves (Fig. 7) of candlepower performance of a number of such lamps, all showing a very rapid decline.

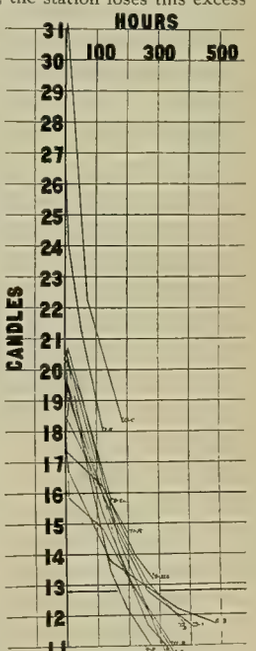


FIG. 7. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CANDLEPOWER CURVES OF UNDERRATED LAMPS.

It pays most decidedly to secure closely selected lamps. The saving to the lamp user is worth many times the saving in first cost of two or three cents, which the careless and incompetent manufacturer offers as an inducement to use his lamp. The loss of one lamp eats up the first-cost saving on six or seven lamps. It costs the manufacturer a good deal to test and select lamps accurately and weed out the imperfect ones. The user has the choice of wisely paying the full price for reliable results, or of buying on price and paying far more in the end through failure and breakage and increased consumption of lamps or power.

Candlepower Performance.—This is a subject which must be familiar to all, as we have heard a

[*Continued on page 377.*]

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CONVENTIONS AND EXPOSITIONS.

Independent Telephone association of the United States, Convention Hall, Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st

Association of Railway Telegraph Superintendents, Statler's Pan-American Hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Northwestern Electrical association, Sheboygan, Wis., June 26th and 27th.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

Pennsylvania State Street Railway association, York, Pa., September 4th.

Ohio Electric Light association, Put-in-Bay, Ohio.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Visitors to the Pan-American Exposition will find the Western Electrician's space in Section F 2 in the Electricity building, where they will be cordially welcomed.

It is, of course, impossible to predict the extent to which Mr. Edison's storage battery will supersede the ordinary lead accumulator until the new cell has been put into actual commercial service on an extended scale. With the performance of the old type we are all familiar; its defects are admitted and well known; but nevertheless it has done valuable work and is not to be lightly discarded. Millions of dollars are invested in lead storage batteries in the United States alone, and if, by Mr. Edison's invention, all this apparatus has become obsolete, the situation is, indeed, one of grave importance and great interest. But so far the claims for the new battery rest principally on its adaptability for automobile work. Mr. Edison himself is reported to have laid stress on its advantages in heavy trucking. Little has been said about the use of the nickel-iron cells in stationary power plants, where weight is of less importance. It is likely, however, that if the new battery "makes good," to employ an expressive slang phrase, in vehicle work, its comparative absence of deterioration and rapidity of charge and discharge will also make it more available for all classes of work to which storage batteries are applied. The mechanical design and construction of the cell are evidently of great excellence. If the chemical combinations and electrical characteristics outlined in Dr. Kennelly's cautiously written paper are achieved in practice, outside of the laboratory, and if the cost factor can be satisfactorily adjusted to commercial requirements, there seems to be no escape from the conclusion that the new battery will indeed prove to be epoch-making. But the lead batteries are doing the work now. The future alone can determine whether they are to be superseded.

A long abstract of Mr. F. W. Willcox's paper on "The Practical Side of the Incandescent Lamp," which was read at last week's meeting of the National Electric Light association in Niagara Falls, N. Y., is presented in this issue of the Western Electrician. It contains much information and many hints of value to central-station and isolated-plant men, although, of course, the author looks at the subject from the point of view of the manufacturing company with which he is connected. Mr. Willcox has gone into his subject exhaustively, for a convention paper, and his essay, if printed in full in the Western Electrician, would occupy twice the space devoted to the condensation made for this journal.

The author divides his paper into three parts—lamp types, lamp quality and lamp use. The first two are interesting and valuable, but the last heading will excite especial interest, for under it Mr. Willcox advocates free lamp renewals as the key to the incandescent-lighting situation. The writer goes further than this and asserts that the lamps should be periodically replaced at regular intervals. "Some other standard than the limit of a customer's patience should prevail," says Mr. Willcox, who cites with approval the method of replacing lamps originated by Mr. James English at Bridgeport and New Haven, Conn. Lamp manufacturers naturally desire to see the greatest possible consumption of incandescent lamps, but Mr. Willcox's assertion that central-station men "pay either the lamps or the penalty" may be exactly right, nevertheless. The question of prompt and unsolicited lamp renewal is worthy of careful attention on the part of electric-light men—of more attention, in fact, than it receives. In this respect, as well as others, the paper under consideration deserves studious perusal.

Diverging opinions on the part of steam and electric-railway men are manifested in England in relation to the project of building a high-speed "monorail" electric railway between Manchester and Liverpool. The promoters of this line anticipate that the cars will be able to attain a speed of 110 miles an hour, making the journey between the two cities in 20 minutes. They propose to run single cars containing 60 passengers at intervals of 10 minutes, with no stops between the termini. The cars are to be fitted with two brakes, one to be the Westinghouse and the other an electric or magnetic brake. By applying the Westinghouse brake alone the car, when running at 110 miles an hour, can be stopped in 1,000 yards, it is said, and by applying also the electric brake, it is said that the stoppage can be effected in 500 yards. F. B. Behr, designer of the line, says that the railway would consist of an A-shaped structure, with one rail line at the apex and two on each side of the A. The carriage would sit on the top line like a pannier on a pony, and the center of gravity would be below that line. On the side lines guiding wheels would run, and these would chiefly come into play when the carriage passed around a curve. It would be impossible to derail the car unless the line itself were broken, however sharp the curve. He considers that the line would be safer than any double line, and that not the slightest risk would be involved in running at the rate of 110 miles an hour. The floor of the car is to be 4½ feet above the ground.

At a recent parliamentary hearing on this interesting project Dr. E. Hopkinson said that he had no doubt whatever of the possibility of running the trains on the monorail line at the speed proposed. In relation to the transmission of the power from the motor shaft or shafts to the car axle, he said that three methods were feasible One way was what Mr. Behr adopted in Brussels—to put the motor down below and drive by a chain from the motor axle to the axle carrying the car. He believed that it would be quite practicable to apply this system to the proposed new railway, although he did not say he considered it would be the best one for the purpose. Another way was by adopting the method used on every trolley car in the world—that of having a spur-wheel on the motor and another on the axle and gearing one up to the other. He had known a line in which gears had run up to 50 or 60 miles an hour very successfully. He thought that powers up to something like 80 horsepower or 100 horsepower had been transmitted by means of these gears, but he believed it was possible and practicable that such a power as 375 horsepower could be transmitted by them. Another plan would be to do away with gear altogether and to put the motor direct upon the axles. That was the plan adopted on the City and South London railway, and it was both possible and practicable for the "mono" line. Dr. Hopkinson advocated four motors of 375 horsepower each, operated at 1,000 volts, for each car. Apparently, he favors polyphase motors, for he speaks of three conductors, one arranged for a sliding contact on the car.

Major P. Cardew said he had investigated the scheme, and had no doubt that it was possible to propel a car of about 50 tons' weight at the speed suggested by the promoters. The power would be generated in one power house, and the three-phase current would be used at an alternation of 15 complete periods per second and a pressure of about 10,000 volts, though the pressure need not be so high as that. A pressure of 10,000 volts would be sufficiently high for transmission to the distance required without undue loss. If the Board of Trade allowed the pressure which was now being worked on the continent, or was just about to be put into practice, it would be a pressure of 3,000 volts.

Sir William Preece also approved the plans. However, Sir Douglas Fox, a civil engineer, and others opposed the scheme. Sir Douglas said that it would cause a setback to the introduction of electric traction at high speed. Professor S. H. Short, now firmly transplanted in England, it appears, did not believe the car was planned to be sufficiently substantial. The braking arrangements were also inadequate, he thought. Stephen Sellon, chief engineer of the British Electric Traction company, considered the scheme both crude and impracticable. Professor A. A. C. Wilson said that Mr. Behr did not have room on his proposed car for the heavy motors required; his motors were where his passengers should be. The speed limit of safety on curves would be 85 miles an hour. Other gentlemen added their mites of opinion before this exceedingly instructive hearing was adjourned.

This radical project and its vigorous discussion, when considered with the London tube projects, show that while the Englishmen were slow in taking up electric traction, they are now considering its very latest phases. American engineers can find much that is instructive in the British situation.

Photometric Value of Arc Lamps.[1]

Professor C. P. Matthews (photometrist to the committee), Purdue University: It may be of some interest to you to know that these are the first tests that have been made on arc lamps in which the candlepower has been followed up during the life of the lamp. There are plenty of life tests taking the duration of the burning of the carbons, but, so far as I know, and I have watched the literature of the subject closely, there are no tests in which the candlepower is measured from time to time through the entire life of the lamp. Hence, in that respect, these results are somewhat unique.

G. W. Hubley, Louisville, Ky.: This is a very interesting report and evidences the very good work performed by the committee. I wish to move that the association accept the report and tender a vote of thanks to the committee, and that the committee be asked to continue this work until its completion.

The motion was carried.

Charles R. Price, New Bedford, Mass.: What is a Hefner unit?

Professor W. E. Goldsborough (member of the committee), Purdue University: A Hefner unit is the unit that has been adopted by the American Society of Electrical Engineers as a better standard to determine the standard of light than the old British candle. In our investigations we use what is called the Hefner-Alteneck lamp, in which we burn a wick very much on the style of the ordinary lamp, and it is bound to be more reliable than the English candle. The ratio of 0.88 between the Hefner unit and the British candle gives us a basis of comparison which may be employed in judging of the results of our work, so as to put them on the basis of British candles. The committee has thought best to introduce the use of Hefner units in its work in view of the fact that in America it has been given a certain standing by the action taken by the American Institute of Electrical Engineers, and I believe also by your own association. For that reason it is well for us to begin to think in Hefner units, as it is a much more reliable standard than the other, and so regarded by engineering societies generally at the present time.

Professor Matthews: Nobody really knows what the British candle is. When we say a Hefner unit is 0.88 of a British candle, we do not say much. One batch of British candles will give one result and another batch will give an entirely different result. You can get an accuracy within two per cent. with a Hefner lamp. It is subject to changes in the amount of moisture in the atmosphere and also slightly reacts to carbonic-acid gas in the room, but it is by far the best of all standards of light. It has an unfortunate color, rather reddish, but until we get something better we cannot do better than use it.

The American Institute committee on standards of light showed unmistakably that of all the standards which it tested—I was myself a member of that committee—no standard gave quite the performance that the amyl-acetate lamp did, for steadiness and reproducibility. I am quite convinced there is no standard quite as good as the Hefner lamp. The wick is about the size of a lead pencil, and the flame height is 40 millimeters, which is a little over an inch and a half, the height of an ordinary candle flame. Taking the mean of all the given measures of a British candle, the intensity of the Hefner unit is 0.88 of the British candle.

Converse D. Marsh, New York: I think there is one point which should be brought out and kept in mind by our friends who undertake these measurements. Different observers, at different times, have found a different ratio of value, but the American Institute hit on 0.88. It had a committee appointed which recommended that this fixed value, 0.88, be made in terms of standards of electrical candles. If the ordinary observer wants to make observations on the photometer, he should use the electrical standard and not touch the lamp. The lamp is variable, and among other considerations that have been noted is the barometrical pressure, which has an influence on the measurements. If we fix on 0.88 as the Hefner unit, we can translate that readily from an electrical standard into candlepower. Many observations are based on candlepower, but I believe it would be unwise for the ordinary observer to attempt to get his results from the Hefner unit. He should use an electrical standard, which is as unchangeable as anything can be.

Samuel Scovil, Cleveland: I would like to get some information as to the rated candlepower of the Welsbach lamps. I understand that they are generally rated at 50 candles, but I believe the candlepower varies, whether we test these lamps in a dry room or test them out of doors in damp weather.

Mr. Price: We have not tested Welsbach lamps in any quantity to establish a specified candlepower. We have tested them occasionally. We assume, in the first place, that they give about 50 candles. It will depend on the age of the mantle at the time of the test, and there are also other causes which operate as a factor in rating the candlepower of Welsbach lamps. Then there are the differences, owing to the individual investigator, that will come in, and among six men I think we will find a difference varying from four to five candles. I have not heard the point brought up that on damp nights they give less candlepower than at other times.

President Cahoon: I have not heard it brought up, but I think you will find a decided lowering of the candlepower on a damp night.

W. F. White, Cincinnati: I think there is a point which should be borne in mind in regard to comparative candlepower and the effect of comparisons taken from a report of this kind, which gives the mean hemispherical candlepower from the lower hemisphere. The results ascertained by this committee have been principally for hemispherical candlepowers, which are for commercial or indoor conditions, and, of course, for that purpose the hemispherical candlepower is a very interesting basis of comparison; but it seems to me that the investigation of the illumination of streets is of more interest to the greater number of members of this association than the indoor conditions. The mean hemispherical candlepower is a good comparison, and gives results which are desirable for indoor lighting, but in a commercial way we find the indoor conditions take care of themselves, and we do not need to put forth any arguments in favor of indoor lighting. For street-lighting conditions, by taking the average of the lower hemisphere, you do injustice to the merits of arc lights for that purpose. With the enclosed lamp, particularly, the candlepower under the lamp is low; the candlepower at a fair degree below the horizontal is high. Therefore, by taking an average of the lower hemisphere, you reduce the candlepower and get a lower average candlepower, and thus you indicate a result in street lighting which you do not get. The fact is that the reduction of candlepower under the lamp or close to the lamp is an actual advantage, and yet instead of showing that as an advantage you show it as a disadvantage, on account of taking into consideration the average light near the lamp. We will take average readings around 360 degrees of the lamp; the light at a given angle from the horizontal is fair; but it is not fair in street lighting to take 180 degrees in the vertical plane below the horizontal. In street lighting we ought to determine the height of the lamp and the angle at which the average is to be taken; thus for a Welsbach lamp of 50 candlepower, 100 feet apart, 10 feet above the ground; for an arc light of 500 candlepower, at any desired angle, 25 feet above the ground. Therefore a different angle is desired, and the average illumination of the 360 degrees at the angle below the horizontal determined upon, for the candlepower decided upon, should give a fair basis of comparison. I should like very much to see this committee bend its efforts to a considerable extent to street-lighting conditions, to determine the relative candlepowers of the illuminants, if it is secured at different distances from the source of light, at different heights from the light and different angles from the horizontal.

E. F. McCabe, Bloomsburg, Pa.: I believe the work of the committee determined whether the American or foreign carbons give longer life or better intensity. Do I understand that the foreign carbons give both the longer life and greater intensity?

Professor Matthews: From the standpoint of life we get the longest life in the American carbons, say, 115 hours' average life; from the simple standpoint of intensity only we get the best from the European carbons; from the standpoint of life times intensity, that is, candlepower-hours, we get also the best from the European carbons.

1. Discussion following the progress report of a committee of the National Electric Light association at Niagara Falls, N. Y., on May 22, 1901, and presented in abstract in the Western Electrician of May 25, 1901.

Annual Meeting of American Institute of Electrical Engineers.

At the annual meeting of the American Institute of Electrical Engineers held in New York city last week, new officers for the ensuing year were elected. Charles P. Steinmetz of Schenectady, N. Y., was elected president to succeed Carl Hering. Vice-presidents elected were Dr. Samuel Sheldon, George F. Sever and Michael I. Pupin, while those holding over are Gano S. Dunn, Arthur V. Abbott and W. L. R. Emmet. Managers elected for the three-year term were John W. Lieb, Jr., Samuel Reber, Charles F. Scott and W. E. Goldsborough. The hold-over managers are Charles S. Bradley, William D. Weaver, C. O. Mailloux, W. S. Barstow, John J. Carty, Calvin W. Rice and Ralph D. Mershon. George A. Hamilton and Ralph W. Pope were re-elected treasurer and secretary, respectively. A new constitution for the Institute was adopted at the meeting. Reports of the treasurer and secretary showed a cash balance of $1,451.48 and a total membership of 1,260.

Rate Question in Chicago.

A measure proposing uniform rates for electric lighting and power was presented at the meeting of the Chicago City Council on May 27th. The ordinance prohibits discrimination in rates "directly or indirectly by means of any rebate or other shift or evasion" under penalty of a fine of not less than $25 nor more than $200. It is provided that the rates of compensation to be exacted by any of the electric companies shall be uniform throughout the city. By the terms of the ordinance each company can charge its own price to its customers, but the price must be uniform. The measure was made a special order for the next meeting, and Corporation Counsel Walker was ordered to give an opinion as to whether the ordinance was legal.

Benefits of Association.

Just before the adjournment of the convention of the National Electric Light association at Niagara Falls last week Lieutenant James Blake Cahoon, the retiring president, made the following pertinent remarks:

"We have completed the programme of the meeting, not in a hurry, but a little ahead of time, which is something unusual. In my address to the association, I mentioned the fact that I had not unduly urged the members of the association to put their shoulders to the wheel and endeavor to increase our membership. When we compare our membership with that of the gas association, the waterworks association, and various others of the national bodies, we find that their membership is well in advance of ours. I do not know why it is that electrical men hold back from joining this association. One of the members remarked that perhaps it was due to the fact that in earlier years we had acquired a reputation for being somewhat boisterous at our conventions; but, like many things in the earlier days, that is a thing of the past. The association has come more and more each year to realize that these meetings are for the benefit of the members, and that much can be learned by coming here and meeting other gentlemen in the same business and gaining knowledge from contact with each other.

"I hope that during the year to come you gentlemen will each and every one make up your mind to bring a new member into the association. We have made a good beginning. We want that work to go on, and we want particularly to bring this association up to the plane on which it should be. There are 1,800 stations in the country that can afford to join this association. In our present membership we have, roughly speaking, 10 per cent. of that number.

"The only way a central-station manager can make progress and get out of the rut that he is liable to get into is by going out in the world, moving around, and seeing what other people are doing. If he vegetates and remains at home, his plant droops gradually, and he wonders why it is not paying dividends. He becomes plant-blind and does not know what other plants are doing. He does not know what his own plant is doing, and because so many central-station managers have gotten into this position, the result is, as was reported last year, that only a small percentage of the electric-light plants are actually earning dividends.

"We were all much interested in the question of steam heating as an auxiliary to an electric-light station. In the case of those plants that are to-day going behind, I believe if they would take up that subject, in one form or another—hot-water heating or steam heating, whichever their particular needs demand—they would derive a revenue which would put them on a paying basis. The same way with many of the plants that are now without storage batteries. If they would come here and learn of these things, they would realize what is to be gained by the use of storage batteries; they would discover where their plants are weak and how they can overcome these weaknesses.

"During the last year I have had letters from many small plants saying they desired to make certain changes, but that they could not afford to pay an engineer, and wanted to know if I would help them out. The president of the association stands ready at all times to help the small station, and, wherever we can, we give information which will benefit our smaller members. The big companies can take care of themselves. We have helped many companies in the question of municipal ownership. We have distributed various pamphlets and literature in this last year. I know, in fact, that this literature has done a good deal of good to central stations, and in numerous instances I have had replies thanking us for the assistance we have rendered. In one case the manager of the station said he hoped in time to persuade his board of directors to allow him to have the company join the association. Through our efforts we were enabled to knock out a proposed municipal plant in the city in question, and the old plant got the city lighting at remunerative prices; yet that plant to-day is not a member of our association. Many plants call on us for help and yet they do not contribute one cent to help the association. The only way we can get the data which we supply these companies is through the expenditure of money, and such companies should contribute to the support of the association.

"There is a field for missionary work in this association, and I rely upon you gentlemen to put your shoulders to the wheel and help your new president to carry this work forward and bring the association to the point where it belongs. We should have at the next convention a membership of 500, and we can have it if you gentlemen would take this little talk to yourselves, to your hearts, and when you go home not forget what has been said, but go to work and get a new member and bring him into the fold at once.

"I want to thank you, gentlemen, for the very cordial co-operation which you have given me in the work of the association during the last year, and I lay down the reins of the presidency with the feeling that I have done a little to help our organization. I have not been able to give my entire time to the association, as other duties have pressed upon me, but I have done what I could, and only wish that the association could be brought up to a point where they could see their way clear to increasing its usefulness in many directions."

DEVELOPMENT OF THE TELEPHONE FIELD.

Indiana Telephone Items.

Articles of incorporation were filed with the secretary of state on May 24th by the Mansfield and Carbon Co-operative Telephone company. The capital stock is placed at $2,500. The directors are W. N. Simer, G. M. Pell, J. H. Throop, J. B. Garrigus, C. Garrigus, J. P. Coleman and S. J. Wilton.

The Indianapolis council, by ordinance, has increased the pay of telephone operators and watchmen in the fire department from $2 to $2.25 a day.

Litigation has been begun to test the right of the council of Hartford City to revoke the franchise of the Central Union company. Fifteen years ago the latter company was granted a franchise, but after a time the exchange was abandoned, and only long-distance connection was maintained. After the Independent company entered the field the Central Union concluded to re-establish the old office and service, whereupon the council revoked its franchise; hence the litigation.

The Debois County Telephone company, which has been working in the vicinity of Jasper for some weeks, opened its exchange in Jasper to the public on May 17th.

W. S. Chapman, auditor of the Central Union company, has reported that the accounts of W. E. Branson, manager of the local office at Goshen, are not in a tangled condition, as reported by the public press. "There was some confusion," said he, "but the position is a vexatious one, owing to sharp competition." Branson has returned to the city and is reinstated as manager.

The Western Electrician was led into error last week in giving publicity to a story of court proceedings by telephone. Judge Neal of Noblesville says that there is nothing in the story published to the effect that he heard testimony by telephone, listened to the argument of James M. Fippin of Tipton in the same manner, and then granted a decree in a divorce case.

The Central Union Telephone company has established a new "short-time talk" rate between Indianapolis and Terre Haute, and if the plan is a success it will be tried between other important points on the company's lines. The new rate is 25 cents for one minute, and five cents for each additional half minute. The old rate was 45 cents for three minutes and 15 cents for each additional minute. Manager Hill says he thinks the division or new rate will be appreciated by people who use telephones frequently. "Few people have an idea," said he, "of how much they can say in a minute. A business man goes into a telegraph office and sends a message, boiled down to a few words. He can, in a minute's time, speak between 50 and 100 words over a telephone, which ought to be sufficient for accomplishing what he desires."

Manager Sheerin of the Independents says that his companies will not be affected in any way by any reduction that the Central Union may make. "We fixed our rates when we put in our system," said he, "and we intend to stand by them. We are gratified with the business we are doing under the present rates."

Mr. Sheerin has sent out a personal letter to the managers of the Independent telephone companies in Indiana, asking for the exact number of Independent and Central Union telephones in each county. He will make up a report from this and incorporate it in his annual report at the National meeting of the Independent companies at Buffalo, N. Y., June 11th to 13th. Mr. Sheerin is secretary of the National association, and will read a paper before the convention. F.

Telephone News from the Northwest.

The Fulda Telephone company has been incorporated at Fulda, Minn., with $25,000 capital stock.

The local exchange at Willmar, Minn., will install a new switchboard with a capacity of 200 instruments.

H. H. Heath of Neillsville, Wis., and J. C. Marsh of Marshfield, Wis., have bought the Loyal telephone line, and will combine it with the Clark County system. The old line will at once be put in first-class condition, and extended to Marshfield, via Granton and Chili.

The Citizens' Telephone company of Mankato, Minn., contemplates establishing a local exchange in Lake Crystal, Minn.

The Fairmont Telephone company is arranging for a system to accommodate 400 subscribers. The company started with accommodations for 100 and increased it to 200, but it now has 240 subscribers, and the number is increasing.

The Chippewa Valley Telephone company has been formed to build a line from Cameron to Tony, Wis. Local exchanges will be put in at Bruce, Ladysmith and Tony.

The Elbow Lake Telephone company has been incorporated at Elbow Lake, Minn., and has begun constructing a local line.

Farmers between Fountain and Wykoff, Minn., will build a telephone line.

The E. H. Martin Telephone company of Webster City, Iowa, has offered to install a local exchange at Dayton, Iowa, if 35 subscribers are secured.

The Lewistown Telephone company has been granted a franchise for a local and long-distance system at Lewistown, Mont.

The Franklin-Hardin Telephone company has been formed at Iowa Falls, Iowa, to establish a system of rural telephones in Franklin and Hardin counties.

The Farmers' Mutual Telephone company, which operates lines from Villisca to Hepburn and Clarinda, Iowa, will build another line to Clarinda and connect with other mutual lines at Villisca and Clarinda.

The Central Telephone company of Rockwell City, Iowa, plans an extensive system of rural telephones, to cover the entire county.

The Interior Telephone company is an applicant for a local franchise at Grinnell, Iowa.

The Iron Range Electric Telephone company has started work at Hibbing, Minn., for a local exchange. A central-energy system will be installed. R.

Ohio Telephone Notes.

The Home Telephone company of Dayton has been granted a franchise in that city by the Probate Court of Montgomery County, under the state laws governing the matter, when terms cannot be agreed upon between a company and municipal corporation. The franchise is to exist for the term of 25 years, the same as was granted the Bell interests. The matter has been before the court for several months and very careful consideration has been given it. Harry Keifaber is the president of the new company; Albert Emanuel, an attorney, is the secretary, and Joseph Weil, general manager. The terms of the franchise require the company to complete the plant by January 1, 1903, and have it in operation within 60 days after that time.

The Valley Telephone company of Wilmot, Stark County, has been incorporated, with a capital stock of $1,000, to build a village exchange.

The Union Telephone company of Fairview has been incorporated, with a capital stock of $10,000, by C. E. Miller, B. F. Sheppard and others. The company will operate lines in Guernsey, Harrison and Belmont counties.

The Harrison County Telephone company of Cadiz has filed notice with the secretary of state of an increase of capital stock from $25,000 to $50,000.

The Buckeye State Telephone company of Norwalk, Ohio, is one of the new incorporations of last week, with C. D. Miles, F. H. Jones, H. E. Graham, J. R. McKnight and George H. Gates as the incorporators. The capital stock is placed at $10,000. The articles of incorporation provide that the company may lease, own and build a telephone system and a magnetic telegraph system in the counties of Huron, Erie and Lorain.

The Madison and Clark County Telephone company has absorbed the systems at London and South Charleston, and the latter will hereafter be operated under one management, Fred Peirce, formerly of the London company, being the general manager. Hon. William M. Jones, banker and capitalist, is the president of the consolidated company.

The Miami Telephone company has received an extension of franchise for 25 years from the Middletown council, on condition that the system be improved. The Citizens' Telephone company was refused a franchise. C.

Rate Reduction in Washington Upheld.

The Court of Appeals of the District of Columbia has affirmed the constitutionality of the Act of Congress of 1898, which reduced by 40 per cent. the telephone rates in the city of Washington, D. C. The Bell Telephone company refused to reduce its charges to the rates fixed by the act, alleging it unconstitutional for the reason that it interfered with chartered rights and that service could not be performed at the prices fixed by Congress. Suit was brought before the Supreme Court of the District of Columbia and Justice Barnard held that the act was unconstitutional. The case was then carried to the Court of Appeals, which reversed the judgment of Justice Barnard and directed the granting of an injunction. An appeal will probably be taken to the Supreme Court of the United States.

Independents to Continue Fight in Berliner Case.

Six years ago a national committee of the Independent telephone interests was appointed to look after the litigation they were involved in with the Bell telephone interests over the Berliner patents. Hugh Daugherty of Bluffton, Ind., a member of that committee, has just returned from New York and Boston, where the members of the committee held a meeting recently. He is quoted as saying: "The Bell company has ordered a transcript in an appeal from the Boston decision to the United States Court of Appeals, hence the committee must continue the fight in the higher court. But I believe that the lower court will be sustained."

A large force of workmen is building a telephone line from Dresden to Sharon, Tenn., for the Weakley County Telephone company. The company already has a large list of subscribers in Sharon, and the exchange is rapidly nearing completion.

Uniform Rural Rates Wanted in Indiana.

It is announced that the Independent telephone men of Indiana will be called together within a few days to take some action toward establishing uniform rates for service in the rural or farming districts. The Independents, who have taken the initiative in this important development of the telephone business in Indiana, say that while there is a uniformity of rates in the cities and towns, and an understanding concerning the long-distance connections, there has been much confusion as to what shall be charged in the country districts. Thousands of farm residences have been connected with the city and town exchanges within the last few years, and the demand for telephones among the farmers is increasing at a rapid rate. Hon. Hugh Daugherty of Bluffton, who has been prominently identified with the organization of the Independents and is a heavy stockholder in the business, announces that the meeting will be called to consider rural charges. Mr. Daugherty says "that in some localities the farmers are charged $1 a month for telephones, in others the rate varies from $1 to $2, and there are some places where competition has ground the rate down below $1 per month." With the rapidly increasing business in this department, the men who have been conspicuous in shaping the progress of the Independents have decided that something should be done at once toward bringing about a uniform rate for country service. "There has been a wonderful development in the rural branch of the telephone business lately," said Mr. Daugherty. "The farmers are anxious to have telephone connection with the cities, towns and their neighbors, but at this time there is no uniformity among the Independents as to what rate shall be charged." Mr. Daugherty said he thought there should be a uniform rate of $1.50 a month for telephones in the rural districts. This would not be too much for the class of farmers to pay who want telephones, and it will result in better service. The Central Union company has recently entered the rural districts in competition with the Independents, and in some localities they are said to be charging but 50 cents a month for each telephone.

Telephone Competition in Chicago.

It is reported that the committee of the City Council of Chicago to which the matter was referred does not favor the ordinance to grant an extension of territory to the United Telegraph, Telephone and Electric company, which is now confined to Hyde Park. Officers of the company appeared before the committee in behalf of the ordinance. They said that their company was willing to install free telephones beside those of the Chicago Telephone company, and that their own instruments should only be paid for at the rate of five cents for each time the telephone is used. The officers of the company also promised to make the rates lower by one-half than those charged by the Chicago Telephone company. Finally, the committee agreed to meet again on June 7th for further consideration of the ordinance.

While the company in Hyde Park is making strong efforts to gain a foothold downtown, the Chicago Telephone company announces reduced rates for all subscribers under the newly inaugurated nickel-in-the-slot system.

Bell Company May Increase Its Stock.

The American Telephone and Telegraph company will hold a special meeting in New York on June 3d, at which the stockholders will vote on a proposition to increase the stock from $100,000,000 to $150,000,000. It is understood that the new stock, if authorized, will be issued in accordance with the policy adopted at the time of the transfer of the American Bell property, but that only $10,000,000 will be issued in the near future. This will be given the stockholders at par. It is thought that the increase is in connection with the extension of the properties of the subsidiary companies and to carry out the Bell company's intention to exchange stock for that of subsidiary companies, thereby forming one large corporation.

Extensions of Twin City Company in Minneapolis and St. Paul.

The Twin City Telephone company of Minneapolis, Minn., has awarded contracts for the erection of sub-exchange buildings at Hague and Dale streets in St. Paul, and at Twenty-sixth and Blaisdell avenue, Minneapolis. Work on both buildings will be rushed, and the company will cover the suburbs adjacent to those points as soon as possible. The company is also installing a switchboard on the East Side in Minneapolis, with 2,000 capacity, which will be in working order about July 1st. The sub-exchanges just contracted for will have a capacity for about 3,200 connections each. Since the reorganization of the company, debts to the amount of $180,000 have been paid, cash has been paid for a large amount of material and the company has placed itself in a position to discount all its bills.

Government Telephone System in Porto Rico.

With the annexation of Porto Rico, the government came into possession of the telephone system of the island. A continuance of the policy followed by the Spanish government is favored by General Greeley, who superintended the reconstruction of the lines. If his plan is followed, the United States government will have a valuable telephone system, which will cover almost the entire island.

Concessions for telephone lines, under the Spanish system, were granted to the highest bidder at public auction, the bidding being on the percentage the government received from the total collection, the minimum of which was six per cent. of the collections. Concessions were granted for a period of 20 years, counted from the date of the drafting of the instrument containing the contract. Upon the expiration of the period of concession the telephone lines and apparatus become the property of the government.

The concessioners were required to install the latest and most perfect apparatus obtainable, and if there were any inventions which, in the judgment of the government, would be of benefit to the service, the concessioner was required to make use of it within the period of six months, and should he not do so the government was authorized to establish a new service, making use of the improvements which the new invention might furnish. In addition to this, the government fixed the rate charged for telephones, the maximum charge being $102 per annum for each station.

Opposition to Canadian Bell Company.

Although the bill to increase the stock of the Canadian Bell Telephone company from $5,000,000 to $10,000,000 passed the Senate committee on banking and commerce of the Dominion Parliament without serious amendment, it was, nevertheless, hotly contested in the Senate itself by those senators who were determined that the company should be held down to the clause inserted in its charter in 1892, compelling the company not to raise its rates above what they were in that year. The demand is a most unusual one, but those who supported it claim that the company has received favors of the greatest value from Parliament; that the company is now practically in the position of a monopoly, and that, in view of the handsome profit its business nets, it owes this much to the public. In consequence, however, of the determined opposition to the bill and the lateness of the parliamentary session, Senator Kirchoffer asked leave to withdraw the bill for this year. He intimated that the company would endeavor to reach an understanding with the opponents of the measure during the parliamentary recess.

EXTENSIONS AND IMPROVEMENTS.

The Gainesboro (Tenn.) Telephone company of the Georgia division has finished a long-distance line to Tallapoosa, Ga.

The Chesapeake and Potomac Telephone company has secured a franchise to construct a telephone system in Hyattsville, Md.

Pensacola, Fla., has granted the Southern Bell Telephone company a franchise to construct a telephone system in that town.

James Oliver, owner of the Gainesville (Ga.) local telephone lines, has begun the erection of a long-distance system connecting with nine or more outside points.

The Wood County Telephone company of Grand Rapids, Wis., recently purchased 3,000 feet of cable and will make many improvements to its system this coming season.

The Interstate company of Raleigh, N. C., which city has three telephone systems, has ordered a new switchboard, with a capacity of 1,200 telephones. This company also contemplates erecting several long-distance lines to outside points.

TELEPHONE MEN.

T. V. Alden, wire chief of the Columbiana County Telephone company of Salem, Ohio, has resigned his position to accept a similar one with the Stark County Telephone company of Canton, which is now under course of construction.

H. P. Miller of Chicago succeeds Major R. B. Hoover as manager of the Central Union Telephone company at Springfield, Ohio. Mr. Miller is a young man, and has served as special agent of the company in Chicago for some time.

George H. Brainerd, the New England Telephone company's electrician who shot four men in Portland, Me., has been committed to the care of the superintendent of the Maine Insane Asylum at Augusta. He will be examined as to his mental condition.

William T. McKelvey, late manager of the Central Union Telephone company at Marion, Ohio, died at the home of his father in St. Clairsville, Ohio, on May 23d, after an illness of some months. He had been identified with the company for some years and had served as manager at Canton and Zanesville, although now but 29 years of age. He leaves a wife and four small children.

GENERAL TELEPHONE NEWS.

A franchise has been granted to the American Telephone and Telegraph company to establish a long-distance telephone system at Greenville, S. C.

The Southern Bell Telephone and Telegraph company has been granted a franchise to construct and operate telephone and telegraph systems at Rome, Ga.

A contract has been let by the Walnut Hill Telephone company, Walnut Hill, Ark., for the construction of a line from Walnut Hill to New Lewisville, Ark.

The Southern Bell Telephone company and the Peninsular Telephone company have each applied for a franchise to operate a telephone system in Bartow, Fla.

The Memphis and Oxford Long-distance Telephone company has been chartered at Oxford, Miss., to construct a long-distance telephone system. W. H. Harvey is the general manager of the company.

At a meeting of the stockholders of the Bell Telephone company of Philadelphia, on May 21st, it was decided to increase the capital stock from $6,000,000 to $8,000,000. Half of the increase will be offered for subscription on June 8th, and distributed pro rata among the stockholders.

The directors of the Mutual Telephone company of Coopersville, Mich., have been authorized to accept the proposition of the Muskegon Citizens' Telephone company to buy the entire exchange. The Mutual company has 45 subscribers and its own lines to Allendale and Grand Haven.

In regard to the strike of the linemen working for the United Telephone company at Huntington, Ind., James H. Hessin, manager of the company, states that no difficulty was experienced in filling the places of the strikers with both union and non-union men, and that the work was not delayed.

Telephone apparatus will, in the future, be carried by the principal railway trains in Sweden. This apparatus may be attached to the telegraph wires—one side to the wire itself and the other side to the rails. By this arrangement communication may be had with the nearest station, and it will prove invaluable in case of accident.

A. F. Blundell, general manager of the Havana Telephone company in Havana, Cuba, was in Chicago this week for the purpose of securing supplies for his system. Among his purchases was one of 2,500 automatic telephones, which he has ordered from the Strowger Automatic Telephone company for immediate shipment.

The Chicago Telephone company has made a successful trial of the nickel-in-the-slot service on the North Side of the city, and it is now extending this class of service to other parts of Chicago. Three hundred residence and party-line telephones have been installed in the Hyde Park district. The president of the company, John I. Sabin, originated and installed this service in San Francisco some years ago.

At a recent meeting of the stockholders of the Independent London (Ohio) Telephone company and the South Charleston (Ohio) Telephone company, the arrangements for the consolidation of the companies were consummated, and directors and officers were elected under the new corporation. The London company has 105 miles of line and the South Charleston company's lines connect with many large towns. The company's name has been changed to the Madison-Clark Telephone company, and the officers elected are: President, William M. Jones; vice-president, J. F. Rankin; treasurer, Robert W. Boyd; secretary, J. C. McMillen; manager, F. W. Peirce; directors, R. W. Boyd, William M. Jones, A. S. Bell, James F. Rankin, J. C. McMillen, E. L. Barber and James S. Braley, Jr.

MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing company's plant in Chicago is to be enlarged by two additional stories, at a cost of $30,000.

The Ericsson Telephone company, 296 Broadway, New York city, recently received a postal card from a telephone exchange in British India, in reference to the publication of the company, Telephone Information. The card also stated that "the Ericsson telephone sets are the best in the world and we use them here."

The Central Electric company of Chicago says it is in a position to make immediate shipments of large and small orders for telephone-construction material. The company is carrying large quantities of cross-arms, pins, brackets, insulators, telephone wires, etc., in Chicago stock, in order to be able to make quick shipment of this material.

The Warner pole changer for ringing telephones, manufactured by the Warner Electric company of Muncie, Ind., has been on the market only a little over three years, but in this time the company has sold over 1,200 of them, having the machines in successful operation in nearly every state in the United States, as well as four foreign countries. The Warner company is prepared to fill all orders promptly. It has recently issued a catalogue which describes the pole changer in detail.

The Practical Side of the Incandescent Lamp.

[*Continued from page 373.*]

great deal of it through published results of tests; and nearly every user has, no doubt, made such tests and plotted the results in the usual form of candlepower curves.

In general, such tests can be said to be conclusive only when the average product of the manufacturer is taken; when a sufficient number of lamps are included in the test to secure a correct average; when correct methods of test are observed, and, finally, when the test is continued long enough to bring out the qualities of the lamp. One of the details of importance is to have the initial efficiency

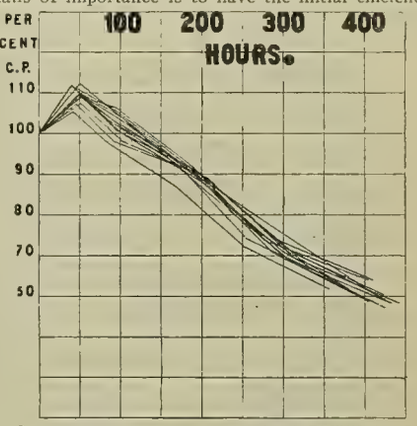


FIG. 8. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CANDLEPOWER CURVES SHOWING CHARACTERISTICS OF GOOD LAMPS.

of the lamp accurately determined, certainly within one-tenth of a watt per candle. The preferable efficiency for test is 3.1 watts per candle, as lamps burned at this efficiency will give results in shortest period about half of that necessary with lamps set up at 3.5 watts.

The basis of measurements of lamps has always been horizontal candlepower, and the watts per candle are determined by the ratio of horizontal candlepower to the total watts consumed. This has been taken as the measure or strain of the filament and as a basis of comparison. It is to be noted, however, that this is correct only when the forms of filament are the same. When the filaments differ in type, as, for example, a loop compared to an oval, equal efficiency by horizontal candlepower measurement does not secure equal strain on the filaments nor form an exact basis of comparison.

In considering candlepower performance, a slight rise in candlepower is not objectionable, but excessive rise, averaging above a candle or more, is

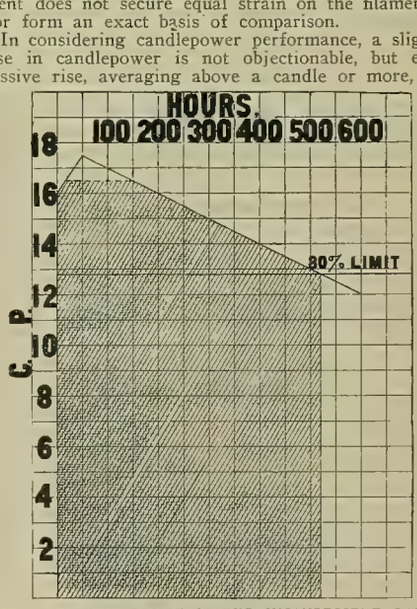


FIG. 9. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CANDLEPOWER AREA.

objectionable, as the filament is severely strained thereby, and is very apt to break. Fig. 8 shows the characteristics of good lamps, well-maintained candlepower and uniform performance, which is fully brought out in modern test by diagraming the results of each individual lamp, instead of averaging the results and plotting only the one curve. The basis of comparison on candlepower performance, as now adapted, is candle-hour area. This, no doubt, is familiar to all, and is illustrated in Fig. 9. The period in which a lamp declines to 80 per cent. of its normal candlepower, that is, in which it loses 20 per cent. of life, is called its useful life, and it is taken as the limiting period of useful service of lamps. The candle-hour area with normal curves is in proportion to useful life, and useful life can, therefore, be used as a basis of comparison the same as candle-hour area. In both cases this basis is subject to criticism, as it is possible to produce a lamp giving a curve which, while candle-hour area and useful life are at a maxi-

mum, can hardly be considered the best type of lamp. It would seem that in connection with candle-hour area a requirement exacting a certain average of candlepower between initial and 80 per cent. would be desirable.

I have referred to the use of a correction factor to reduce results upon lamps burned at varied initial efficiencies to one common efficiency for comparison. This is here given in Fig. 10, which shows curves giving changes of volts, watts per candle and life due to different candlepowers. From these curves we can get various information as follows:

1. Given candlepower and life to find (a) candlepower at another life and (b) life at another candlepower.

2. Given candlepower and volts to find (a) candlepower at another voltage and (b) voltage at another candlepower.

3. Given candlepower and watts per candle to find (a) candlepower at another watts per candle and (b) watts per candle at another candlepower.

4. Given volts and life to find (a) volts at another life and (b) life at another volts.

5. Given volts and watts per candle to find (a) volts at another watts per candle and (b) watts per candle at another volts.

6. Given watts per candle and life to find (a) watts per candle at another life and (b) life at another watts per candle.

Lamp Use.

The lamp is designed and used to give light, and lighting companies are in the business of making and selling light—not power. The selling is done, it is true, by the watt-hour, but what the consumer is needing, buying and using is light. Now, it should be plainly evident that in the production of light, the lamp is practically the sole and chief essential. All the station does is to generate current; the lines deliver it; the converter transforms it; the meter measures it; but it is the lamp that produces the light. In the parlance of the day, "it is up to the lamp."

Now, if it be good practice to provide good and efficient apparatus and lines, transformers and meters to deliver and measure current, is it not much more important to provide and care for the controlling device that produces the substance desired; that is, the light? The manager who thinks he can maintain a well-lighted service without caring for the lamps is in the same position as the ostrich that thinks itself concealed when its head is hidden in the sand; he has forgotten the most prominent part of the system on view. The great source of trouble lies in the practice of charging customers for the incandescent lamps, and the reason for it is simply this: Lighting results are directly dependent upon the lamp. All lamps lose in candlepower as they burn, some makes to a much greater extent than others. If lamps are not renewed, therefore, the lighting service must certainly deteriorate just as the lamp does. Extensive experience shows that few, if any, customers ever renew their lamps when charged therefor, except when they are burned out. We see, therefore, that as long as the central stations charge for lamps, deterioration in lighting service cannot be properly repaired.

The worst case is that where the station does not handle the lamps, and the customers are permitted to buy any and everything. This is the general practice in Europe, and it is directly responsible for the miserably poor lighting service to be found in the continental cities. Not only this, but it is responsible as well for the backward condition of lamp manufacture abroad, as the only lamps there are those that cost little and have a long life; that is, cheaply made, low-efficiency lamps, a low-grade article. This practice, adopted from the gas business, is a most mistaken one when applied to electric lighting, as the conditions affecting the two cases are wholly dissimilar.

The case is somewhat better where the central station sells the lamps at a fixed price, particularly if they wisely make the price a low one. Unless, however, the price be made at cost, and preferably less than cost, the consumer is apt to buy all kinds of lamps. This plan is of value, therefore, only so far as it secures the sale of all the lamps used.

To control the type of lamp used, and thus insure the adoption of the best grade and proper efficiency of lamp, is an important essential. This is the first step, but it is only a small part of the battle. As long as the customer has to pay for the lamp, even though it be but five cents, he will generally use it through a dim and useless old age to the breaking point. He will thus always have it in his power to depreciate lighting results, and to checkmate all the endeavors of the station to improve. It seems to me that we cannot escape the conclusion or avoid the plain facts of the case., viz., that free lamp renewals are a necessity to the best results.

The only objection I know against free renewals is their cost. Let us see what this amounts to and if it be too great a price to pay for the benefit. When lamps were sold at from 40 to 50 cents apiece, the question of cost might have been a serious one, but at the present low prices we should not find it so. At present prices the cost of free lamp renewals amounts to from one-third to two-thirds of a cent a kilowatt-hour, depending upon efficiency of lamp used. Stations can be fully reimbursed for this charge by making this increase in their meter rates, or they can advantageously adopt free renewals in place of making reductions in rates. Slightly increased rates ought to be possible for the improved service that free renewals will secure. Whether reimbursed for it or not, however, central stations can and should afford the step.

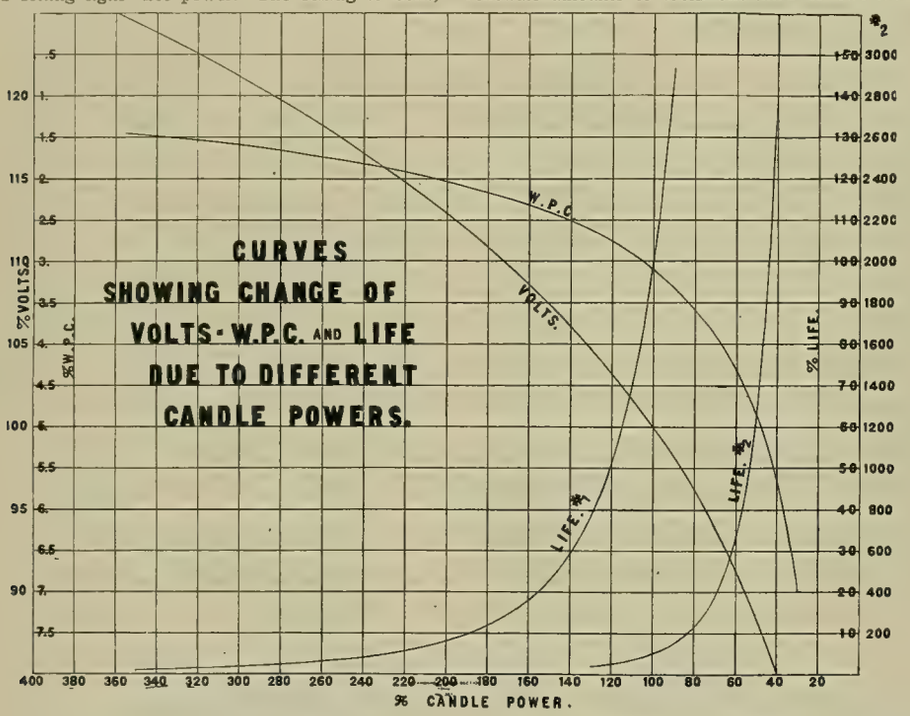


FIG. 10. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CURVES GIVING CHANGES DUE TO DIFFERENT CANDLEPOWERS.

Taking average conditions, it is safe to say that free and periodic renewals will effect an improvement of 50 per cent. in lighting results. Is not half a cent a kilowatt-hour a small price to pay for this?

It seems to me not so much whether stations can afford it, as whether they can afford to do without it.

Free renewals, then, is the key to the situation, and gives the station the needed control of lamps to secure results. Now, how should this control be exercised? Shall we leave the results to take care of themselves, or shall we take full care of results and provide for the periodic replacement of lamps? It is just here that many companies fail in performance by neglecting to care for renewals. A systematic method is needed by which lamps may be periodically replaced, instead of the too prevalent custom of waiting until the customer complains or the lamps become dim, dark and disappointing. Some other standard than the limit of a customer's patience should prevail.

Arc lamps are regularly trimmed as a matter of necessity. Because incandescent lamps do not fail, is that any reason why they should not regularly be trimmed? The incandescent lamp for proper service requires but one trimming to five or eight for the 100-hour arc lamp, and certainly the incandescent lamp would seem to deserve one-fifth to one-eighth as much attention as is given to arc lamps.

Now, the only way to keep a clean house is to regularly clean it, and the only way to keep a clean and bright lighting service is periodically to sweep the service clear of the old and dim lamps.

The best method for accomplishing these results is that originated by Mr. James English at Bridgeport and New Haven, Conn., and now adopted by many other stations in the country, at Lowell, Mass., New Orleans, La., Atlanta, Ga., and other places. On this system employes regularly visit customers, remove all the lamps in circuit and replace them with good ones.

The lamps removed are both good and bad. These are returned to the station and passed through a photometer, and can rapidly be assorted (500 to 600 an hour) into two general classes: Those above and those below any prescribed limit of candlepower

FIG. 11. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—CLEANING RETURNED LAMPS.

taken, say 14. Those above this limit can be replaced in service at the next exchange. Those below the limit can be assorted again into classes; those above and those below, say 10 candlepower; the former can be used in various ways, about station, or rented for street illuminations or fêtes and special occasions.

At Mr. English's station at New Haven, Conn., the residence lights are, as a rule, not disturbed, but the business sections have their lamps replaced four times a year. In this station not quite one-half of total lamps connected (representing business circuits) were removed four times during the year; of this number over one-half by simple visual examination (passing lamps in front of a piece of white paper) were rejected. This left less than 50 per cent. that merited cleaning and photometering, and nearly 90 per cent. of those tested out above 15 candlepower, and worthy, therefore, of being returned to the circuit on the next exchange. The actual work, therefore, narrows down to testing but a small fraction of total number of lamps connected.

The work of cleaning is done easily and rapidly by means of a jig, as shown in illustration (Fig. 11). A cloth, some water and a little "Bon Ami," or similar cleaner, effectually clean globe and base with a few revolutions in jig. Two men can work at jig, one at each end. The work of photometering is very rapid (see illustration, Fig. 12), and, as stated above, can be done at the rate of 400 or 500 an hour. For this work at New Haven, one good man and a helper are employed. In addition, these men do a good deal of other work, including testing

FIG. 12. PRACTICAL SIDE OF THE INCANDESCENT LAMP.—PHOTOMETRIC TEST OF RETURNED LAMPS

of all the new lamps received, some meter testing, etc. The company estimates that the work is equivalent to the full time of one man costing, say, $600 a year. The total cost of lamp renewals and work of renewals, etc., averages, per kilowatt-hour, .428 cent, or less than half a cent per kilowatt-hour. This certainly is a small price to pay for the benefits of such a system.

Such work should be in charge of a properly organized incandescent-lamp department. We have meter and arc-light departments; why not an incandescent-lamp department as well? Such a department would be responsible for the incandescent-lighting service and have charge of lamp renewing, lamp testing and lamp stocks.

Remember, you must break eggs to make an omelet, and likewise must break lamps to have good light. Every 100 kilowatt-hours of incandescent service means a certain lamp depreciation calling for so many lamps to be replaced. You pay either

the lamps or the penalty. The service must be fed with new lamps or it will languish and suffer.

On contract rates sell lamps, if you must, but at the lowest price possible; but for meter customers let free and liberal lamp renewals be the invariable policy. In this way you can clear the way to a good lighting service and be enabled to make your electric lighting so good that no one can afford to do without it.

DISCUSSION.

E. F. McCabe, Bloomsburg, Pa.: I would like to ask Mr. Willcox if he considers it good policy to use 3.1-watt lamps for a small alternating station with hand regulation and transformers distributed variously about a small city. Doesn't he think it would be better to use 3.5-watt lamps and get longer service with regulation that is not very good with those high transformers?

Mr. Willcox: I should say that that question is simply a question of regulation. If you can use a 3.1-watt lamp I would certainly use it. If you cannot, of course, you have to use the 3.5-watt lamp. The limit of regulation would be, say, two and three per cent. It is possible for many alternating stations to use the 3.1-watt lamp, due to a combination of improvements in the station and improvements in the lamp, where, in former years, it was utterly impossible, and I should say that it ought to be the ambition of every central station, alternating or otherwise, to have its regulation devices, transformers, etc., improved to the extent that would admit of the use of the 3.1-watt lamp. That should be the ambition and end; but until you get that regulation, of course, it would be impracticable to use that lamp. You sacrifice a great deal to get it.

Stanley Spherical-coil Wattmeter.

An indicating wattmeter is now generally regarded as absolutely essential to a modern switchboard equipment. The S. K. C. spherical-coil wattmeter, manufactured by the Stanley Electric company and illustrated herewith, is constructed upon the dynamometer principle, which makes the readings on alternating-current circuits practically correct. A movable coil attached to the pointer is suspended within the field of a fixed coil. The fixed coil carries the main current of the circuit, and through the movable coil the pressure is taken. The winding

STANLEY SPHERICAL-COIL WATTMETER.

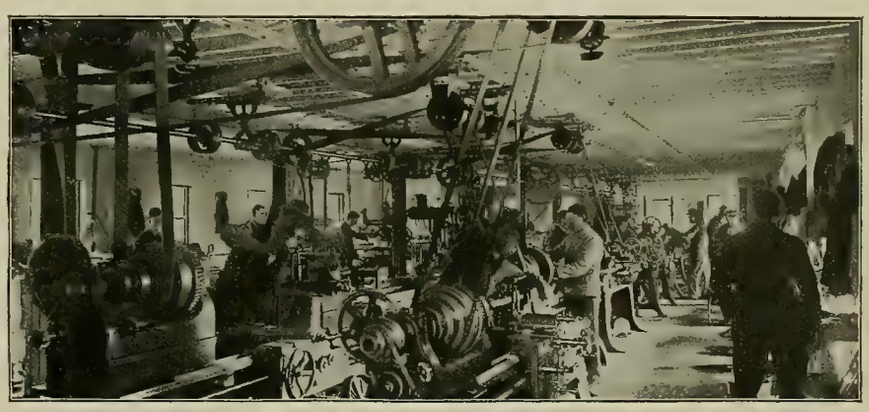
of the fixed coil is of a hollow spherical form, from which the instrument takes its name. The movable coil and pointer are delicately suspended in jeweled bearings, and their motions are dampened by an air dash-pot, making the instrument dead-beat. It is not affected by frequency or wave form, nor by inductive or leading loads of any power factor. It is equally available and efficient for direct-current work. With a resistance of approximately 30 ohms per volt in the pressure circuit, this wattmeter is said to be of remarkable efficiency.

Station instruments of 150 amperes or less capacity and for use on circuits of less than 5,500 volts have the resistance self-contained in their cases, and the total current is introduced into the fixed coil. With instruments of a greater capacity or for use on circuits of a higher voltage than this, series transformers are regularly provided. If, instead of the instrument taking the total current through its fixed coil, the series transformer is used, it must be calibrated on the frequency for which it is intended, as the introduction of a series transformer makes the instrument subject to frequency errors. A special adjustment is also made in the instrument for use with a series transformer, which compensates for any change in the phase relations, making the instrument correct on inductive loads. A feature of these instruments, worthy of special mention, is that they have practically the same case and base as the well-known type of S. K. C. hot-wire ammeters and voltmeters; that is, a rubber base-plate set in a brass rim, rubber cylinder for the sides, spun-brass cap and beveled plate-glass front. They are insulated for extremely high potentials and may be subjected to pressures as high as 10,000 volts between case and working parts without danger.

The Rowland multiplex system of telegraphy is being introduced into Germany.

New Shops of Sturtevant Company.

Thirty days after the fire in the engine and electrical departments of the B. F. Sturtevant company at Jamaica Plain, Mass., that enterprising concern had established new shops, with a complete equipment of new tools, as is shown by the accompanying illustration of one of these departments, taken on May 14th. The fire, which occurred on the morning of April 14th, was fortunately confined to the building in which it originated, and the fire wall about the power plant served to protect it and the remainder of the buildings. The only damage resulting to the engine room was that due to wetting of the belt by water in the wheel pit. Fortunately, the fire did not reach the patterns and left the entire shipping facilities, together with the blower, heater, forge and allied departments, including the foundry, entirely undamaged. The large fireproof vaults on



NEW SHOPS OF STURTEVANT COMPANY.

the three floors of the office building preserved intact all of the valuable drawings, correspondence, records, catalogue plates and cuts, so that by the next day business could be continued as usual, although in new quarters, which were immediately secured.

By a process of rearrangement, the company was able to establish new shops for the injured departments in other buildings. Immediately after the fire rush orders were placed for large quantities of new high-grade machine tools, and within a week these began to arrive. These machines were at once installed in their respective shops and belted to line shafting already in place and driven by local electric motors. This feature of power transmission by electricity greatly simplified the work of installation. Three new shops have thus been established, one for heavy machine work, another for lighter work of a similar character, and a third devoted to the uses of the electrical department. The offices have been repaired and are again occupied, and work is now progressing much as though no fire had occurred. In fact, the fire brought with it some advantages, in that it compelled the replacing of many tools and enabled this company to equip its plant throughout with only those of the very latest design.

Electric-lighting Rates in Denver.

One result of the competition in Denver, Colo., between the rival electric-lighting companies is the following open letter from the Denver Gas and Electric company. The letter was originally written to certain electrical contractors of Denver as a memorandum to cover data presented orally at an informal meeting "relative to encouraging the more liberal use of electric current for light and power." The letter, which is signed by Henry L. Doherty, acting president of the company, refers to the rate schedule of the company, which was printed in the Western Electrician of May 11th. It is headed "Electrical Secrets," and reads as follows:

The flat charge of $12 for each consumer is not included in these prices, and if your prospective customer is not already a consumer, this "consumer charge" must be added. The net amount of this charge after deducting the 50 per cent. and 10 per cent. discount would be $5.40 per year, or 45 cents per month.

At our open-rate schedule, a copy of which is enclosed, a motor horsepower, used 10 hours per day, for 365 days in the year, would cost $47.56, or less than $4 per month. I do not think there are more than half a dozen steam plants in town which can develop power for this amount or less, and it seems to me we should be able to get practically all the power business in Denver. Waterpower in this locality is sold for from $30 to $100 per horsepower-year, based on maximum demand, which would be equivalent to from $60 to $200 for the average Denver plant, if based on actual consumption, as the maximum load is generally at least double the average load.

This is certainly the cheapest steam power in the country, and is equivalent to a rate of 1¾ cents per kilowatt-hour, or 1.31 cents per horsepower-hour.

This rate should make the use of all kinds of heating appliances possible, and especially industrial appliances, such as soldering irons, electric welders and brazers, tailor and laundry irons, etc.

We should also be able to develop the lighting business enormously on these rates. There is scarcely a mercantile establishment in this city but can afford to light its stores and show windows lavishly.

Nothing adds more to the appearance of a town than well-lighted show windows. Under our present rates, additional store and window lights may be used six hours each night, and 365 nights in the year, at a cost of but $3.57 per year for each 16-candlepower light, or less than 30 cents per month. If these lamps are already included in our "readiness to serve" charge, the cost for each additional use of a 16-candlepower lamp for one hour each day, and 365 days in the year, would be but 46 cents per light per year, or less than 4 cents per month. These same figures will, of course, be true of residence lights also, and should result in the liberal use of all lights, and permit almost constant use of yard and porch lights.

At these rates, can you not induce merchants to equip their show windows generously with lamps and keep them lighted each night until the people have gone home after the theaters and from other places of amusement?

Sign lighting is another branch of the business in Denver which has yet remained undeveloped, owing to the existence of unattractive rates and severe limitations of the city ordinances forbidding any sign to encroach more than three feet over the sidewalk. I recognize the fact that unless this limitation is removed, we cannot hope to develop sign lighting materially, but I believe the city authorities will see that it is to the advantage of the city to encourage the use of electric signs, and will so modify the present ordinance that electric signs will be excepted. I still adhere to the statement that I made to the mayor, that with this limit removed, we can install enough electrical signs to add more to the appearance of the city than can be added by the expenditure of $1,000,000 on any other public improvement. The city authorities can add wonderfully to the attractiveness and brilliancy of our business streets by simply removing this obstacle from the use of electrical signs, and without an expenditure of a single cent of the city's funds.

An electrical sign is generally made up of four-candlepower lamps and from six to 12 are used for each letter. Under our present open schedule, a four-candlepower lamp, consuming 20 watts of current, and used six hours per night, and 365 nights per year, will cost but $1.25 per year, or a little more than 10 cents per lamp per month. Our present schedule for lamps used six hours per night figures out in the neighborhood of 2.8 cents per kilowatt-hour. This includes free lamp renewals, and, as far as I know, and to the best of my belief, is the lowest price for lighting service of any place in the world, not excepting those plants supplying current generated by waterpower.

Merchants can easily arrange to have sign and window lights cut off by the night watchman, and we would not object to sending a man out every night at 12 o'clock to turn off these lights, if it would encourage the use of more signs and window lights.

British Pacific Cable Project "Hung Up."

An unexpected deadlock has arisen between the government of New South Wales and the Dominion government over the proposed all-British Pacific cable scheme. The Australian colony has granted important concessions to the Eastern Extension Telegraph company, the competing line. To this Canada strenuously objects, claiming it to be a breach of good faith. The question was referred to the law officers of the crown in Canada, who reported that the action of New South Wales was clearly detrimental to the interests of the Dominion. The British law officers have also reported upon the subject, but in a directly opposite sense, thus causing friction between Britain and Canada as well. In view of the evident gravity of the situation, and the likelihood of a collapse of the whole cable scheme, Sir Wilfrid Laurier, upon the second reading of the cable bill shortly before the prorogation of Dominion Parliament, reviewed the condition of affairs in respect to the cable project and added a proviso to the cable bill that it shall not go into effect except upon an order-in-council. This means that, so far as Canada is concerned, the cable project is hung up for the present.

The Machinists' Strike.

The strike situation among the machinists throughout the country has, on the whole, improved during the last few days. Early in the week it was estimated that there were 24,000 machinists on strike, while 52,000 had returned to work, thus making the total number of machinists in the International Association of Machinists 76,000. In Chicago the manufacturing institutions have scarcely been affected by the strike. In Ohio electrical shops have been hindered to some extent. In Cincinnati about 33 machine shops were shut down, while at Dayton 400 men are out. Possibly the strike will affect the steam-railroad companies, which are threatened in several cities, while one or two roads are already troubled with striking machinists.

Naval Report on Wireless Telegraphy.

Admiral Bradford, chief of the naval bureau of equipment, has made public the following extract from the report of the board which has investigated the question of transmitting messages by wireless telegraphy:

"Referring to the last recommendation (that wireless telegraphy be adopted by the navy for transmission of messages between distant points), the board is of the opinion that a high degree of special electrical training is demanded for the successful operation of wireless telegraphy, and it therefore suggests as necessary the establishment of two stations, sufficiently far removed from each other, for the training of officers and men. In its opinion, this requirement would be best met by the establishment of such stations at the navy yard, Washington, and the Naval Academy, Annapolis. If wireless telegraphy fulfills what now seems to be its possibilities, the cadets should be thoroughly trained in it.

"As the investigation made by this board is not technical, there being no apparatus of any kind ready for test, but general in its character, such partial examinations, as outlined above, would not change the recommendations already made.

"The selection of any special system of wireless telegraphy is, in the opinion of the board, very largely a matter of business detail.

"If, for any reason, any competitive test of different systems be thought desirable, the board recommends, in view of the fact that the improved Marconi apparatus will not be available for several months and that improvement in any other system may occur in that interval, that it be made only after due notice and preparation therefor, and by a special board of experts appointed for the purpose."

Rate War in Montreal.

A war of rates is now imminent between the two big lighting companies of Montreal, the Lachine Rapids Hydraulic company and the Montreal Power company, the latter being the new "combine." The purpose of the Lachine company to invade the territory of the latter corporation, by going into the gas business, is regarded as a preliminary step in the direction of a bitter fight. Apart from the proposed installation of a gas plant, the officials of the Lachine company do not hesitate to say that they are now selling electricity cheaper than the "combine," and if the latter meets the price, it will be further reduced, until electricity is practically given away. It is not the intention of the Lachine company to sell illuminating gas, but only gas for fuel and heating purposes. The reason given for leaving illuminating gas out of consideration is the claim of the Lachine people that they can supply electricity for lighting cheaper than gas. For fuel and heating, however, gas cannot at present be beaten. It is claimed that not more than $1,000,000 will be required to establish such a gas plant as it is proposed to erect.

Rapid Transit in Germany.

Consul-general Guenther of Frankfort, Germany, writes in the United States consular reports as follows, concerning electric cars for rapid transit in Germany: "The association for the study of electric rapid-transit railroads has issued its report for 1900. Among other things, it is stated that the elevated track of the military road between Berlin and Zossen, upon which experiments will soon be made, has been carefully inspected and strengthened. It is hoped to attain a speed of 125 miles per hour. Two cars will be employed, which are supplied with the strong machines required, and will hold from 40 to 50 passengers. The construction of the cars and their equipment differ, in order to make manifold experiments. Each car will have four motors aggregating from 1,100 to 3,000 horsepower, two three-axle movable trucks, and the necessary transmuters, switching apparatus, etc. The cars will be 71½ feet long and will weigh about 90 tons. The effect of this speed on the elevated track will also be noted. The experiments will doubtless prove of the highest importance for the improvement of rapid transit, although it may be found that the speed contemplated will not be feasible."

Chicago Elevated-railway Consolidation.

Negotiations for the consolidation of several of the elevated roads in Chicago seem to be taking definite form. It is said that the Northwestern Elevated Railroad company will immediately take over the Union Elevated Railroad company on the basis of $125 a share for its stock, and the Metropolitan and South Side companies are expected to come into the consolidation some time in the future. The position of the Lake Street company at this time seems to be problematical. The men behind the consolidation are John J. Mitchell, Marshall Field and Blair & Co. of New York.

Work has been commenced on a new cable between England and Germany, which will be the seventeenth in existence between the two countries. The line runs from Emden to Barton.

Municipal Ownership versus Private Corporations.[1]

By Thomas D. Miller.

The subject of municipal ownership is one that has attracted more general attention throughout this country in the last few years than almost any other municipal policy that has engaged the profundity of the ward politicians, and it has also attracted the notice of some eminent political economists, both pro and con. It is not the purpose of this paper to attempt to settle this question, but to provoke a discussion of it, in the hope of arriving at a more settled conclusion as to the best remedy for the evil, for I am convinced that evil it is.

The spirit of our government is freedom and government by the people to be governed, and while I believe it to be the best form of government in the world, it has its thorn to accompany its rose. Corruption, the result of personal greed and political preferment, will meet its rebuke at the hands of the suffragists, but, unfortunately, it does not come until there have been ruinous losses to both public and private funds, and this constitutes the principal danger from the municipal-ownership delirium. City ownership and control of gas works in some European countries have been in the public eye for many years.

Because of success of municipal ownership in European cities and failure in this country it cannot certainly be traced to superior ability of the people over on the other side, or indifferent qualifications of those here, but to the selection of the men who have the work in hand, and this selection of such men is as different under our form of government—different from that of the European cities referred to.

The statement that there is not a city government in the country that is run on the same business principles and by the same business methods that successful enterprises of the same magnitude are conducted is made by parties who are well informed and competent to judge, and while there may be exceptions, they are only numerous to, proverbially, prove the rule. The reasons for this are obvious.

With indifferent success in the management of ordinary affairs of a city, how can it be expected that success will be assured in the management of an enterprise requiring special training and experience and which business is subject to a great variety of vicissitudes known only to the initiated.

M. J. Francisco, in an address before the League of American Municipalities, said: "The functions of a municipality are to govern and regulate. It is a well-established axiom that to govern and regulate successfully requires that one shall be wholly disinterested, while ownership implies the greatest self-interest." In municipal ownership, "therefore, we have two propositions that are directly antagonistic."

In the same address Judge Dillon is quoted: "The Legislature should be prohibited from allowing municipal corporations to engage in extra municipal projects, or to incur debts or to levy taxes for such purposes. Their chief function should be to regulate and govern. To invest them with powers of individuals or private corporations, for objects not pertaining to municipal rule, is to prevent the institution from its legitimate ends and to require of it duties it is not adapted satisfactorily to execute."

As a regulator of prices, competition has proved a failure, excepting for a few years in any one place, and invariably has resulted in disaster to the investments and higher prices to the consumers. The semi-public corporation has not only the ordinary exigencies of business to contend with, but an additional uncertainty to provide for in the possible attacks of municipal authorities, in various ways; the inviting of competition because of dissatisfaction with existing concern, attack of franchise privileges, excessive and burdensome taxes, and numerous other methods of annoyance, and whether successfully applied or not, are expensive to meet or combat, and all must come out of the earnings.

On February 27, 1901, L. N. Case, manager of the Water and Light Department of Duluth, Minn., read a paper on municipal ownership before the Economic Club of Duluth, which he opened thus: "Almost the first of my preparatory thoughts preceding the preparation of this paper was the perfect applicability to my condition of the expression, 'Out of the abundance of the heart the mouth speaketh,'" and he might have added, "Where man's treasure is, there will be his heart also," for in the same paragraph he says that he has been in the employ of municipal plants for 35 years. Verily, Brother Case is a great politician to have held on so well, or his municipal plant has had mighty little politics mixed up in it, and he has had the good fortune to have his abilities recognized and rewarded. In fact, in closing the paper, he says: "These results are but the results of municipal ownership, untrammeled by political influence and operated on business principles alone." And then, as a final compliment to himself and to the honor of the mayors and councils, he adds: "Not one single official act, or attempt at an act, has been done or made that was in any way calculated to interfere with the administration of the affairs of the department upon the above principles." Who would not be an advocate of municipal ownership under such circumstances? No private-corporation-ownership advocate ever said that municipal ownership would be a failure under such circumstances. The whole point emphasizes the argument always emphasized against municipal ownership, that such business administration of its affairs could not be obtained, and history proves the correctness of the statement.

Mr. Case further says: "I am free to admit that there have been failures in municipal ownership because of corruptness in politics, the spoils system, and the incompetency resulting therefrom;" and there is no logical argument against it, so he says. Then Glasgow is quoted as an example of successful ownership of public utilities, as well as a large number of tenement houses, but he bucks at the ownership of the houses, on the grounds that it is a violation of the correct principles of municipal ownership. When it is necessary to occupy the public property of a people in order to carry on a business, that business should be owned and operated by the people, and "the people, as such, should not engage in any business that requires only the occupation of private property and which can be maintained by private enterprise and private capital." Can one imagine a business involving the handling of a commodity which does not use the public property in its distribution? Carrying out this idea, the city would be justified in going into the supply of foodstuffs, for they are necessities, and the public property (streets) are used in their distribution, and so on, ad infinitum.

The streets are the property of the people, for their use, and such use as they choose to make of them, so long as individual or public rights and privileges are not infringed. The humblest citizen has the same right to walk the streets undisturbed as the nabob to drive his tally-ho, and yet the one who makes elaborate use of the streets is not called upon to pay for a special privilege, nor is the one who uses them the least of all relieved of any part of a special tax because of his failure to use them. The mains of gas companies, electric-light companies and the lines of street-car companies are for the public use and such use as each individual citizen chooses to make of them, so long as he does not infringe on individual or public rights, just the same as the streets are at his service.

It would be superfluous to argue further on this part, for I take it that you all agree with me that it is bad policy for municipalities to own and operate lighting plants. I also take it for granted that you all clearly see that this subject is in the saddle in almost every community large enough to warrant the installation of a lighting plant, and that the issue has to be met in one way or another.

It is obviously unjust to tax all the people for the maintenance of public utilities, such as gas or electric plants for supplying private uses, when only a fraction of all the people use these commodities, and it is just as obviously unfair to tax these users of such utilities for the benefit of all. The franchise tax or bonus is just such a tax on the consumers, and the municipal plant operating on a basis of revenue equal to expenses is the other form of tax on the non-consumer, for they are deprived of the benefit of the taxes that would have been paid by a private corporation doing the same business. How much more apparent then when there is a tax levied to pay sinking fund, and even interest on bonds issued to pay for the plant.

The special power granted to several cities of the state of Texas to regulate prices of gas and electric current places the authorities in the attitude of an arbitrator who is especially interested in the results of the arbitration. If he is avowed in the interest of the dear people to the hurt of the corporation, he is actuated by prejudice or political motives; if another be striving for an equitable adjustment, his opponent will attempt to whip him into his line with the charge of being a henchman of the corporation and opposed to the interest of the people. While it is possible to get just adjustment of rates under such conditions, it is not possible to know that you have any security from readjustment with each new administration.

Where the demand for municipal ownership fails to carry before the people, the city gets from the Legislature the power to regulate service and prices. At the last session of the Texas Legislature a bill was introduced to give all cities and towns the right to regulate the price of all commodities in the distribution of which the public streets were used, and while the bill failed to pass the committee on cities and towns, it shows the tendency of some of our officials.

[1] Read before the Southwestern Gas, Electric and Street Railway association at Houston, Texas, on April 19, 1901.

Railway Extensions in New York State.

Another electric railroad has been secured by the Powers-Colvin syndicate of New York state. On May 10th the syndicate purchased more than two-thirds of the capital stock of the Glens Falls, Sandy Hill and Fort Edward Electric Street Railroad company. This company controls nearly 20 miles of railroad and is capitalized for $150,000. By securing this road the Powers-Colvin syndicate has secured an important link in its system connecting Lake George and Caldwell with Albany and Troy. The syndicate controls or has in process of construction lines connecting Warrensburg, Lake George, Glens Falls, Fort Edward, Greenwich, Schuylerville, Stillwater, Mechanicsville and Waterford, a total length of 65 miles. It also owns the Saratoga Traction company's lines, which operate between Saratoga and Ballston. These lines will be connected to the main line.

CORRESPONDENCE.

New York Notes.

New York, May 25.—The agreement of consolidation of the New York Gas and Electric Light, Heat and Power company with the Edison Electric Illuminating company of New York has been filed with the secretary of state. The title of the new corporation is the New York Edison company, and it has a capital stock of $45,200,000, which is the aggregate of the capital stock of the two companies. The directors are Anthony N. Brady, Harrison E. Gawtry, Stephen S. Palmer, Thomas E. Murray, Samuel A. Beardsley, Nicholas F. Brady and Lewis B. Gawtry.

The cable-car service on Broadway, between Fifty-ninth street and the Battery, will be discontinued to-night at nine o'clock, in order to complete the installation of the electric service. There is a great amount of work to be done in removing the cable and the small wheels upon which the cable is supported. After that is done there will be about 200 electrical connections to be made, 8,000 plugs to be removed and about 40,000 bolts to be set before the current is turned on. None of this work can be done, however, until the cable, which is 56,000 feet long and weighs 3½ pounds to the foot, is removed. It is expected that electric cars will be running on Broadway early Monday morning.

Both branches of the Municipal Assembly have approved the plans of the Rapid Transit Commission for the tunnel to Brooklyn, and all that is necessary now for the beginning of the work is the appropriation of the $8,000,000 by the city and the letting of the contracts. Mayor Van Wyck will act upon the assembly's resolution on Monday, and his approval is expected. The Brooklyn tunnel extension will be built from the City Hall loop to Manhattan to the junction of Flatbush and Atlantic avenues in Brooklyn. At this point the underground-railroad system of the Long Island railroad will begin, and by depressing the tracks on Atlantic avenue, through to East New York, and by elevated structures to Jamaica, a direct line from New York City Hall to Jamaica will be established. The officials of the Atlantic avenue commission say that the running time between the New York City Hall and Jamaica will be about 18 minutes.

The annual commencement of the Hebrew Technical Institute was held on Wednesday, May 22d, at the hall of Cooper Union. There were 40 graduates in the class of 1901. Among the papers given were "Technical Education," "The Electrical Equipment of the Manhattan Elevated Railway," and "Electrical Power Distribution." Several electric motors and dynamos, made by members of the electrical class, were shown, and an exhibition of wireless telegraphy was given. Addresses by Professor Loeb, Principal Edgar S. Barney and Leo N. Levi were included in the evening's exercises.

At the annual meeting of the American Institute of Electrical Engineers, held at its rooms last Tuesday evening, Dr. Schuyler S. Wheeler presented to the Institute the fine library of electrical works of the late Latimer Clark, an eminent British telegraph engineer. Dr. Wheeler recently purchased the collection from the Clark estate. The catalogue contains nearly 7,000 entries.

Work upon the rapid-transit tunnel has been stopped by a strike. Three or four hundred skilled mechanics on strike have caused a thousand or more men, not skilled, but ordinary laborers, to be kept from their daily work along the subway. It is expected that, in all, about 5,000 men employed on the subway will be affected by the strike. The strike arose out of a demand of the rock drillers for $2.75 for an eight-hour day and 70 cents an hour for overtime. The trades involved in the strike include the rock drillers and tool sharpeners, the eccentric engineers, the safety engineers, the double-drum hoisters and the pipe calkers. M. L. G.

New England News.

Boston, May 25.—On Tuesday last, when the House of Representatives considered the bill allowing the Boston Electric Light company to sell its franchise to the Edison Electric Illuminating company of Boston, it rejected an amendment providing that the latter company's dividends should not be over eight per cent. of the capital actually paid in, and rejected also an amendment providing that the Edison company should not pay its employes lower wages than are paid by other companies or compel its employes to work more than eight hours in every 24. The House passed the measure, and it was sent to the Senate.

The Ayer Electric Light company of Ayer, Mass., has filed a certificate of incorporation at the office of the secretary of state. It has a capital of $20,000. Henry Krey is president and Arthur H. Krey is treasurer.

When the committee on manufactures reported to the House of Representatives, giving Representative McNary leave to withdraw his petition for legislation regulating the sale of electricity, the House—on motion of Mr. McNary—substituted a bill providing that the sale of electricity shall be by meter, the unit being the watt, and that all meters shall be sealed and stamped by the inspector of gas meters or his assistants; that no meter shall be used that may confuse or deceive the consumer; that no rent shall be charged for the meter when the consumer uses electric current to the value of $7 per year, and that no charge shall be made when electricity is not actually furnished. The bill was read and referred to the committee on ways and means.

The stockholders of the Hartford Electric Light company have ratified the directors' recommendation to increase the capital stock from $1,050,000 to $1,400,000. It was voted to issue 3,500 new shares, allotting the stockholders one share for each three held on June 1st.

R. H. Bradford, the organizer of the Boston Linemen's union, went to Manchester, N. H., recently to organize a union. The Manchester linemen agreed to strike.

The striking housesmiths, who were employed on the new State street elevated station in Boston, have declared the strike at an end.

In reply to the House of Representatives' inquiry regarding the bill providing that electric-light companies shall not consolidate without the approval of the gas and electric-light commissioners, and the bill providing for the sale of the Boston Electric Light company's plant to the Edison Electric Illuminating company of Boston, the attorney-general of the commonwealth says that there are no inconsistencies between the two bills, as the Legislature may enact a general statute applying to any class of corporations, and, before or afterward, it may enact a special law applicable to certain of such corporations. The attorney-general further says that he knows of no statute prohibiting such combinations of electric-light companies as are intended to be regulated by the first-mentioned bill, but whether such combination would be void at common law, as against public policy, is a question which can only be determined upon the facts of each particular case; that electric-light companies may make combinations not forbidden by statute or by the policy of common law, whether or not the consolidation bill is enacted, and that the prohibitive bill would be a permissive, and not a restrictive, law.

The Legislature has passed the bill incorporating the Mount Wachusett Street Railway company.

The Westinghouse Electric and Manufacturing company has been awarded the contract for the electrical appliances for the new power house to be built at the Charlestown navy yard. The company's bid was for $59,000, for which it will install three Westinghouse dynamos of 250 kilowatts' capacity, and space for two more will be reserved. The dynamos have been inspected by Assistant Naval Constructor-William P. Robert and Master Electrician Charles S. Davis, who reported favorably. They will not be delivered until the building is ready for them. A big conduit, containing electric wires and pneumatic and hydraulic pipes, has been laid from the new building to the dry docks, water front, and some of the old shops. Master Electrician Davis will have charge of the station when it is completed.

At Worcester, Mass., the Consolidated Street Railway company is about to increase its capital stock from $2,179,999 to $2,750,000 or $3,000,000. There is a floating indebtedness of several hundred thousand dollars, which the principal stockholders wish to meet by the proceeds of a new issue of stock. The company will also need money for contemplated improvements to the plant.

The gas and electric-light commissioners have approved a measure providing for the inspection of electric-light meters by any disinterested party, designated by the commission, upon the complaint of a consumer. The bill also provides that if the inspected meter varies more than five per cent., the commissioners may remove it and have another substituted, the company to pay for the inspection. If the meter is correct, the complaining consumer must foot the bill. The measure does not apply to the sale of electricity for power.

A controlling interest in the Enfield and Longmeadow Street Railway company has passed into the hands of Gaston, Snow & Saltonstall, the Boston lawyers. The company operates 8.36 miles of railway between the Massachusetts state line and Warehouse Point, Conn., and it pays a dividend of five per cent. During the present session of the Connecticut Legislature, the company obtained an amendment to its charter by which it acquired the right to extend its lines south from Warehouse Point to the terminus of the Hartford Street Railway company's tracks at East Windsor Hill, making a continuous trolley line from Hartford, Conn., to Springfield, Mass. The company's officers are: President, F. M. Saltonstall of Boston; vice-president, T. C. Perkins of Hartford; treasurer, Lyman A. Upson of Thompsonville, Conn.

The Blackstone and Uxbridge Street Railway company has petitioned the Northbridge (Mass.) selectmen for the right to lay tracks and string wires through Linwood. The proposed line would extend from Millville, through Uxbridge to Linwood where it will connect with the Linwood street railway, which, in turn, connects with the Blackstone Valley road at Whitinsville. If the line is built through Linwood, there will be a continuous electric-railway line from Warren to Worcester, Mass., to Providence, R. I., to Boston, and back to Worcester. The Northbridge selectmen will hold a hearing on the petition soon.

A trial train of three coaches has made a continuous trip on the Boston elevated road from Sullivan Square to the subway, through the latter to Pleasant street, and thence via the elevated to Dudley street. The first train was run by Superintendent S. S. Neff as motorman and J. H. Hiscox as guard. Among those aboard were George H. Benjamin, supervisor of motormen; Harold G. Brown, inspector of signals; John A. Riley, air-brake inspector; J. M. Prendergast, a director of the Boston Elevated Railway company; about 25 signalmen, in charge of J. W. Drew, and half a dozen newspaper men. B.

From the Buckeye State.

Columbus, Ohio, May 25.—On reliable authority it is stated that the Northern Ohio Traction company has in contemplation an extension of its lines to Wheeling, W. Va. The proposed line to Massillon and Canton is the beginning of the plan. From Massillon to Navarre a road is now being built which will be used by the company. From Navarre to Strasburg the company will have to construct its own line, but from the latter place to New Philadelphia there is a road now in operation. From New Philadelphia to St. Clairsville a long stretch of road will have to be built, but the country is good, and so far there is little competition, so there will be no danger of putting money in that territory. There is now a line in process of construction from St. Clairsville to Wheeling. E. W Moore is a director of the company operating the Wheeling system, so there will be no trouble in making traffic arrangements with that road. Will Christy says this may be done later on, but that at present only the work already mapped out will be undertaken.

It is said that the Everett-Moore syndicate has in contemplation a plan that will revolutionize the rapid-transit business of Cleveland, and that is nothing less than an underground road from the Public Square to Rocky River, on the west side of the city, where thousands of people live in the suburbs. The plan contemplates the operation of express trains over the eight miles' distance at the rate of 60 miles per hour, with stops as frequently as will make it convenient for the patrons.

The Hamilton, Oxford and Western Electric Railway company of Hamilton has been incorporated, with a capital stock of $10,000, for the purpose of building lines from Hamilton to Oxford and College Corner and probably on into the state of Indiana. The Cincinnati and Venice Electric Railway company of Hamilton has also been incorporated, with the same capital stock, for the purpose of building a line from Cincinnati to Bevis, Groebeck, Venice and other Hamilton County points. The incorporators of both companies are Will Christy, Akron; M. J. Mendelbaum, Cleveland; F. J. J. Sloat, Hamilton; O. V. Parrish and Peter Schwab, Hamilton. These gentlemen form practically the Southern Ohio Traction company. The Oxford route will likely be out of Hamilton on the Southern Ohio tracks, in order to escape securing additional terminals, and it is quite possible that a loop will be built at Oxford to give a local service, which is needed in that place.

The Columbus Southern Electric Railway company has announced that its interests and franchises have been purchased by the Scioto Valley Traction company. The Columbus Southern had a franchise in Ross County, which will go to the Scioto Valley road, as it has planned to build a line from Columbus to Chillicothe.

Champaign county commissioners have granted the Columbus, London and Springfield Railway company a franchise to build a line from Mechanicsburg, to connect with the main line at Summerford, in Madison County. The village of Mechanicsburg has also granted a franchise for the use of the streets. L. D. Fisher, son of General Manager H. A. Fisher, has had charge of the work of getting rights and franchises for this branch.

The assertion has been made that the entire right-of-way and all needed franchises have been secured for the Lake Shore electric line from Cleveland to Detroit. It is also reported that the road will now be completed as rapidly as possible. Henry Everett says that about 40 miles of road between Toledo and Cleveland will have to be built to connect the properties now under the control of the company. Work is progressing nicely on the Toledo and Western line, which is being built up to meet the Michigan roads under construction by the new company. It is said the line between Toledo and Detroit will be in operation some time in August and that the entire road will be completed within the year.

The State Board of Public Works has leased the right-of-way along the west and south banks of the Licking reservoir, in Licking County, to the Columbus, Buckeye Lake and Newark Traction company, on a valuation of $18,891, on condition that the road be built standard gauge and that any other road may be allowed to use the tracks at a rate to be fixed by arbitration, if the companies cannot agree upon the matter themselves. The Lancaster and Newark Traction company will likely use the tracks with the other road, as arrangements are now under way to that effect.

The new barns and power house of the Millcreek Valley road at Hartwell have been finished and the road will now put into effect a six-minute schedule from the city proper to the suburbs. General Manager Wagenhals says that the line will be completed to the courthouse in Hamilton by July 4th.

The Camden Interstate Railway company has secured the contract for the lighting of Ashland,

Ky., at the rate of $75 per arc light, to continue for three years.

Henry A. Everett and E. W. Moore of Cleveland are now making an inspection of all the property that has lately come into their hands. They are going over the Michigan lines this week, and will look up some other property which is said to be on the market, especially all that which is tributary to Detroit. In the meantime, they will complete all the deals which have not already been terminated. They expect to inspect the London (Ont.) system and then go to Toronto and Montreal, after which they will visit New York.

A meeting of the managers of the plants controlled by Emerson McMillin of New York was held at the Chittenden Hotel, Columbus, Monday, about 40 persons being present, representing both gas and electric-light interests. The meetings are held semi-annually, and are for the purpose of discussing matters relating to the business and devising means for the more economical operation of the plants. E. G. Coudrey of Milwaukee presided and Arthur Doty of Detroit acted as secretary.

The Springfield end of the Urbana branch of the Dayton, Springfield and Urbana road has been completed, and the cars now run into the city.

The power house of the Tiffin and Southwestern road will be located in Kenton, according to information which Samuel R. Bullock of New York is said to have given out a few days ago.

The Northern Ohio Traction company is building an addition 40 by 50 feet in size, to its light plant at Akron. A new dynamo of 1,000 kilowatts will be installed, in order to render the capacity equal to the demand during portions of the year.

Allen F. Edwards, manager of the Toledo and Monroe electric line, has arranged to shorten the time between the two places 15 minutes. From the Toledo limits to Monroe, a distance of 18 miles, the time will be 35 minutes. The time from the courthouse in Toledo will be one hour, the rate of speed being necessarily slow within the city limits. The extension to Monroe Piers will be completed in July. A casino will be built on this extension.

The Toledo and Bryan Air Line Railway company has been organized, by the election of the following-named directors: Milton Taylor, Joseph C. Bonner, R. G. Kerlin, F. V. H. Collins, B. Hebert, W. C. Brewer, J. L. Yost, Charles J. McLaughlin and Fred J. Bollmeyer. The directors chose the following-named officers: President, Milton Taylor; first vice-president, Joseph C. Bonner; second vice-president, R. G. Kerlin; secretary, F. V. H. Collins; treasurer, J. Q. Adams; general manager, William C. Brewer.

The Electric Depot company of Cleveland has been incorporated, with a capital stock of $200,000, for the purpose of building a union depot for the suburban roads in Cleveland. H. A. Everett and other prominent electric-railway men are the incorporators. The new depot will be situated at Eric and Boliver streets, and work will be commenced on it at once.

The Findlay, Columbus Grove and Fort Wayne Railway company of Findlay will soon be incorporated, with a capital stock of $50,000. So far, only local men are interested in the new company.

The Columbus, Delaware and Marion Railway company has asked for a franchise through Franklin County, north of the present terminus of the Worthington road, to Delaware County.

The Columbus and Southern Electric Railway company, which was promoted by J. M. Wilson, now president of the company, has given up the line between Columbus and Chillicothe, and the field is now clear for the Scioto Valley Traction company, which proposes to build between these points. There has been a contest between the two companies, and Ross County now holds a certified check for $3,000, which was given by Mr. Wilson when the franchise was granted him, that it now refuses to surrender. The Scioto Valley Traction company expects to complete its lines to Chillicothe and Lancaster within a year.

The Northern Ohio Traction company will build a branch line to Hudson, which is about 30 miles from Cleveland. O. M. C.

Information from Indiana.

Indianapolis, May 27.—Electric line work of various kinds has been somewhat retarded by a strike among the linemen. The men, who are members of the Electrical Workers' Union, have been receiving $2.25 a day, without extra pay for overtime and with little or no regularity of hours. They are asking for a straight wage of $2.50 for a nine-hour day with time and one-half for overtime, except in emergencies expressly stipulated in the contract. The linemen employed by the Indianapolis Street Railway company and the Indianapolis Light and Power company are involved, while those employed by the Central Union and Independent telephone companies will take action in a day or two. There are about 200 linemen in the city, and should all become involved in the strike it will cause much trouble for the companies interested.

The New Albany street-railway system was sold on the 23d, under a decree of the Federal Court, to Richard L. Veach of Louisville, for $56,100. Louis Schneck of Seymour, president of the New Albany, Jeffersonville and Sellersburg Rapid Transit company, was also a bidder. The system has been in the hands of a receiver for three years.

The Big Four railroad has announced that it will inaugurate a rate war against the Union Traction company wherever brought in competition on June 1st. The fare will be reduced 50 per cent., and tickets issued good for one person on a round trip or two persons one way, good for three months. Hourly trains will be put on, and the liveliest competition is expected.

The Pennsylvania Railroad company has withdrawn all opposition to electric lines crossing its right-of-way, and the Greenfield company will now complete its line to Matthew's Park. The patrons of the latter line have been compelled to walk nearly a mile to reach the park pending the dispute. The suit has been dismissed.

A receiver has been asked for the Citizens' Street Railway company of Vincennes. Mary A. Byers secured a judgment against the company for damages. The principal stockholder of the company is B. G. Hendnot of Terre Haute. The move is to enforce payment of the judgment.

The specifications for the new public lighting contract for Indianapolis are being sent out to applicants. Bids will be received after June 1st. F.

Northwestern Notations.

Minneapolis, Minn., May 25.—The Logan Electric Light company of Logan, Iowa, contemplates moving its plant to Dunlap, Iowa.

The Seattle-Tacoma Interurban Railway company has filed a mortgage to the Old Colony Trust company of Boston for $2,000,000. The company will now proceed with the construction of the line between Seattle and Tacoma, Wash.

A power and heat plant has been installed at Sioux City, Iowa, for the operation of light, heat and power for the Garretson and Mondamin hotels. It is expected to save $5,000 a year.

The city of Oshkosh, Wis., has contracted with the Electric Light and Power company for 1,200-candle lighting at $48.90 per light per annum.

The Public Service company of St. Cloud, Minn., has begun setting poles and stringing wires toward Sauk Rapids, Minn., and will soon be in a position to furnish lighting for that city.

The Suburban Railway and Traction company of Omaha seeks a franchise for the construction of a power canal from the Platte River, near North Bend, Neb., to Omaha. It proposes an electric line from Omaha to Fremont also.

The City Railway company of Des Moines, Iowa, has filed a mortgage for $3,000,000 to the Illinois Trust and Savings Bank of Chicago. Of this amount $2,000,000 goes to refund an old issue, and the remainder will be used for extensions and improvements.

W. B. Swaney and Mr. Ohrt have bought the electric-light and heating plant at Manning, Iowa, of A. Dethlefs, and will erect a new power house and put in new machinery.

It has developed that the survey from Cedar Rapids, Iowa, to Washington, Iowa, is for an electric road, and not a steam line, as was supposed. Several Cedar Rapids capitalists, as well as eastern capitalists, are interested. The line will connect with Iowa City.

The Madison Canyon Electric Power company is pushing work vigorously at its new waterpower plant in Madison Gulch, near Virginia City, Mont. The company expects to have the plant ready for operation by October 1st, with 12,000 horsepower, and to increase it within a year to 40,000 horsepower. There will be a market for the power with the mining companies and for lighting Virginia City, Laurin, Sheridan and Twin Bridges.

Hon. John Porter of Eldora, Iowa, who is interested in the projected electric railway from Des Moines to Eldora, says that the line will be completed and in operation between Des Moines and Nevada, Iowa, inside of six months.

The Sac City Electric company of Sac City, Iowa, contemplates installing a system of hot water for heating and to furnish power for electric motors.

Surveys have been completed for the waterpower and electric-light plant of the Athena Light and Power company of Athena, Ore. It is expected to develop the power and transport the water by means of a barrel flume, to supply electricity for Milton and Athena, Ore., and Walla Walla, Wash.

The Electric Street Railway company of Everett, Wash., has started work on what is said to be one of the finest power stations on the Pacific coast in point of completeness. The new building will require an outlay of $200,000, and will place the street-railway and electric-lighting systems in first-class shape, with capacity for a much larger city than Everett. The power house will be 106 by 138 feet in size.

John R. Price & Co. are interested in the construction of an electric railway from Spokane, Wash., to their new summer resort on the Little Spokane River, 12 miles away. They expect to have the system completed by October. R.

PERSONAL.

F. S. Hunting, sales manager of the Fort Wayne Electric Works, was in Chicago last week in the interests of his company.

E. C. Hathaway of Lexington, Ky., has been appointed general manager of the United Railways and Light Company of America.

Thomas A. Edison is said to have received on May 6th a letter containing a threat to kidnap his daughter, Madeline, 12 years old, if a sum of money were not left in a certain place. The police were immediately informed and the letter turned over to them. Mr. Edison is said to make light of the matter, but adequate protective measures have been taken, nevertheless.

At the last session of last week's convention of the National Electric Light association in Niagara Falls, Secretary Porter received the following dispatch from Henry L. Doherty of Denver, the newly elected president of the association: "Please convey to the association my deep appreciation of the honor conferred upon me and assure them of my wish to make the association large and prosperous."

George F. Porter of the Kerite company passed through Chicago last week on his way to Seattle, Wash., from the electric-light convention at Niagara Falls. Mr. Porter is preparing to lay a 125-mile submarine telegraph cable from Juneau to Skagway, Alaska, for the United States government. He will charter a boat at Seattle for the work and expects to be back in the East within two months.

ELECTRIC LIGHTING.

The Royal Electric company's contract for lighting the streets of Montreal expires in December, 1903, and tenders are now being called for on a new contract. Specifications are now out, and bids are to be in by June 15th next. Bidders must accompany their bids by an accepted check for $50,000.

ELECTRIC RAILWAYS.

The Golden Bridge Electric Railway company has been incorporated at Albany, N. Y., and will construct an electric road between North Salem, N. Y., and Ridgefield, Conn.

Promoters are interested in the construction of an electric line between Pontiac, Flint and Saginaw, Mich. The name of the corporation will be the Pontiac and Saginaw Railway company.

The Dayton (Ohio) and Germantown Traction company has secured, with one or two exceptions, a private right-of-way for its electric railway, from the Dayton Soldiers' Home to Middletown, Ohio.

The City Council of Kaukauna, Wis., has granted a franchise to the Wisconsin Light, Heat and Traction company, to build an electric railway into that city and also to build a power plant at South Kaukauna.

The board of directors of the Louisville (Ky.), Mount Washington and Fairfield electric railway has decided to begin work on the road within the next month. Lexington (Ky.) capitalists will finance the enterprise.

The Williamsport and Lock Haven Traction Railway company of Williamsport, Pa., has received a charter to construct a line from Lock Haven to Jersey Shore. The company is capitalized at $150,000, and H. Cochran is president.

The Monessen, Webster, Belle Vernon and Fayette Street Railway company has been organized at Monessen, Pa., with $60,000 capital stock. An electric road will be built along the Monongahela River for 10 miles from Webster to Fayette City.

An electric railway has recently been opened in Russian Poland. The road is 21 kilometers in length and is owned by a company consisting of Polish manufacturers and merchants. It has cost about $400,000. This line is said to be the first electric railway established in Russia.

An ordinance has been passed by the City Council of Ottumwa, Iowa, granting to the Ottumwa Electric and Steam company a 25-year extension of franchise to operate an electric street railway for the transportation of passengers and freight. R. H. Holbrook is manager of the company.

M. J. Mendelbaum, representing the Southern Ohio Traction company, has purchased the Hamilton and Lindenwald Electric Transit company's lines in Hamilton, Ohio, the purchase price being $225,000. The Southern Ohio company will operate the system, and it is said that the latter will be re-equipped and extended to some other points at a cost of $100,000.

A company has been organized at Chester, Pa., under the name of the Oxford, Cochranville and Parkersburg Electric Railway company. Thomas O'Connell is president. The company will apply for a charter at once and will erect an electric street railway connecting Oxford and Parkersburg and touching Cochranville. The line will be 14 miles long.

The Carthage Electric Light and Power company has been incorporated at Carthage, N. Y., with a capital stock of $75,000. It is the purpose of the company to manufacture and supply electricity for the producing of light, heat and power in the towns of Creghan and Denmark and the villages of Copenhagen, Carthage, etc. The directors of the company are J. E. Strickland, P. J. Corcoran, T. M. Basselin and others.

A franchise has been granted by the county commissioners at Zanesville, Ohio, to the Newark, Zanesville and Coshocton Traction company for connecting the three cities named with Hanover, Frazeysburg, Nashport, Irville, Dresden, Trinway, Adam's Mills, Franklin and Roscoe. A franchise was also

granted Attorney G. K. Browning, representing eastern capitalists, for a line from Zanesville to Hebron, along the national road.

Franchises have been secured in the city of Montpelier, Ind., and considerable right-of-way has been obtained between Montpelier and Marion for a proposed electric railway to run from Montpelier to Marion, a distance of 22 miles. A branch is to be built from a point about five miles west of Montpelier, to run due south into Hartford City. There will be in all about 30 miles built. Kerlin Bros. of Toledo, Ohio, are interested.

At the meeting of the Chicago City Council on May 27th an ordinance granting a 50-year franchise to the Wisconsin Inland Lakes and Chicago Railway company was introduced. A similar ordinance was killed by the council three years ago. The company asks a franchise to run an electric or elevated railway, starting in Lake street, between Clark and Lasalle streets, then running north to Huron street and following a zigzag line northwest through to the limits of the Twenty-seventh ward. It is proposed to continue the line to the Wisconsin lakes. It is said that much of the line outside the state has been constructed. The ordinance was referred to a committee.

PUBLICATIONS.

The Electric Appliance company, Chicago, has just published a booklet cataloguing its new hotel telephone, intercommunicating-telephone and annunciator systems.

The Peru Electric Manufacturing company of Peru, Ind., has just issued a new and novel booklet, entitled "Peru Mains and Branches and the Reason for Their Existence."

A description and several illustrations of different types of the Jandus enclosed-arc lamp are presented in an attractive booklet issued by the Jandus Electric company of Cleveland, Ohio.

A circular on Stombaugh guy anchors, issued by W. N. Matthews & Bros. of St. Louis, calls attention to the fact that "they have been boring in Texas and elsewhere." A price-list of the anchors is given in the circular.

The Willard storage battery is the product of Sipe & Sigler of Cleveland, Ohio, which is described in a recently published catalogue. Several photographic reproductions show installations of the Willard batteries for various uses. The catalogue also contains some interesting matter descriptive of the battery and the uses of storage batteries, and also price-lists and testimonial letters. The publication has been neatly prepared and sets off the advantages of the Willard batteries in excellent manner.

POWER TRANSMISSION.

The Niobrara Irrigation and Waterpower company, with a capital of $60,000, has been organized at Niobrara, Neb. The officers are: President, B. Y. High; vice-president, G. G. Bayha; treasurer, G. W. Chambers; secretary, E. A. Fry. The company will develop the waterpower of the Niobrara River, which, in a distance of five miles, has a fall of 52½ feet.

A company is being organized to develop the waterpower on the Yadkin River, near Charlotte, N. C. It is said that the Fidelity Deposit company of Newark, N. J., will finance the enterprise. A dam and power plant will be erected at a cost of $800,000, and it is expected that 10,000 horsepower will be obtained for manufacturing plants in Charlotte and other cities.

A report has been presented by Professor S. Arrhenius, who was engaged last autumn by the Swedish government to visit the continent of Europe, with a view of studying the various waterpower schemes. He points out the fact that population is densest where coal is found, as in Belgium, France and Germany. He estimates the total waterpower available in France, Italy and Switzerland at between 3,000,000 horsepower and 5,000,000 horsepower, that in Finland at 2,500,000 horsepower, exclusive of falls of under three meters. Similar force in Sweden is estimated at 4,000,000 horsepower. The waterpower installation worked at the lowest cost of any visited by Professor Arrhenius was that at Savoy, in the French Alps, where the cost is placed at 100 francs ($20) per horsepower at the source of power. At some of the stations this cost rises to from 1,000 francs ($200) to 1,200 francs ($240) per horsepower.

SOCIETIES AND SCHOOLS.

Arthur V. Abbott, chief engineer of the Chicago Telephone company, gave a lecture on wireless telegraphy before the students of Armour Institute of Technology, Chicago, on May 22d.

The Roentgen Society of the United States will hold its second regular meeting in Buffalo, N. Y., at the University of Buffalo on September 10th and 11th. A large attendance is expected on account of the Pan-American Exposition, and the excursion rates. Applications for space for exhibits should be sent to R. C. Adams, secretary, Drawer No. 963, Buffalo, N. Y. Dr. Heber Robarts, 301 Chemical building, St. Louis, Mo., is president of the society, and Dr. J. Rudis-Jicinsky, Cedar Rapids, Iowa, is secretary.

SPACE TELEGRAPHY.

The Cunard and White Star companies are hastening the equipment of their steamers with the Marconi system of wireless telegraphy. The Lucania of the Cunard line, which will sail from Liverpool on June 15th, will be fitted with the Marconi system and will signal messages on both sides of the Atlantic.

A report of a successful test of a new wireless-telegraph system comes from England. The system used was one invented by Colonel Henry M. Hozier and Nevil Maskelyne. The sending apparatus was placed upon a steamer outward bound and the receiving station was at Browhead. Signals were exchanged until the steamer was 25 miles from Browhead.

The New York Herald has made arrangements to institute wireless-telegraphy connections with incoming ocean liners. The Marconi system will be installed aboard the Nantucket shoal lightship and on the nearest point of land, Sankay Head, on the island of Nantucket. A contract has been made with the Marconi Wireless Telegraph company of London, and special machines are now being manufactured for the service. The communications received at the Sankay Head station will be telephoned to the Nantucket station, and sent from thence by telegraph. It is expected the system will be working by July 1st.

MISCELLANEOUS.

Sealed proposals for the installation of an electric-conduit and wiring system for the postoffice at Monmouth, Ill., will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 2 p. m., June 20th. Drawings and specifications may be obtained by addressing James Knox Taylor, supervising architect.

City Electrician Shurig of Omaha, Neb., is preparing a "pole" map of that city. There are about 8,600 poles to be located. These are owned by different companies, as follows: Nebraska Telephone company, 2,600; Thomson-Houston Electric Light company, 2,400; Omaha Street Railway company, 2,400; Western Union Telegraph company, 800, and Postal Telegraph company, 400.

TRADE NEWS.

The general offices of the Continuous Rail Joint Company of America have been moved from the Lawyers building to the sixth floor of the Century building, 142 Market street, Newark, N. J.

It is reported that steps are being taken looking toward the reorganization of the United States Carbon company of Cleveland, which was involved in the recent failure of the Cuyahoga Savings and Banking company.

On May 22d the General Incandescent Arc Light company of New York city, manufacturer of arc lamps, switches, switchboards, motors, etc., arranged with its employes to run its factory 54 hours a week and pay the same wages as were paid when the factory was running on a 60-hour basis.

The Anchor Electric company of Youngstown, Ohio, has been incorporated, with a capital stock of $35,000, to manufacture arc and incandescent lamps and other electrical supplies. N. L. Norris, R. T. Hamilton, C. N. Crandall, H. W. Davis, Thomas Carr and Fred Keast are the incorporators.

W. F. Warner of Muncie, Ind., the inventor and patentee of the Warner pole changer for ringing telephones, has perfected an electrical piano-playing attachment, which is constructed on different lines from anything of its kind on the market. Mr. Warner has organized a company for its manufacture, which will commence operations about July 1st. The factory will be located in Muncie, Ind.

The Sawyer-Man Electric company announces that it has recently opened its new works in New York city, where, in future, the greater part of its product will be manufactured. The company's principal office will be at these works, 510 to 530 West Twenty-third street, to which all orders and correspondence that have hitherto been sent to the Allegheny office should be addressed on and after June 1st. This does not apply to business transacted with the company's various district offices, which will continue to look after the needs of its customers as in the past.

BUSINESS.

The Star Brass Works, 67-69 South Canal street, Chicago, manufacturers of the Star whitewash and painting machine, assert that their machine is particularly adapted for use in electric plants and power stations, and that it has been proven to be a great time-saver.

The Maltby Lumber company of Bay City, Mich., recently suffered quite a loss in the fire at Detroit which burned the pole yard of the Western Union Telegraph company. The Maltby company had some 15,000 poles stored there and the telegraph company nearly 100,000. The two together, it is said, made the largest stock of poles in one place of any yards in the country. The Maltby company has numerous other yards in Michigan, notably at Pinconning, Saganing and Boyne Falls, and the loss will not deter it, to any large extent, in making shipments. It expects soon to have as large a stock as ever in Detroit. The insurance on the destroyed stock will cover about half the cost of the poles.

The Western Electrical Supply company of St. Louis has recently taken the agency for the Lowatt incandescent lamp. It states that the success of this lamp has been instantaneous. The lamp has a complete metal reflector, entirely within the bulb, directly behind a multi-coiled, carbon filament, both in proper relation to each other and utilizing all the reflecting surfaces in a scientific manner. The company states that an eight-candlepower Lowatt lamp, consuming 32 watts, gives a more effective light and will easily replace a 16 or a 25-candlepower lamp consuming 60 to 90 watts. It is asserted that the Lowatt lamp in the concave type has a measured candlepower at the tip of from four to eight times its rated candlepower.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 21, 1901.

674,401. Car Lighting. Robert M. Dixon, East Orange, N. J. Application filed November 20, 1900.

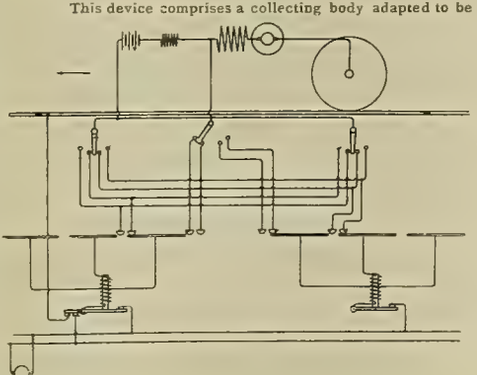
In addition to the ordinary lighting system of the train there is a miniature lighting system in each car that is wholly independent of the ordinary lighting system. The miniature system comprises one or more berth lights, located between adjacent berths. A pneumatically driven dynamo is placed beneath the car and can be controlled from within the car. Means are provided for compressing and storing air for the dynamo and also for regulating the same.

674,402. Telephone Switchboard. Harold A. Douglas, Grand Rapids, Mich., assignor to Peter C. Burns, Chicago, Ill. Application filed November 2, 1898.

A main switchboard and a transfer board are combined with a transfer spring-jack on the main board and a plug seat on the transfer board. A trunk circuit extends between the boards and terminates at the main board in the spring-jack. A connecting plug is provided for the other or transfer end of the trunk circuit and is normally seated within the plug seat. An operator's connective means at the main board include a connecting plug, a signaling device associated with the seat and a generator to operate the device. Circuit connections are provided from the generator and device to the jack and seat for operating the device when an operator's plug is in the jack and the trunk plug is in its seat and also when the trunk plug is out of its seat and the operator's plug is withdrawn from the jack.

674,427. Apparatus for Collecting Atmospheric Electricity. Andor Palencsar, Budapest, Austria-Hungary. Application filed July 10, 1900.

This device comprises a collecting body adapted to be kept in motion. Heating means are provided for the body and a rheostatic machine and a converter are connected with the body electrically.



NO. 674,458.

674,458. Closed-conduit System of Electric Railways. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction company of West Virginia. Application filed November 21, 1895.

Positive and negative main conductors are combined with two series of contact points or sections along the railway corresponding to the conduc ors respectively. Electromagnets are placed between one main conductor and the corresponding series of points or sections respectively and a switch operated by each magnet which has one terminal connected to the other main conductor and its opposite terminal connected to one of the series of points or sections corresponding to the other main conductor. A magnet in circuit between one main conductor and the motor controls the connection between the other main conductor and one of its points or sections. (See cut.)

674,467. Line Conductor for Electric Railways. Alexander Palmros, Fairmount, W. Va., assignor to the Jeffrey Manufacturing company, Columbus, Ohio. Application filed January 12, 1901.

Open spaces are provided in the trolley conductor wire. Conductor wires connect the adjacent ends of the trolley wire at the open spaces and are sufficiently out of aline-

ment with the trolley wire to permit the passage of vehicles through the open spaces. A section of trolley wire is in the open spaces and registers with the main trolley wire, and means are provided whereby the section may be supported within the open space and adapted to be temporarily removed from the open space.

674,469. System of Typewriting Telegraphs. Frank D. Pearne, Grand Island, Neb. Application filed December 11, 1900.

A main switch includes a number of contacts, a finger for engagement therewith and electromechanical means for shifting the finger from one to another of the contacts. This switch is combined with a local circuit having energizing means, a line relay for cutting the shifting means into the local circuit, a line relay responsive to a different quality of current, for cutting the finger into the local circuit, and means which are provided for sending currents over the line corresponding to the relays included therein.

674,501. Storage Battery. William Gardiner, Chicago, Ill. Application filed August 8, 1900.

An element for an electric accumulator comprises a plate, with perforations in the plate containing active material. A pocket of absorbent material entirely encloses the plate. A perforated support is placed on each side of the pocket, with elastic bands for holding the supports in contact with the pocket. A contact lug from the plate extending through a perforation in the top of the pocket is provided.

674,505. Armature Core. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing company, Windsor, Conn. Application filed October 4, 1900.

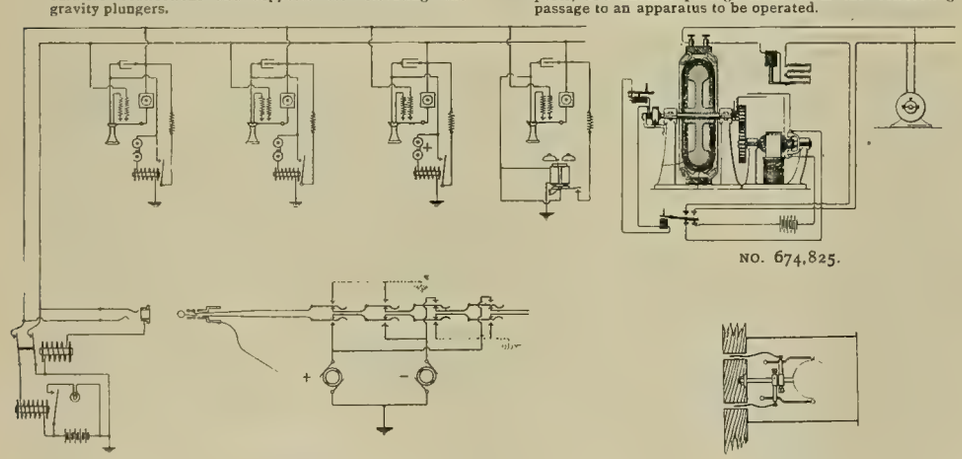
This device consists of a frame with undercut ribs extending along the outer surface of the rim parallel with and adjustable toward and from the axis of the frame. Means for adjusting the ribs radially of the frame are provided. Annular sectional laminæ fit the rim of the frame and have mortises which receive the undercut ribs.

674,515. Calling Apparatus for Party Telephone Lines. Joseph J. O'Connell. Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed December 26, 1899.

A circuit having two branches in multiple is combined with a bell, condenser and circuit-closing device connected in each of the branches. The bells of the different branches respond respectively to current of opposite direction and the circuit-closing device responds to current of either direction. The circuit-closing device of a given branch is adapted to short-circuit the condenser and provide a local circuit for the current caused by the discharge of the condenser, when ringing current is directed over the branch to actuate the bell. (See cut.)

674,523. Automatic Signal for Electric Railways. Charles H. Storm, Waterloo, Iowa, assignor to himself, Ralph L. Storm, Edwin M. Storm and Charles S. Chase, Waterloo, Iowa. Application filed August 28, 1900.

An electric generator and a trolley wire are combined with a frame having openings and gravity contact plungers movable vertically in the opening and which are adapted to be actuated by a trolley wheel. There are armatures on the plungers in circuit with electromagnets above the trolley wire. Gravity releasing plungers are movable vertically in other openings in the frame and are provided with contact conductors which are adapted to move vertically when actuated by the pressure of a trolley wheel and break the electrical circuit through the conductors. Conductors are provided for carrying a current from the trolley wire to the releasing and contact plungers and thence to and from signal lamps. The signal lamps are situated at either end of a section of track, in circuit with the gravity contact plungers, and means are provided for grounding the current from the signal lamps. There is also a trolley-actuated mechanism with suitable connections and supports for elevating the gravity plungers.



NO. 674,515.

674,540. Relay. Frank D. Pearne, Grand Island, Neb. Application filed December 11, 1900.

This device consists of a field magnet which has opposing poles of like polarity and an unlike pole spaced therefrom, and an armature comprising a member disposed to aline with the like poles, and a member to project in the direction of the unlike pole. The armature is pivotally mounted, and a bipolar electromagnet is disposed with its poles adjacent to the first member of the armature at opposite sides of the pivot of the latter, to rock the armature.

674,541. Protector for Telephone or Telegraph Instruments. Jean Piel, Schöneberg, near Berlin, Germany, assignor to Aktiengesellschaft Mix & Genest, Telephon und Telegraphen Werke, Berlin, Germany. Application filed November 2 1900.

A series of spring-controlling current protectors is combined with a mechanical contrivance which is independent from the current protectors and appropriate to be moved to and fro, and which is arranged in the proximity of the series of current protectors in such a manner that it can be set in motion by any single one of the series of current protectors. Means are provided to produce a signal by the moving of the mechanical contrivance.

674,552. Self-playing Musical Instrument. George H. Davis, New York N. Y. Application filed November 30, 1897. Renewed April 22, 1901.

A movable magnet carries a friction shoe between its cores. The magnet is in circuit with a source of electric supply. A device is provided for making and breaking the circuit, whereby the magnet is energized, which moves the friction shoe into contact with the periphery of a revoluble iron drum.

674,589. Trolley. Joseph Trickel, Reading, Pa. Application filed November 10, 1900.

This device comprises a single-piece harp split at its lower end, and which is adapted to be secured permanently to the pole and carries spring boxes in each of its arms. The boxes are backed by a coiled spring which rests on flanges in the arm. Coiled springs are located inside the boxes surrounding the trolley-carrying spindle, and are adapted to bear against non-revolving washers formed with a lip, which are located between the boxes and the trolley-wheel hub.

674,617. Trolley-wire Clip. James W. Perry, Philadelphia, assignor to the H. W. Johns Manufacturing company of New Jersey. Application filed April 6, 1901.

The device described has a longitudinal groove on its bottom formed with inward and downwardly projecting longitudinal ribs. There is one or more apertures through the upper part of the clip and these open through the upper wall of the longitudinal groove through which solder may be poured.

674,642. Electric Arc Lamp. Royal E. Ball, New York, N. Y., assignor to the Ball Electric company, Yonkers, N. Y. Application filed April 11, 1900.

A feed-regulating mechanism loosely engages the carbon rod of an electric arc lamp. A guide for the carbon rod is pivoted to a moving part of the feed-regulating mechanism and engages the carbon rod at a single point. The carbon rod swings free on the pivot of the guide.

674,656. Hanger Clamp for Trolley Wires. George H. Ricke, Cincinnati, Ohio, assignor to Samuel K. Druce, John Asa Hosbrook and Daniel S. Hosbrook, Madeira, Ohio. Application filed December 28, 1900.

Members have clamping jaws to impinge upon a wire and are formed with hollows adapted to correspond when the members are held in relation. This produces a socket, the walls of which are screw-threaded. A part having wedging and screw-threaded engagement with the outer sides of the members presses the jaws forcibly upon the wire. These features are combined with a bolt having at its lower end threaded engagement in the socket.

674,660. Electric Signaling Device. Conrad F. Wilder, Chicago, Ill., assignor of one-third to Henry Kamm, Chicago, Ill. Application filed November 7, 1900.

A fixed circuit-closing device is placed in proximity to a movable portion of railway track. This device consists of two spring terminals. There is a connection from the movable part which projects between the spring terminals. When the movable part of the track is moved, the spring terminals are permitted to come together, thus closing the signal circuit.

674,683. Electromagnetic Valve, Nils O. Lindstrom, Borough of Queens, New York, N. Y., assignor to Alonzo B. See and Walter L. Tyler, New York, N. Y. Application filed February 4, 1901.

An electromagnet has two armatures, one of which controls a supply port and the other an exhaust port. A chamber or passage connects the supply and exhaust ports, and another passage leads from the connecting passage to an apparatus to be operated.

NO. 674,825.

NO. 674,846.

674,740. Trolley. Alexander Palmros, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Application filed October 6, 1899.

Two supports extend upward from the motor car, one at each side of the car. A bearing or box is at the upper end of each support. The transverse shaft is rotatably mounted in the bearings. The reversible springs at the sides of the car are connected directly to the shaft. The reversible support is secured rigidly to the shaft and extends in opposite directions therefrom, and there are two laterally elongated trolley contacts, one at each end of the reversible support. (See cut.)

674,754. Manufacture of Electric Glow Lamps. Fritz Blau, Vienna, Austria-Hungary. Application filed January 2, 1901.

This is a process of manufacturing self-regenerating incandescent lamps, which consists in permanently placing in the bulbs of the lamps a compound which will evolve a carbon-containing gas or vapor.

674,770. Electric Lamp. Cloice B. Hull, Chicago, Ill. Application filed January 30, 1901.

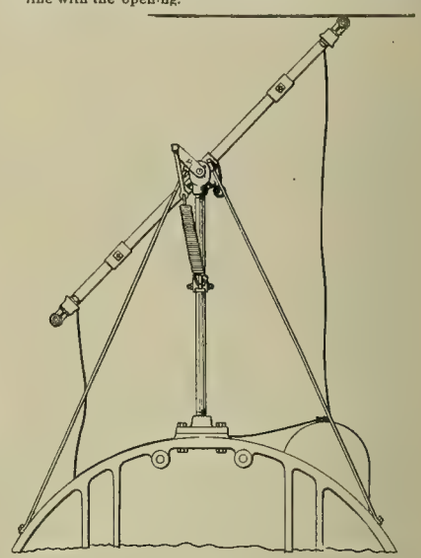
Spaced supporting finger pieces are connected with a casing, which has a lamp therein, and is constructed and arranged to receive the fingers of the operator to support the device. One of the finger pieces is flexible. A contact is carried by the fixed finger piece and is connected with one terminal of the lamp, and a second contact is carried by the flexible finger piece and is adapted for engagement with the first contact to complete the circuit of the lamp.

674,798. Illuminated Sign. Frank E. Smith and Frank C. Watson, Philadelphia, Pa. Application filed January 21, 1901.

A sign holder is revolubly mounted in a sign-exposing casing and is readily removable therefrom. Means are provided for rotating the holder within the casing to bring the signs in alinement with the opening. Electric contacts are carried by the casing and sign holder.

674,799. Illuminated Sign. Frank E. Smith and Frank C. Watson, Philadelphia, Pa. Application filed January 21, 1901.

A shell or casing has an opening formed therein, and stems or posts extend inwardly from each end thereof. There is a removable sign holder. Means carried by the holder are provided for embracing the stems and normally holding the holder in position and permitting ready removal from the casing. Means operative from without the shell or casing are also provided for changing the position of the sign holder within the shell or casing, to bring one or another of the signs carried by the holder in line with the opening.



NO. 674,740.

674,807. Telephone System. Ernest E. Yaxley, Chicago, Ill., and Charles C. Cadden, Cleveland, Ohio. Application filed December 16, 1899. Renewed April 11, 1901.

A spring-jack is provided with a branch terminal to the sleeve contact. A tip contact is adapted to open the line when actuated by a switchboard plug. There is a test piece. A separate contact spring is actuated by a member of the jack controlled by a switchboard plug and is normally in contact with the test piece, but separable therefrom when actuated by a switchboard plug.

674,816. Illuminated Sign. Frank E. Smith and Frank C. Watson, Philadelphia, Pa. Application filed July 13, 1900.

A main frame or casing has an opening formed therein. A sign holder is mounted in the casing and is readily removable therefrom. Means are provided for holding the sign holder in its adjusted position in the casing.

674,825. Apparatus for Accumulating and Storing Energy. Angel de Castro, New York, N. Y., assignor of one-half to Henry W. Schlomann, New York, N. Y. Application filed April 10, 1900.

A fly wheel is adapted to form one member of an electric generator. An armature is provided with coils or windings and encircles the wheel. Conductors are connected with the terminals of the armature winding. A translating device is connected with the conductors. An electric motor is connected with and serves to rotate the wheel. A small electric generator is rotatable with the wheel. A source of electric energy serves to supply the motor. A switch is adapted to close the supply circuit of the motor and to open the circuit in which are included the fixed armature coils or windings or to close the latter and open the former. An electromagnet is included in the outer circuit of the small electric generator and serves to actuate the switch. (See cut.)

674,840. Circuit Controller. Carl Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Application filed March 10, 1900.

A reservoir has means for varying the pneumatic pressure therein. An electric motor is provided for operating the pressure-varying device. A circuit is connected with the motor and a switch device controls the circuit. A governor consisting of a hollow structure is made collapsible and expansible. This communicates with the reservoir, and there are connections between the governor and the switch device. The variation of pneumatic pressure in the governor varies the size thereof and thereby operates the switching device.

674,846. Electric Telegraphy. Oliver J. Lodge, Liverpool, England. Application filed December 20, 1897.

In this system of Hertzian-wave telegraphy, an emitter consists of a single conducting body. Means are provided for suddenly and disruptively communicating opposite electric charges to the emitter. Oscillations are set up in the conducting body and waves are emitted. The conductor is supplied with opposite "electricites" by a pair of knobs which are connected to the terminals of a high-potential source. The emitter is combined with a partial metallic enclosure which serves to lessen the emission of the waves in undesired directions. The coherer comprises a variable electrical contact sealed in vacuum. In the receiver are combined the following instrumentalities: A coherer and a vibrator, mounted in proximity to the coherer and which is adapted to agitate its elements. There are automatic means to break down successively the cohesion caused in the coherer by the Hertzian waves. Means are provided which serve to collect and convey to the coherer waves produced at a distance. (See cut.)

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Independent Telephony in Buffalo and Vicinity.

The members of the Independent Telephone Association of the United States of America who expect to attend the fifth annual convention to be held in Convention Hall, Buffalo, next Tuesday, Wednesday and Thursday, June 11th, 12th and 13th, anticipate a most successful gathering. There is every reason to believe that this convention will be largely attended and that the men who have within a few years built up such an extensive industry will be well represented.

In the city of Buffalo the convention will come in touch with a powerful public demand that a franchise be granted to a company that is representative of Independent interests, in order that the best possible telephone service be given all classes at the minimum of cost. The application for an Independent franchise is now pending, and there is a possibility that the city officials will bow to the earnest demands of the people and grant the franchise even before this is printed. The Queen City Telephone company is the applicant, and the battle this company is waging has associated with it the same elements of opposition met with in many other places where monopoly has held full sway.

In the prosperous, energetic city of Niagara Falls, N. Y., the Independent movement has attained a firm foothold. The example set by Niagara Falls in its fight for freedom from monopoly is being followed by other equally ambitious places in Western New York, and soon this entire section will be connected.

The Niagara Falls Home Telephone company has a capital of $100,000. This company secured a franchise in 1896. Before the work of construction was begun the breaking out of the Spanish-American war crept in and delayed matters. However, in the latter part of 1898 construction was begun under the franchise, and about a year ago service was given. To-day the company has 550 subscribers and is making additions every day. It operates two exchanges, one of which is in the Gluck building on Falls street, the other in the Pletcher block on North Main street. Thus, one is at the south end of the city, the other at the north end. The rates charged are $36 a year for business telephones and $16 for residence telephones. The president of the Niagara Falls company is Dr. Campbell, while Mighells B. Butler is practically the manager. Mr. Butler is mayor of the city of Niagara Falls and a man who is devoting his best energies to the Independent cause. He is major of the Fourth Battalion, and therefore prominent in military circles of the Empire State. Major Butler's portrait is given on the next page.

POLE LINE OF THE NIAGARA FALLS HOME TELEPHONE COMPANY.

Each subscriber to the service of the Niagara Falls Home Telephone company secures a long-distance instrument on full-metallic circuit and an independent line. The service is unlimited, and there are no party lines. The pole line of the Niagara Falls Home Telephone company, shown in the accompanying illustration, is pronounced the finest in the state. At the south end each pole has 10 cross-arms, carrying 10 wires each, or a total of 100 wires. The poles are very high and very straight.

The village of Tonawanda, Erie County, and the city of North Tonawanda, Niagara County, two places side by side, and the greatest lumber markets in the world, have opened their arms to Independent telephones. The exchange has been in operation about three months and has 300 subscribers. The Tonawandas are midway between Buffalo and Niagara Falls on the New York Central.

In Lockport, the county seat of Niagara County (population, 16,038), an Independent telephone franchise has been granted, the work of construction being now under way. The same may be said of Batavia (population, 9,180) and of Dunkirk (population, 11,616), and also of Middleport, Warsaw and Lewiston. Other franchises will soon be granted, and soon the entire western section of New York state will have its Independent telephone service. In securing the above-mentioned franchises, Mayor Butler of Niagara Falls was an important factor, the officials of the several places listening with much interest to his recital of the manner in which the Independent service had been received in Niagara Falls, which has a population of 19,457. Trips of inspection were made to Niagara, where the excellent construction and system won immediate favor.

Major A. H. G. Hardwicke of Niagara Falls is a leader in the movement for cheaper and better telephones. He is a leading business man of Niagara and will no doubt be present at the convention in Buffalo.

Pan-American Telephone Service.

The time selected for the convention is none too early, as many may possibly imagine. The Pan-American Exposition will be found in a state approaching full completion, while the delightful weather of June will make the enjoyment almost perfect. In adopting the color effects and giving the buildings a dress of rainbow hues there has been a very marked display of good taste and good judgment, and this has won and continues to win high favor. The illumination at night far surpasses anything of the kind ever before attempted.

All who are interested in the Independent telephone movement will rejoice over the fact that on the grounds and throughout the various buildings of the Pan-American Exposition an Independent system has been installed, the results of which have been gratifying to all of the officials and employes who had to use telephones.

This system is a central-energy plant, installed by the Stromberg-Carlson Telephone Manufacturing company of Chicago. It is for official service, and the exposition officials have never hesitated to praise the service given. The entire installation of the system has been in charge of Paul M. Krahmer, traveling engineer of the Stromberg-Carlson company, who has won much favor with the exposition officials for the efficient service the system has rendered.

Work was commenced on March 20th, and on April 15th 45 instruments were in service. Throughout the exposition there is a total of 92 Stromberg instruments in use. Every official from the director-general down has a Stromberg instrument. There is an instrument in every building, some having three or four, the company's privilege being to place their telephones wherever other instruments were placed. An Independent line strung on the poles of the power-transmission line connects the terminal station of the Niagara power service with the exposition grounds, the length of the line being 4½ miles. There is a Stromberg instrument in the chamber of the Electric Fountain in the North Bay for the use of the fountain operators when the fountain is in play. Away up on the 360-foot level of the Electric Tower an Independent telephone has been placed, to aid in the operation of the searchlights to be placed there, and running from the Electricity building, Niagara transformer plant to the water rheostat on the northwest side of the exposition grounds, there is a private Independent line. In the engine room of the Machinery building, also in the boiler room, Independent telephones have place.

In the entire installation about the exposition grounds there is in use about 200 miles of duplex wire, manufactured by the Hazard Manufacturing company of Wilkesbarre, Pa. The wire is laid underneath buildings, through conduits and on poles.

The switchboard shown in the illustration on the next page is the board installed for temporary use. It is a central-energy, lamp-signal board of the double-supervisory, clearing-out type. The battery in use in connection with the system is of 160-ampere-hour Chloride cells, two volts to the cell and 20 cells in the battery.

The operation of the Stromberg-Carlson system on the grounds of the Pan-American Exposition is divided into three shifts of eight hours each, young men taking the shifts from 4 p. m. to midnight and from midnight to 8 a. m., and a young lady, Miss L. Grieve, the shift from 8 a. m. to 4 p. m.

Mr. Krahmer, who installed this system, started in the electrical business when but 13 years old. He worked for the Western Union Telegraph company in Chicago, and then went with the Postal. Next he went with the Chicago Telephone company, with which company he remained until 1898. He then took a position as superintendent of the Mutual Telephone company of Des Moines, Iowa, and at the end of a year became chief inspector of the Central Union Telephone company. In a little over a year he took the position as traveling engineer of the Stromberg-Carlson Telephone Manufacturing company. He is 44 years old, and has worked in all the branches of his field.

Independent Exhibits in Electricity Building.

Members of the Independent Telephone association will no doubt find great pleasure in the Independent

exhibits in the Electricity building. Professor George Francis Sever of Columbia University is superintendent of electrical exhibits, and it was his idea to place all of the telephone exhibits in adjoining spaces. With an appreciation of this forethought on the part of Superintendent Sever, the members will find the exhibits that will principally interest them in a space at the east end of the building. This, of course, does not refer to the wire and cable exhibits, which will be found in various sections of the building.

The American Electric Telephone company of Chicago has the finest exhibit ever made by the company. The booth is two stories high, the space occupied being 516 square feet. The upper section is supported by beautiful pillars, while sculptural work adds to the general beauty. Mr. S. J. Bear has had charge of the work of installing the exhibit, and he, with other prominent representatives of the company, will be present to extend greeting to all who call. The balcony will be found a delightful spot to rest and view the interior of the beautiful building. The company will have a multiple central-energy board connected up and in operation, and it will also show its different styles of telephones. In every feature the exhibit will be complete. The telephone shield is seen in prominence about the booth, while in the center of the ceiling of the booth there is a shield three by three feet, containing about 80 incandescent lamps. An easy stairway leads to the office or second floor. In the northeast corner of the Electricity building, on the end wall, the company will have a shield six by six feet, in which there will be 463 flash lamps with the inscription, "American Electric Telephone company, Independent Manufacturers, Chicago, Ill.

The Kellogg Switchboard and Supply company of Chicago will exhibit a complete central-battery telephone exchange of 3,000 ultimate capacity, equipped for 1,080 lines, also a section of its straight multiple switchboard of 12,000 ultimate capacity for central energy. These are the company's major boards. The Kellogg people will also exhibit a section of their 3,000-line, central-energy minor board, the difference between the major and minor boards being wholly in the construction, the operation being the same. They will also show a combination board having central energy and magneto line on same board, and several small boards known as "Express," having self-restoring drops. Visitors will also find a working model of this company's new central-battery, two-division switchboard on exhibition. This is a lamp-signal board, and works with relays. Desk sets and wall sets, also a sound-proof booth, have been placed. The basement contains all power apparatus, storage batteries, distributing frames and relay racks for the 3,000-line major board, the 3,000-line minor board, the combination central-energy and magneto, the two-division and "Express" boards. The exhibit will be connected for operation. The main booth of the Kellogg Switchboard and Supply company is in section R. The company has a branch in section F containing two sound-proof booths for long-distance tests. C. F. Wheeler designed the booth, while Paul W. Bossart will have charge of the exhibit during the exposition. R. H. Manson will look after the electrical and engineering work in the company's interest. Prominent officials of the company will be in attendance to welcome visitors.

The Stromberg-Carlson Telephone Manufacturing company of Chicago has a space 28 by 38 feet, in which it shows one section of its 9,600-capacity, new-style switchboard, one section of its 3,600-capacity, old-style multiple switchboard, one section of its 100-capacity, visual-signal, central-energy switchboard, one section of its 100-capacity-line lamp-signal, central-energy switchboard, one section 100-capacity, magneto board, and one combination protector and main distributing board of 500 capacity. It has also sections of show boards for instruments on which wall instruments are mounted. Small parts of switchboard apparatus are displayed and protected in a showcase, while other pieces of apparatus are displayed on a table. The company also shows a telephone booth and machine stand. The space is surrounded by a neat brass railing, and is quite commodious. The exhibit is in charge of Mr. Krahmer.

PAUL M. KRAHMER.

The space of the National Automatic Telephone company of Chicago adjoins that of the Stromberg-Carlson company. Mr. O. A. Estes is in charge of the exhibit, which is most complete. This company shows a selective party line on which as many as 30 instruments can be operated. It is non-interfering, the person talking having absolute control of the line. The National people also show an automatic system whereby each subscriber makes his own connection, thus doing away with the necessity of an operator and "Central." This feature reduces the cost of maintenance, while the service rendered is quick and private. An illustration is also given of how an automatic system, such as the National, can be operated in conjunction with the manual system.

Right in the center of the east end of the Electricity building, between the two doors, the Clark Automatic Telephone company of Providence, R. I., has a very desirable space, its exhibit being in charge of Mr. L. A. Stillings. The exhibit is most complete, and Mr. Stillings is ever ready to demonstrate the efficiency of the system. The system is automatic and quite simple. The exhibit contains the various styles of telephones, office, wall, desk and residence—all of which are well displayed.

MAJOR M. B. BUTLER, PROMINENT IN INDEPENDENT TELEPHONY IN WESTERN NEW YORK.

Legal Aspects of Telephone Removal.

A written contract for the use of a telephone provided that the lessee should pay therefor $15 a quarter in advance and $1 additional for an extension bell, the rental all to be paid on the first day of each quarter. It further provided that, upon non-payment of any sum due, the lessor might terminate the lessee's right immediately by written notice mailed to or left at the premises mentioned, and sever his connection, and remove the instruments. Besides, the rental was made payable upon demand, and it was stipulated that the terms of the contract could not be varied or waived by any representations or promises of any canvasser or other person, unless the same was in writing, and signed by the general manager of the lessor.

Under these conditions, the Supreme Court of Montana holds, in the case of Ashley against the Rocky Mountain Bell Telephone company, that a request should have been granted that the jury be instructed that if it believed from the evidence that the company's collector demanded of the lessee payment of the money due for such telephone service, and such payment was not then made, then the company had the right to terminate the contract; and this was so even if the collector informed the lessee that he might make such payment at some subsequent time, unless the jury further believed from the evidence that the representation or promise of the collector, if any, was in writing, and signed by the general manager of the company. But the rental being payable in advance and refused by the company, its manager declaring that he would not render service longer, the court does not consider that there was any obligation on the lessee to keep the tender good, or to make further tender.

Furthermore, the court holds that the company was entitled to show as a defense that, after the alleged notice of termination of the contract and the removal of the telephone, the company offered, the same month, to put in a telephone for the use of this subscriber, presumably at the same rates as agreed upon under the first contract, provided that he would pay the sum of $15 for the expense of putting up poles. The offer it does not regard as a modification of the original contract and a waiver of the alleged breach thereof, though it says that if it appeared on the trial to be in fact in such terms as to state or reasonably imply a waiver or modification, then, of course, it would not be incumbent upon the party to accept it. To accept telephone service from the company, if service was necessary to the subscriber's business, and it could not be obtained except from the one company, it having, as alleged, a monopoly of the telephone business in the city, the court holds, would not necessarily be a waiver or modification. The authorities declare it to be the law, long settled, that it is the duty of the injured person, if in his power, to take reasonable measures by which his loss may be less aggravated. Wherefore, the company having offered to prove that by expenditure of $15 the subscriber could have avoided the alleged loss of $1,900, the court holds that if that were the case it was the subscriber's duty to have accepted the $15 offer, and kept down the damages which might be claimed for alleged breach of contract.

Indiana Telephone and Telegraph Items.

The linemen employed by the two telephone companies in Indianapolis have returned to work, all differences having been settled satisfactorily.

The workmen in the employ of the Decatur County Telephone company at Greensburg, who have been extending wires in every section of the county, are on a strike. The question of wages is not involved.

The farmers in the vicinity of Lafontaine, Wabash County, have effected an organization. The purpose is to establish a central telephone exchange or station at Lafontaine and connect the homes of farmers within a radius of 10 miles. It is practically assured that the system will be put in at once.

Amos Studebaker of Young America, a village in Howard County, is trying to prevent the Central Union Telephone company from planting a pole in front of his house. One was erected and he chopped it down. He placed a tin can on the post, on which there is a label, "Nitroglycerin. Beware." Studebaker is on guard with a Winchester rifle and says he will shoot and explode the nitroglycerin upon the appearance of the workmen who try to put up another telephone pole.

The Indiana Supreme Court has recently decided several important questions relating to the sending and delivery of telegraph messages. In the case of the Western Union Telegraph company vs. Henry, the court held that where the company had an arrangement to send messages for Henry on credit, to be paid for at the end of the month, its acceptance of a message "on the usual terms" and failure to transmit it with diligence and in its turn made the company not only liable to the statutory penalty, but also for the reasonable expense of sending an agent to obtain the information asked for in the telegram. A condition that the company shall not be liable for mistakes, delay or non-delivery unless the message is repeated is no defense to an action for damages. In the case of Furgason against the same company the court holds that mental anguish, unaccompanied by either pecuniary or bodily injury, is not sufficient ground for the recovery of damages from a defendant whose negligence caused it. The court says that the "mental-anguish" doctrine in telegraph cases originated when telegraphy was in its infancy, and that in common law damages for mental anguish can only be allowed when the anguish grew out of the actual infliction of a positive injury either by way of physical hurt or malicious trespass that amounts to a hurt. There is no open or practical means by which the damages occasioned by a negligent act that causes only mental anguish can be assessed, as the defendant cannot prove how slight the damages really were. Manifestly a telegraph company is not to pay for the mental anguish caused by the death of a relative, as there is no means of knowing whether the complainant would really have gone to the funeral, except by his own assertion. The court cites many cases in which the courts have held that damages were or were not recoverable, where the telegrams related to sickness or death of relatives of different degrees of kinship, and declares that the mental-anguish doctrine is not capable of being reasonably enforced. In arriving at this conclusion the court overruled the Reeves case, in which it was held that damages were recoverable for mental anguish. The defendant company is greatly pleased with the decision.

F.

TEMPORARY SERVICE EXCHANGE AT PAN-AMERICAN EXPOSITION.

Annual Convention of the Independent Telephone Association at Buffalo.

The fifth annual convention of the Independent Telephone Association of the United States of America will be held in the banquet room of Convention Hall, corner of Virginia street and Elmwood avenue, in Buffalo, on Tuesday, Wednesday and Thursday of next week. The convention headquarters, aside from actual convention sessions, will be at the Iroquois Hotel. The programme is as follows:

TUESDAY MORNING, JUNE 11TH.

Reception of delegates, distribution of badges, tickets, etc., at headquarters, Iroquois Hotel.

TUESDAY NOON.

Opening of the convention in Convention Hall.

Address of welcome—Hon. Conrad Diehl, mayor of Buffalo.

Response—Hon. James M. Thomas of Cleveland, president Independent Telephone Association of the United States.

Annual address by the president of the association.

TUESDAY AFTERNOON.

Inspection of exhibits by manufacturers at Iroquois Hotel.

WEDNESDAY MORNING.

Second session of the convention at Convention Hall.

Paper by Hon. S. P. Sheerin, New Long-distance Telephone company of Indianapolis; subject, "Village Exchanges and Farmers' Lines."

Discussion led by J. B. Ware of People's Telephone company, Detroit, Mich., and T. J. Fricker of Ashtabula Telephone company, Ashtabula, Ohio.

Paper by Charles E. Wilson of Keystone Telephone company, Philadelphia; subject, "Independent Telephone Development East of the Alleghanies."

Discussion by C. E. Stinson, Rochester Telephone company, Rochester, N. Y., and Senator C. W. Kline of Hazleton, Pa., president of the Interstate Telephone and Telegraph company of Pennsylvania.

Paper by L. W. Stanton, Cuyahoga Telephone company, Cleveland, Ohio; subject, "Exchange Service."

Discussion by convention at large.

Reports from various states and other business.

WEDNESDAY AFTERNOON.

Inspection of exhibits by manufacturers at Iroquois Hotel.

Pan-American Exposition and Niagara Falls.

THURSDAY MORNING.

Third session of the convention at Convention Hall.

Reading of paper by Hon. H. D. Critchfield, general counsel, Cuyahoga and United States Telephone companies, Cleveland, Ohio; subject, "Legislation and Litigation."

Discussion by E. Kibler of Newark Telephone company, Newark, Ohio, and C. S. Bash, Home Telephone company, Fort Wayne, Ind.

Reading of paper by E. B. Fisher of Citizens' Telephone company, Grand Rapids, Mich.; subject, "Bell Methods."

Discussion by George W. Beers of National Telephone and Telegraph company, Fort Wayne, Ind., and W. A. Bisbee of Georgia Telephone and Telegraph company, Savannah, Ga.

Election of officers and unfinished business.

At a recent meeting of the advisory board of the association, held in the city of Chicago, the following resolution was unanimously adopted: "Resolved, That no company shall be entitled to admission to the coming annual convention of the Independent Telephone Association of the United States, at Buffalo and to participation in its proceedings, reports, advantages, etc., save those who shall have paid, at or before the opening session, on the 11th of June, their annual membership fees for the association year of 1901-1902, which said fees shall be at the rate of two cents per telephone for each telephone station represented, and two cents per mile for each pole-mile of toll lines represented."

The officers of the Independent Telephone association are: President, James M. Thomas, Cleveland, Ohio; first vice-president, H. C. Young, Columbia, Pa.; second vice-president, C. E. Stinson, Rochester, N. Y.; third vice-president, H. E. Teachout, Des Moines, Iowa; secretary and treasurer, S. P. Sheerin, Indianapolis, Ind.; first assistant secretary, R. F. Johnson, Saginaw, Mich.; second assistant secretary, Samuel E. Wayland, Wilkesbarre, Pa.

The advisory board is composed of James M. Thomas, Cleveland, Ohio; S. P. Sheerin, Indianapolis, Ind.; Hugh Dougherty, Bluffton, Ind.; H. D. Critchfield, Mount Vernon, Ohio; E. B. Fisher, Grand Rapids, Mich.; Samuel E. Wayland, Wilkesbarre, Pa.; W. B. Seaton, Ashland, Ky.; W. H. Durin, Cedar Rapids, Iowa, and George W. Beers, New York, N. Y.

The following-named gentlemen are members of the executive committee: W. W. Tobey, Danville, Ill.; L. A. Frazee, Connersville, Ind.; J. B. Ware, Grand Rapids, Mich.; W. S. Eckert, New York, N. Y.; E. L. Barber, Wauseon, Ohio; C. E. McCluer, Richmond, Va.; John H. Grogg, West Union, W. Va.; Richard Valentine, Janesville, Wis.; C. W. Kline, Hazleton, Pa.; Charles Cockerell, Jefferson, Iowa; H. K. Cole, Henderson, Ky.

Indications point to a well-attended convention. A party of the Chicago visitors is arranging to go on the Wabash road, leaving the Polk street station in Chicago at 3:15 p. m. on Monday, June 10th, and arriving in Buffalo at 7:40 a. m. the next day. City Passenger Agent Keeran is arranging to provide additional sleepers to accommodate the convention attendants from Chicago.

Bell Company Increases Its Stock.

The stockholders of the American Telephone and Telegraph company held a special meeting on June 3d to authorize an issue of new stock, to the extent of $50,000,000. The previous authorized stock was $100,000,000. The new stock will be offered at par, the payments to be made in two installments, each stockholder to be allowed one new share for three old shares held. The new stock will be issued for construction purposes.

Independent Telephone Lines in Ohio and Wisconsin.

The extent to which the Independent telephone interests are covering the north central states is indicated by the two accompanying maps which represent the Independent systems in the states of Ohio and Wisconsin. The development of Independent telephony has been exceedingly rapid during the last two years. There are now believed to be more than 4,000 exchanges in the United States with over 1,000,000 telephones connected, covering an investment of approximately $65,000,000.

Of the whole number of exchanges Ohio has probably about eight per cent. There were in that state recently 332 telephone systems operating more than 65,000 telephones and over 1,200 toll stations. In the map the operating exchanges, the exchanges in process of construction and the toll stations are separately indicated. The long-distance, full-copper-metallic lines of the United States Telephone company connect practically all of the main junction points of the local exchanges. The Independents are said to operate 25 per cent. more telephones in Ohio than the Bell companies combined and to reach approximately twice as many toll stations as the other companies.

The map of the Independent telephone lines in the state of Wisconsin was prepared under the supervision of the Wisconsin Independent Telephone association. It shows the lines and exchanges rather thickly located in the central and southwestern portions, the northern part of the state naturally being almost wholly devoid of any lines on account of the wild and unbroken country. There are now over 150 Independent exchanges in the state and many more are being built.

INDEPENDENT TELEPHONE LINES IN OHIO AND WISCONSIN.

Independent Telephone Convention in Wisconsin.

The Independent Telephone Association of Wisconsin will hold its summer meeting at La Crosse, Wis., on June 25th and 26th. This will be the fourth meeting of the association, and it is planned to make it specially interesting. It is expected that most of the important telephone manufacturers and supply houses of the Northwest will be represented at this meeting and many of them will have exhibits of their apparatus.

The following-named gentlemen are officers of the Wisconsin association: President, A. L. Hutchinson of Weyauwega; vice-president, C. H. Schweizer of La Crosse; secretary and treasurer, H. C. Winter of Madison; executive committee, Richard Valentine of Janesville, F. H. Sweet of Fond du Lac, J. C. Harper of Madison, W. J. Bell of Baraboo, J. A. Gaynor of Grand Rapids, W. F. Gurmaer of Appleton, Emil Maurer of Arcadia and H. H. Stewart of West Superior.

The telephone business of Wisconsin is reported as being unusually active this year and this summer will doubtless witness more construction in that state than in any season heretofore. There are now some 150 Independent telephone companies in the state, and since the first of January this year over 20 new companies have been organized.

Recent Improvements in Chicago Telephone Service.

Many improvements are being worked out and carried into effect by the Chicago Telephone company under the direction of John I. Sabin, the new president, who assumed control of the affairs of the company less than a month ago.

One of the most important extensions undertaken is the installing of an automatic nickel-in-the-slot system by which small users of the telephone may be enabled to obtain telephone service at small expense. This system has been in use on the North Side for almost a year, and the results have been satisfactory, both to the subscribers and to the telephone company. This style of service is now being installed in certain portions of the South Side, and the work of installing it on the West Side will be begun immediately.

RECENT IMPROVEMENTS IN CHICAGO TELEPHONE SERVICE.—THE SHOPPERS' EXCHANGE.

The company's plan is to install in offices, stores, flats and houses any one of several classes of cheap-rate instruments. These are all automatic nickel-in-the-slot telephones and are placed on a guarantee that their earnings will be so much each day, the rate varying according to the number of subscribers on the line. There are four classes of these telephones: One class for business or professional use will be used on an individual metallic circuit and will rent for $5.50 a month. Forty free calls will be allowed, and for all above that number a charge of five cents a call will be made. Another class, with two subscribers on a line, will be furnished on a guarantee of four calls, or 20 cents a day. The third class, on 10-party lines, will be furnished on a guarantee of two calls, or 10 cents a day. This class is the same as that which is now in use on the North Side. The fourth class is for residences only on a 10-party line, and will be furnished on a guaranty of one call a day at the five-cent rate. The old two-party rate of service, 600 calls for $60, has been practically abandoned.

The 10-party line consists of a metallic circuit, extending from the exchange to the subscribers' stations. For ringing purposes five are connected to one side of the circuit and five to the other. When any one of the subscribers wishes to use the telephone, he drops a nickel in the slot. Then, by taking the receiver from the hook, he automatically signals the operator at the exchange. If the line for which he calls is busy or if for any reason he is unable to obtain the desired connection, the operator can, by manipulating a special key, refund the deposited coin. If the line is not busy and the connection is completed, the operator, by pressing another key, throws the coin into a receptacle in the telephone toll box.

On lines of this class on the North Side the five stations on one side of the circuit are designated "black" and the five on the other side of the circuit are designated "white." When a station on one side of the circuit is signaled the bells at all the stations on that side of the circuit are rung, the particular station desired being called by a distinctive number of rings. On the South Side the terms "blue" and "gray" will be used to designate the stations on the two sides of the circuit. Of course, the main objection to the system is the frequent ringing of calls which must not be heeded, but it is stated, on the authority of a subscriber, that one becomes so accustomed to the ringing of the telephone that he instinctively gives attention only to his own number.

The public apparently regards the new plan with favor, to judge by the large number of contracts for this service that have been obtained in every part of the city. From the South Side alone, nearly 700 contracts have been secured, and Mr. A. S. Hibbard, general manager of the Chicago Telephone company, is authority for the statement that orders for the automatic telephones are being received at the rate of 100 a day.

The lines for the automatic toll service on the South Side now terminate at the Oakland exchange at Forty-fifth street and Cottage Grove avenue, but it is expected that the other South Side exchanges will be fitted up for this style of service very soon. The West Side exchanges will be ready for the new system in about a week. The telephones of the $5.50 a month class are expected to prove popular in large office buildings. Twenty instruments of this class have recently been installed in the Masonic Temple. For residences the 10-party-line telephones will undoubtedly prove popular, as the cost is small.

The telephone company is experiencing a great deal of difficulty in obtaining a sufficient number of instruments to fill its orders, and the Western Electric company is exerting every effort in supplying the demand.

Another innovation recently made by the company is the opening at No. 96 State street in the heart of the downtown district of a "Shoppers' Exchange" for the accommodation of shoppers and, in fact, anybody who is desirous of using a telephone. The company realized the necessity of such a place, as the public booths situated at the different stores are not readily accessible and are usually busy the majority of the time.

The new "Shoppers' Exchange" is complete in its equipment. As shown by the accompanying illustration, six sound-proof booths are arranged on one side of the room. Directly opposite are the lockers for the 10 A. D. T. messengers connected with the exchange. An operator is in charge of the exchange and makes all the connections for the patrons. The exchange has been furnished with the view of making it a favorite meeting place for lady shoppers. A divan, rocking chairs, table, desk, stationery, magazines and papers have been provided for the use of customers. Shopping commissions will be undertaken for all telephone subscribers and a professional shopper will be in constant attendance. Should a subscriber wish to secure theater tickets without coming downtown for them, he can call the exchange, tell just what he desires, and an A. D. T. messenger will be sent out to purchase the tickets and, if the subscriber wishes, the messenger will deliver them.

The company lays particular stress upon the accommodations it has provided for the A. D. T. messengers at the exchange. It has picked out for its "Shoppers' Exchange" 10 of the brightest boys in its employment and has furnished them with the best reading matter, pleasant surroundings and everything possible to make their work agreeable.

The company has also arranged for receiving contracts for telephone service at this exchange.

Plans have been prepared for several new exchanges in the Chicago Telephone company's territory, and the preliminary work upon the construction of the buildings soon will be begun. The plans are for exchange buildings at Elgin and Aurora, each to cost $23,000. one at Evanston, to cost $15,000, and one at West Pullman, to cost $2,500. The building of more stations in Chicago is being contemplated, but nothing definite has been arranged.

Telephone Exchange in Shanghai.

That China of to-day is not without some of the modern electrical improvements of this and other countries is evidenced by the accompanying illustration, which is a photographic reproduction of the first portion of the telephone switchboard installed in an exchange at Shanghai. This exchange is a new one and is particularly interesting because of the Chinese operators, who are said to be very rapid and accurate. The switchboard in use at Shanghai at the present time has room for only 600 connections, but its ultimate capacity is 5,000 lines. It was manufactured by L. M. Ericsson & Co. of Stockholm, Sweden. Other sections of the board are already on the way to Shanghai.

TELEPHONE EXCHANGE IN SHANGHAI.

Custom-house Plant in New Orleans.

The Treasury Department is inviting sealed proposals until June 18th, for installing an electric-light and power plant in the United States custom house at New Orleans, La., including engines, generators and switchboard. Specifications and plans can be obtained upon application to the department at Washington, or of the custodian of the building at New Orleans. At the same time and place bids will be received for installing an electric-light-wiring system in the same building.

Electric Cabs in Paris.

Although electric traction, as applied to public cabs in Paris, France, dates back as far as 1894, the first step toward the installation of a successful system was not taken till three years later, and it was not till 1899 that the first 25 cabs were placed on the streets by the Compagnie Generale des Voitures à Paris. The style of cab adopted and now in use has a battery box containing 43 elements of the Julien type, with Planté modifications. The capacity of a battery is from 60 to 70 kilometers (37½ to 43¾ miles) at 15 kilometers (9⅓ miles) an hour without being absolutely exhausted.

The cabs themselves, says H. E. P. Cottrell in Feilden's Magazine, from which this account is taken, are outwardly of the English type, though the open landau and the victorias are an unfamiliar improvement on the improved electric growler to which one is accustomed in London. The power is applied to the hind wheels, the directing gear to the front axle, all four wheels having pneumatic rubber tires of a larger pattern than those on the obsolete London cabs. The cabs themselves are supported on a steel frame, resting on the foretruck, and the hind axle through intermediate flat elliptical springs (See Fig. 1), no transverse springs being possible, because of the accumulator boxes. To secure these as much as possible from vibration and shocks, they are suspended from the frame through coiled springs acting in compression. The whole arrangement of springs constitutes a double system of suspension, which safeguards the delicate accumulators from injury, both in service and during removal for recharging and replacement when charged.

The motors are of the Lundell-Johnson type, with four poles, excited in series, and two collectors: the winding is double, on both magnets and fields, so that, by coupling the windings in series or in parallel, different speeds can be obtained. By this arrangement two motors are linked into one, while their respective collectors are retained separate. The advantage of retaining separate collectors is apparent, as in case of the breakdown of one, the other will enable the cab to be taken to stable, although it is shorn of its intermediate speeds. The motors weigh 211½ pounds, and develop about 3½ horsepower at 1,500 revolutions, which corresponds to a speed of 10 miles an hour. They are manufactured by A. Postel Vinay, Paris.

The motor shafts carry a pinion having 22 teeth made of compressed rawhide, held between steel cheeks, working a toothed wheel having 81 teeth affixed to the crown of the differential coupling. This arrangement, or, rather, the use of a rawhide pinion, diminishes to a great extent the rattle of the driving gearing and is said to soften it down to the swish of a circular saw when cutting through a soft piece of timber of half the diameter of the saw. It is noticeable to anyone that the noise of the Paris electric cabs is far less objectionable in quantity and quality than that of their London compeers used to be.

The differential gearing is of the conical satellite type. Each pinion is keyed on an axle, rotating in long bronze doweled bearings, provided with automatic lubrication. At either end of these axles are placed the chain pinions, having 19 teeth, which drive the toothed wheels affixed to the hind wheel-hubs of the cabs. These toothed wheels have 104 teeth. Both chain pinions and driving wheels are fitted with cheeks to prevent the chain from running off.

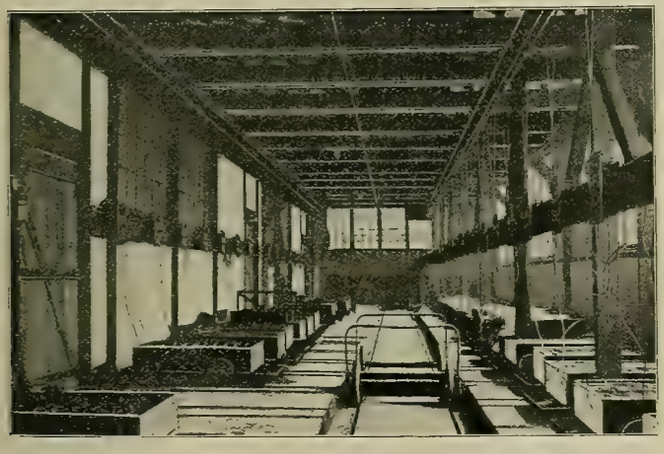

FIG. 2. ELECTRIC CABS IN PARIS.—CHARGING STATION.

Both motor and differential gearing are supported by a steel plate, which in turn is supported on a channel frame hinged on one side, attached to the prolongation of the axle bearings beyond the axle boxes and parallel to the rear bent axle, while on the front side it is attached by three compressed coil springs, two of which support the motor, and the other prevents it from jerking upward on stopping. The driving chains are adjusted by two clamping screws. The weight of motor, differential coupling and the framework amounts to 528 pounds.

The battery is invariably charged at from 80 to 85 volts. The speed combiner, which is on the principle of a telephone-exchange board, was designed and constructed by the Société Industrielle des Téléphones. The lever is brought forward to produce a forward movement or increased velocity, and pushed back to diminish the velocity or change the direction of motion. The speed combiner gives three forward velocities, corresponding with 1⅞ miles an hour, 3¾, 8¾ and 10⅝; also "stop" applies the electric brake, and produces a backward velocity of 1⅞ miles an hour.

The cabs are well provided with brakes, two electric, a coiled Lemoine friction brake and a block brake. The electric brakes are worked by the lever of the speed combiner, the first being put on by short-circuiting the motor on a resistance, the second by short-circuiting it on itself.

The cabs are lighted entirely by electricity, and a much-appreciated innovation is the internal lighting afforded by a five-candlepower lamp fitted to the center of the roof.

The Parisian cab company has been forced to limit the number of electric cabs placed at the disposal of the Parisian public, because its main charging station is situated at such a distance from the center of Paris (five miles), and because it possesses only one small subsidiary station two miles from that center; the capacity of the latter (10 sets of accumulators) has practically governed the number of cabs that have been placed on the streets to ply for hire. The same conditions have so increased the cost of working that electric cabs plying for hire at ordinary fares would be worked at a loss. Thus, the sole causes of dissatisfaction with the Parisian electric cabs are wholly connected with the question of recharging the accumulators and the operations involved thereby.

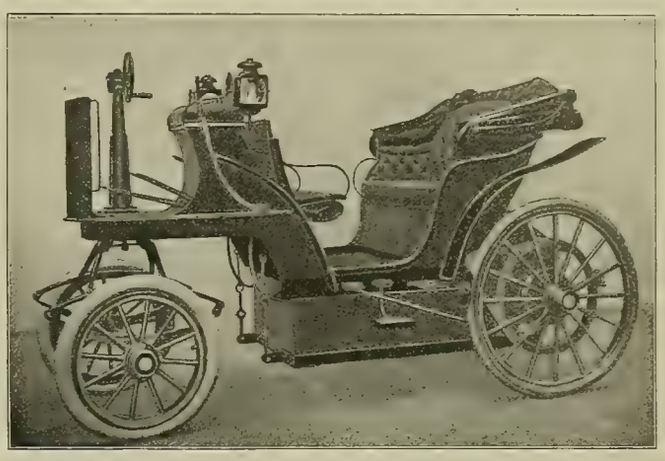

FIG. 1. ELECTRIC CABS IN PARIS.—VICTORIA, WITH FRONT SEAT AND REAR DRIVERS.

The cab company's main generating station is at Aubersvilliers, and consists of the machinery building, which includes the boiler room, dynamo room, etc., the building for accumulator charging and the automobile-cab station to contain 125 cabs. Around the two last buildings runs a training track, 2,147 feet in length. In the generating room are two horizontal engines, each of which drives by means of a belt an Alioth 10-pole generator developing 150 electrical horsepower at 400 revolutions per minute.

The most original part of the whole installation is the charging station for accumulator batteries, which is a building on two floors, over 130 feet in length, and contains a 54-berth charging room on the ground floor and a double room on the first floor, with 52 and 53 charging berths, respectively. In Fig. 2 is illustrated the lower floor of this building. Down the center of each room runs a line of rails for the discharging carrier, and each charging berth has its independent carrier on its own pair of rails arranged at right angles to the central line. Light and air are supplied by large, wide-opening windows. The effect of the acid vapor is neutralized by tarring all the woodwork, and by making the floors of a mixture of asphalt and sulphate of lime. The expended acid water runs off to the sewers through lead conduits communicating with each berth. The distributing switchboards of five panels are placed behind a glazed screen at the end of each room, and consist of one arrival panel, with an ammeter for 800 amperes, a voltmeter and a bipolar circuit-breaker, and four departure panels, two for the right side and two for the left side, with ammeter, fuse and automatic switch (non-polarized) and unipolar circuit-breaker. The current is distributed to the charging-berth boards, along triple naked feeder cables of 0.093 square-inch section, painted different colors, to distinguish the positive and negative sides, the acid vapor having been found destructive of all other kinds of insulation.

The charging-berth boards carry an ammeter and rheostat, a fuse, a circuit-breaker and two flexible charging feeders, firmly connected one with each pole, so that any inversion of current in the batteries is impossible. The charging current is delivered at 110 volts; the batteries take nine hours to recharge, the first 25 amperes being taken up in two hours, and the balance in the succeeding seven hours; all three conductors composing the feeder are used till one-third of the charge is taken up, then two, and finally one for the last one-third.

To remove the expended accumulators and replace them by recharged batteries, the modus operandi is simple and expeditious, the importance of the time element in handling the batteries being thoroughly recognized. Under the covered veranda are three sets of two double platforms with inclined ends, up which the cabs whose accumulators require to be dealt with are run. These double platforms have an inner and an outer groove, to take the front and hind wheels, respectively, and a small hydraulic lift, just large enough for the battery carrier (a low four-wheel trolley), which works in between these platforms. The cab having been run up into place, the carrier is placed just underneath the accumulator battery, the lift is worked, and the battery raised and the springs compressed, so as to allow of its being unhooked from the suspending chains; the lift is then lowered, the carrier with battery removed, and the recharged battery replaced by reversing all the operations. The batteries to be berthed on the upper floor are taken up with their carriers by three hydraulic lifts working between the two floors.

The automobile house is capable of holding 125 electric cabs, and can be extended to hold 1,000, if necessary. It is light, convenient, and inexpensive in construction. Convenient workshops are attached

Ohio Telephone Notes.

The Home Telephone company of Toledo is quietly working on its subscription list, and will soon be able to ask the city for a franchise. It is said that the list will reach 3,000 in a very short time. The company will likely build its exchange in the Nasby building. Frank Graves is the manager.

The United States Telephone company has planned a line from Uhrichsville to Steubenville and Wheeling, W. Va. This line will connect with the Harrison County Telephone company at Cadiz. It has been planned to have exchanges built at Jewett, Scio, Harrisville, Freeport and Adena by the Harrison County company. This company is also arranging for an extensive farmers' service.

The new plant of the Miami Telephone company of Xenia is nearing completion. Its switchboard has a capacity of 1,000 lines and there are now nearly 700 subscribers. The switchboard and appliances are all of the latest design and the plant will be modern and up-to-date in every particular. The new offices have been nicely finished and furnished with the best fixtures, while the operating room will be completed in handsome shape, making a very pleasant place to work in. The old offices will be abandoned as soon as the new one is completed, and the wire and appliances will be used on country lines, which are being built in every direction. John F. Haverstick is the manager.

The Central Union Telephone company has cut its residence rates to 25 cents a month at Zanesville. This is in anticipation of the completion of the new Independent plant that has been established there.

The Findlay Home Telephone company has begun business recently.

The construction of the plant of the Star Telephone company of Ashland has been begun. The company has closed a lease for 25 years for the upper floor of the Guth building, which it now occupies.

The Stark County Telephone company has been granted a franchise to operate an exchange at Minerva.

The Lima Telephone and Telegraph company of Lima has been incorporated, with a capital stock of $150,000, to build and operate a telephone exchange and magnetic-telegraph system in Lima and also to operate toll lines and stations throughout Allen County. The incorporators are W. L. Parmenter, Henry W. Neff, Kent W. Hughes, Mike C. Purtscher and Joseph A. Dutton.

The Youngstown Telephone company will soon begin the construction of its lines.

The Citizens' Telephone company and the Home Telephone company, both recently incorporated, have applied to the City Council of Springfield for a franchise. O. M. C.

The Glencoe Electric Light company of Glencoe, Minn., has increased its capital stock to $25,000.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

Independent Telephone association of the United States, Convention Hall, Buffalo, N. Y., June 11th to 13th.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American Hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Independent Telephone Association of Wisconsin, La Crosse, Wis., June 25th and 26th.

Northwestern Electrical association, Sheboygan, Wis., June 26th and 27th.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

American Institute of Electrical Engineers (general meeting), Temple of Music, Buffalo, N. Y., August 20th to 24th.

Ohio Electric Light association Put-in-Bay, Ohio, August.

Pennsylvania State Street Railway association, York, Pa., September 4th.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Visitors to the Pan-American Exposition will find the Western Electrician's space in Section F 2 in the Electricity building, where they will be cordially welcomed.

The Western Electrician may be permitted to express its belief that, by telegraphing in full, from New York to Chicago, the text of Dr. A. E. Kennelly's recent Institute paper on the new Edison storage battery, it was enabled to lay before its readers the first publication of this important description. A pleasant letter from the author of the paper, given on another page, shows that this enterprise was appreciated. It is proper to add that the noteworthy accuracy of the telegraphic transmission of a technical paper, with chemical symbols and mathematical expressions, was due to employes of the Western Union Telegraph company.

The appointment of Prof. Ira Remsen, the eminent chemist, as president of Johns Hopkins University, shows that men of science are not nowadays ignored in the bestowal of the highest honors in the gift of the great institutions of learning in the United States. Professor Remsen's is not the first case of this kind by any means; it is easy to recall that a political scientist was recently called to the presidency of Yale, and several other instances could be enumerated among colleges and universities other than strictly technical schools. But the prominence of the Baltimore university and its new president serves to make the present case especially significant of a healthy tendency in American college life.

A considerable proportion of the readers of the Western Electrician is much interested in next week's Independent telephone convention at Buffalo. Such readers will find in this issue much matter that, while of general interest, is of especial value to them, such as the complete programme of the convention, a description of the Independent service and exhibits at the Pan-American Exposition, toll-line maps of Ohio and Wisconsin, and several other telephone articles of interest and importance. The Western Electrician extends its best wishes for the success of the convention and hopes the overshadowing exposition will not seduce members and visitors from their allegiance to the association.

By slight changes in the Machinery building at the Pan-American Exposition the engine and pump exhibits in the basement could be displayed to much greater advantage. One exhibitor makes the following complaint and suggestions: "We believe that 99 per cent. or more of the visitors might spend a week on the grounds, and would leave without knowing there is an engine exhibit. The engines are down in a hole, and there is nothing to indicate that the hole exists, nor that it contains an engine exhibit. This hole is roofed over as low down as possible to clear the tops of the flywheels of the engines, and a few inadequate skylights are inserted. It is entirely boxed in, and when the weather gets warm will be a 'sweat-box' in which we do not believe it will be possible for men to stay. We urge that the roof over the engine exhibit, which is building, and the inner partitions of the machinery building be removed, so that visitors may look down upon the engines from the Machinery building, and that suitable conspicuous access be provided to this exhibition space, with conspicuous signs in various parts of the Machinery building calling attention to the fact that there is an exhibition of steam engines."

While this statement is a trifle overdrawn, it is true that, in the early stages of the exposition at least, it is difficult to find the engine exhibits in the Machinery building or to view them in comfort when they are found. The engine builder's protest should be heeded, as apparently can easily be done. Although steam does not play a very conspicuous part in the Buffalo show, it should be given a fair chance.

Sociologically, the development of the possibilities of electricity is of importance, not alone as the electric railway relieves the congestion of cities and the telephone ameliorates the tedium of rural life, but in the rapid growth, or even actual creation, of communities adjacent to electrically utilized waterfalls. Thus at Niagara Falls the cheap electric power has brought many large and prosperous manufacturing concerns to the city, which have aided very materially in the rapid but solid growth that the city has experienced during the last few years. Citing another instance, Sault Ste. Marie, on the St. Marys River, on both the Michigan and Canadian sides, is a scene of present development, and the large amount of electric power which will be available there in a few years foreshadows expansion of the city's population and enterprises.

A noteworthy example of this class of municipalities, which are beginning to be called electric cities, is Shawinigan Falls, Que. This place, which two years ago had but a dozen residents, is now a thriving city of 4,000 people, all owing to the generation of electric energy there. The town is bounded on two sides by rivers, and the chief industries are the Shawinigan Water and Power company, having at present a capacity of 25,000 horsepower, with capabilities of developing 100,000 horsepower; the Pittsburg Reduction company; the Belgo Pulp and Paper company, which is building a large pulp factory; the calcium carbide works; large brick works and a cotton mill, about to be constructed. All these industries are the outcome of the electric-power development, and their installation and operation have brought to the place nearly all its inhabitants and made it what it is.

The report of Frank L. Wean, special master in chancery in the famous Peoria electrolysis case, which was filed with the clerk of the United States Circuit Court in Chicago last week and which is given in abstract in this issue of the Western Electrician, is one of considerable importance to the electric street-railway industry. In this litigation, which has been in progress for about three years, the Peoria Water Works company sought an injunction to restrain the local traction companies from the further operation of electric cars until the defendants should have made use of such appliances as would prevent the alleged leakage of their current to the pipes of the waterworks system, the complainant alleging that, under the present construction, its plant and property were being destroyed by electrolysis. In the master's report the waterworks company has won a victory. Mr. Wean states, what is, of course, perfectly true, that the defendants can prevent damage to the waterworks system from electrolysis caused by escaping street-railway current by the use of the overhead double-trolley system. He recommends the granting of the injunction sought and the awarding of damages for past destruction to the complainant's property.

This case has been noteworthy for the amount of expert testimony presented by both sides and for the time taken in the hearing and the preparation of the report just filed. This report must of necessity come before a judge of the United States Circuit Court for final hearing and approval. It is understood that the losing party will appeal the case to the higher courts, since both litigants are determined to make it a test case in the true sense of the word. Should the master's report be eventually sustained, many electric-railway companies throughout the country may be compelled to make alterations on their roads.

The Telephone Situation in Washington.

The decision handed down by the Court of Appeals in the case of Manning & Co. against the Chesapeake and Potomac Telephone company at Washington, D. C., is, for many reasons, one of widespread interest. Not only does it reverse the decision of the court below, but it sustains the constitutionality of the act of Congress, June 30, 1898, whereby the rates for service by the company were stipulated.

Telephone service in the District has reached its present high state of efficiency after many varied experiences, extending over a period of 23 years, and beginning with a service under the Bell patents in 1878, superintended by George C. Maynard, later custodian of the electrical exhibit in the National Museum of this city. In 1879 this company was merged into the National Capital Telephone company, operating under a West Virginia charter. Four years later this company entered into an arrangement with the American Bell Telephone company for the use of its service. Following this was the formation of the present company, with a capital stock of $8,650,000, organized under the laws of the state of New York, for the purpose of acquiring the business of the National company and of the Telephone Exchange company of Maryland. The purchase of the rights of the companies were made on July 30, 1883, the consideration for the National company being $750,000 of the capital stock of the present company, and for the Maryland company $1,900,000 of the capital stock of the Chesapeake and Potomac company. In the conduct of its business since that time 40 per cent. of the company's general office expenses have been charged against its plant operated in the District.

The suit just passed upon was brought in the Supreme Court of the District of Columbia for the purpose of compelling the company to render service at the rates prescribed by act of Congress, which made it unlawful to charge in excess of the following rates:

For the use of one separate telephone, $50 per annum; for the use of two telephones on a wire, $40 each per annum; for the use of three telephones on a wire, $30 each per annum; for the use of four or more telephones on a wire, $25 each per annum.

The contract entered into between the parties, on July 1, 1897, provided for a service at $125 per annum, payable quarterly in advance, $10 additional being paid each year for an extra desk cabinet. The contract was to continue from year to year, subject to termination upon 10 days' notice from either party. After the passage of the act, notice was given by Manning & Co. that they wished to terminate their contract. This was followed by a notification to the telephone company, 10 days later, to the effect that they would retain their telephone equipment at $50 per annum, and tendered payment in advance at the rate named, which was refused, as it was claimed that such a price would not cover the cost of the service. A renewal of service was offered at the old contract price, which was refused. The climax came in an injunction to prevent the telephone company from removing its instruments and a refusal of service when required, for which the plaintiffs were still ready to make payment at the statutory price. The bill was dismissed from the lower court on the ground that the rates proposed by the statute were unreasonably and oppressively low.

After giving a complete history of the case, the opinion touches on the power of regulation with regard to which it presumes that Congress acted with due consideration and all the knowledge of the facts and circumstances which it undertook to effect.

The defendant held its franchise under the laws of New York, and came to the District to engage in business without either invitation or expressed permission. Each time the company has obtained legislative permission for the extension or improvement of its service it has been with the express stipulation that such rights could be revoked at will and without compensation, and this would probably have been the case even had it been incorporated by act of Congress. In the event of such a repeal of rights the corporation would have the right to remove and take away all of its movable property for a similar use in some other city, while at the same time Congress would have an equal right to grant a franchise to some other corporation to use the poles and cables of the first company, proper compensation being made for same. Being a foreign corporation, Congress had the right to allow it to remain or to expel it, at pleasure, and while such action was not taken, yet, even though the act was general in its terms, it applied only to this company, by reason of the fact that no other company was pursuing the same business. It thus makes the statutory rate a condition of further tolerance, practically telling the company either to accept the rates named in the act or withdraw from the District. Congress could not, and did not, compel it to continue to carry on its operations at the statutory rates against its will.

In the event that the company had seen fit to cease its operations under these rates, Congress would have nothing further to do with it than to compel the removal of its obstructions from the streets and other public places. No court would have had the power to compel the company to carry on its business under these rules, but so long as it did elect to continue business, it cannot do so in defiance of the law, and must be regarded by the courts as accepting the conditions. Failure to comply with these conditions, combined with a continued effort to carry on the business, places the company within judicial power to observe the rates fixed by Congress until such time as subsequent laws may be enacted, or it may withdraw from business.

It has also been contended that the act of Congress in question is unconstitutional because it impairs the obligation of contracts entered into by the company with other persons. It is admitted that this would have been the case if Congress undertook to annul or destroy contracts in the nature of grants of private property or vested interests, in which case it might be claimed that such an act would be a usurpation of judicial power and a deprivation of property without due process of law, or without provision for just compensation; but no such contracts were in question, the contracts being those incident to corporate existence and franchises. Such contracts are subject to the dissolution of corporate existence, and all that remains of such contract obligations is the right in equity to their enforcement, when practicable, against the available property of the corporation in the act of winding up its affairs.

In considering the question of the rates as established by Congress being ruinously low, it is claimed that a very great, if not insurmountable, difficulty, in arriving at an accurate calculation as to the legitimate cost of service in the District, which is admitted to be exceedingly high when compared with that of other telephone exchanges throughout the country, lies in the fact that it is only one branch of a widely extended business, of which 40 per cent. of both its bonds and its expenses are charged against the District plant, together with its proportion of interest and sinking-fund appropriations. There is no evidence to show that such proportion of the bond sales was actually expended in the pursuance of its District business, nor that this percentage of the expense is the real and just proportion, business being carried on in Baltimore, several places in Maryland and some in West Virginia. The general offices are in Washington

Taking the actual expenses of the Washington branch as shown by the expert accountant of the company, it is estimated that the actual expense for each telephone operated between 1892 and 1897 was $66.57. In this cost was included annual rentals for receivers and transmitters to the American Bell Telephone company, 40 per cent. of the annual interest on bonds, and of the annual appropriations to the sinking fund, a large proportion of the cost of underground construction, substitution of new appliances and the entire cost of subscribers' connections. The majority of these charges are inadmissible as current expenses, the interest of the public and not of the stockholders being under consideration.

It has been virtually conceded that the interest and sinking-fund items are not chargeable as expense. There is no proof to justify the annual payments to the parent Bell company, as many of the patents which existed in 1883 at the time the contracts were made have since expired, and there is plenty of evidence to show that instruments of equal efficiency can be purchased outright to-day at a cost slightly in excess of one year's rental. It is also considered doubtful as to whether certain improvements can be charged to maintenance; yet it is admitted that the cost of connecting new subscribers and substitution of improved appliances may properly be chargeable to expense. And, further, the court maintained that $115,000 for a new subway with its extra conduits, should, more properly, have been charged to construction, in accordance with a decision of the Supreme Court in U. P. R. R. Co. vs. U. S., 99 U. S., 402, 420, the only time a similar question seems to have been under discussion.

Nor would the court agree to a proposition to charge from 10 to 15 per cent. of the value of the plant for depreciation to annual running expenses, as it is already covered by the regular annual charge for maintenance.

Averaging it, with considerable uncertainty, and making deductions mentioned, the annual average expense for the six years named would be less than $50 per telephone subscriber, leaving a possible margin for dividends of from two to three per cent. upon the actual cost of the plant, which has been estimated at figures varying from $428,000 to $450,000.

A comparison of the cost of salaries per telephone between Washington and other large cities is also taken up, although it was admitted that conditions differ so extensively that this is not a very safe basis for calculation, particularly when it is remembered that the conditions of Washington are peculiar in view of its wide streets, and the increased length of average distances, together with difficult conditions of construction. But it was claimed by the court that not even all of these would quite account for the vast difference in expense.

Again, it was not shown what proportion of the expense was due to outside connections, nor did it appear what proportion should be borne by the so-called private lines.

As the judgment appealed from was reversed on the grounds already stated, regardless of the fact that the statutory rate might be unjust, no particular statement was made up covering the items which would have entered into that consideration, and it was admitted that, had it been necessary, it would have been very difficult to determine from the evidence submitted what particular rate would cover legitimate expenses and in addition afford any return for the money invested.

The most the court felt called upon to say in this connection was that, from the evidence submitted, it did not appear that the enforcement of the statutory rates would be destructive of the defendant's rights of property.

For the reasons given the decree was reversed with costs, and the cause remanded for the entry of a decree granting the injunction in conformity with the opinion.

On motion of Attorney A. S. Worthington, the Court of Appeals has allowed the Chesapeake and Potomac Telephone company to appeal the decision of that court to the Supreme Court of the United States. The bond in supersedeas was fixed at $2,000.

Telephone News from the Northwest.

The Mower County Farmers' Telephone company has been formed at Dexter, Minn., to cover that county.

The Wisconsin Telephone company has about completed a long-distance line between La Crosse and Eau Claire, Wis. A line will soon be started from La Crosse to Dubuque, Iowa.

The La Crosse Telephone company decided at its recent annual meeting to make extensive improvements to its system in La Crosse, Wis., and place a large amount of its line underground.

The council of Brainerd, Minn., laid on the table a request for a franchise from the Iron Range Electric Telephone company. A resolution was adopted to appoint a committee to ascertain the character, condition and rate of telephone exchanges in the state, to the end that the council may be able to adjust the matter of exchange service and rates.

J. M. Ingraham has bought the telephone exchange at Sandstone, Minn., from H. Folsom, and will make improvements.

The Central Minnesota Telephone company has engaged George E. Darling, Jr., of Morris, Minn., to inspect the entire line, examine insulation, overhaul the batteries, etc. The system covers considerable local and long-distance service in Western Minnesota.

The Board of Fire Commissioners has secured from the Northwestern Telephone Exchange company 30 free connections in return for the exclusive use of the fire-department poles for its wires. This permission is revocable at any time the board may need the poles for its own use.

The telephone company at Brookings, S. D., will expend about $2,500 in improvements to the local exchange.

The Union Grove-Paris Telephone company, near Burlington, Wis., has declared a dividend of 18 per cent., after paying for incidental expenses and repairs. The line at Paris will be extended to Bristol.

The new local exchange at Woonsocket, S. D., has been completed. It starts with about 60 connections.

The Twin City Telephone company will make a proposition to establish a complete sub-exchange supplying the city hall and courthouse in St. Paul free.

The projected toll line between Atwater and Willmar, Minn., by way of Spicer, is to be constructed in spite of the inability to secure connection with the local exchange at Willmar.

The Dakota Central Telephone company has begun work on a new line between Hecla and Doland, S. D.

The Wisconsin Telephone company will proceed to construct an underground system for Appleton, Wis., at once.

The Twin City Telephone company will erect a $75,000 exchange in Minneapolis at Third avenue South and Seventh street. Plans for the building are being drawn.

The Mandan and Northwestern Electric company has extended a line of telephone from Mandan, N. D., to Oliver County.

Negotiations are pending for the consolidation into one company of the Little Wolf River, the Wolf River and the Fox River Valley telephone lines, making it the strongest Independent company in Wisconsin. The company will be known as the Fox River Valley Telephone company, with headquarters at Appleton, Wis.

The Martin Telephone company has ordered a new switchboard, and will install an exchange for Dayton, Iowa, as soon as possible.

Musson Bros. have applied to the village of Walnut, Iowa, for a local telephone franchise. The vote on the question will be taken June 11th.

The Iowa Telephone company has plans for a modern exchange building, which it is proposed to erect in Davenport, Iowa.

The Mutual Telephone company is building a line between Creston and Greenfield, Iowa.

The Standard Telephone company of Dubuque, Iowa, will make a number of extensions and improvements to its toll lines.

The Vinton Telephone company proposes a line from Vinton to Dysart, Iowa.

The Garnavillo Telephone company has filed articles of incorporation at Garnavillo, Iowa, with a capital stock of $10,000.

The Mount Ayr Telephone company of Mount Ayr, Iowa, has filed articles of incorporation, with $7,000 capital stock, for Mount Ayr, Iowa. R.

The Hiawassee Telephone and Electric company of Knoxville, Tenn., has about 150 miles of country road covered by wires, and the prospects of extensions are good.

Engine Builders' Association.

The Engine Builders' Association of the United States held a semi-annual meeting on May 28th and 29th at the Denison Hotel, Indianapolis, Ind. Twenty or more leading manufacturers, representing the states of New York, Rhode Island, Pennsylvania, Ohio, New Jersey, Illinois and Indiana, were present. The meeting being a semi-annual conference, no officers were elected. The present officers are: President, J. E. Sweet, Syracuse, N. Y.; vice-president, William M. Taylor, Indianapolis; secretary and treasurer, S. T. Baggs, Watertown, N. Y. The meeting was opened with an address of welcome by President Sweet, who reviewed the conditions of the business and dwelt upon the advantages that are derived by the members of the association.

Professor J. B. Stanwood of Cincinnati read a paper on "Experience with Throttling Engines," and C. G. Armstrong of Chicago one on "The Engine, the Heart of the Modern Building." The papers were discussed at the morning session; many pointed and interesting questions were brought out and experiences related. The labor question and control of prices was by the ingenuity of the president kept in the background, and the exercises made largely of a technical and social character. While the association, or its members, hold some interests in large manufacturing corporations, no intention was expressed at the meeting of their uniting for the purpose of controlling trade or hampering individual efforts.

At the Wednesday morning session Samuel H. Brubaker of Indianapolis read a paper on "The Relationship of Architects to the Engine Builder." Mr. Brubaker said the architect had to have a training in so many lines that it was impossible for him to be an expert on engines, but what he did know was apparently not appreciated by the engine builders. This paper brought out many friendly criticisms, and the countercharge was made that the architects often thought they knew more about the engines and that they were in the habit of putting the engine room in some secluded nook, so built around that the machinery had to be put in position before the building was completed. It was decided that it would be advisable if some concerted action be taken in uniting the two interests. The last paper, on "Conditions and Warranties of Construction Contracts," was prepared by Edward H. Burdick of Syracuse, N. Y., but, owing to his absence, it was read by Secretary Baggs. This paper, though somewhat semi-legal in character, brought out considerable discussion.

The afternoon of Wednesday was given up to a secret session for the purpose of regulating certain abuses of the trade, and reaching some agreement, so that in constructing engines for electrical work there may be more uniformity of patterns, thus simplifying the work.

On Tuesday evening the engine builders were entertained at the Commercial Club with a smoker, to which all members of the club and many citizens joined in entertaining the visitors. On Wednesday evening a banquet was given at the Denison Hotel, and the members of the association were profuse in expressions of the gracious manner in which they had been entertained. The meeting adjourned, to meet in New York next November, at which time new officers will be elected.

American Society of Mechanical Engineers.

The forty-third meeting of the American Society of Mechanical Engineers, which was held in Milwaukee on May 28th, 29th, 30th and 31st, proved to be one of the most successful meetings the association has ever had. The attendance was above the average, there being upward of 400 members and guests who registered during the meeting. On Tuesday evening Professor W. S. Johnson, chairman of the local committee, gave the address of welcome, the response being made by Samuel T. Wellman, president of the society. Different phases of the machinists' strike were touched upon by both gentlemen. Papers were read by Professor W. S. Aldrich of the University of Illinois on "Requirements of Electricity in Manufacturing Work" and by John Riddell of Schenectady, N. Y., on "Portable versus Stationary Machine Tools." Professor Aldrich's paper was discussed at some length.

The programme for the succeeding days was carried out practically as arranged and announced beforehand. The social features were admirably managed by the local committee. Excursions were made to some of the large manufacturing plants and trips were taken to Waukesha and other points of interest. On Wednesday a members' reception and conversazione was held at the Deutscher Club, and on Thursday evening an informal smoker, given by the local members at the Plankinton House, concluded the day's programme. In accordance with the custom of the society, all of the papers scheduled for the meeting were presented in abstract form, thus allowing more time for the discussions. About 30 representatives of the society at Troy, Albany and Schenectady in attendance presented an invitation to the society to hold the next spring meeting in Saratoga, N. Y.

Chicago Electrical Association's Banquet.

The first decennial banquet of the Chicago Electrical association was held in the banquet room of the Grand Pacific Hotel, Chicago, on the evening of June 4th, and was undoubtedly the most successful banquet that the society has ever had. The association gives a dinner each spring, and this one was given as a decennial celebration of the founding of the society on April 2, 1891. W. Clyde Jones acted as toastmaster, and he carried the programme through in a happy and spirited manner. The first speaker was Thomas G. Grier, who gave a reminescent talk on "The Association a Tenth of a Century Ago." Professor Dugald C. Jackson of the University of Wisconsin spoke on "Ten Years of the Infant Industry at College." His address dwelt chiefly on the work of the student at technical schools, the point being made that the principal thing accomplished by the engineering colleges of to-day is not to pound theory into a student's head, but to train him so that he will be able to think for himself, and rely upon his own common sense.

The next toast was responded to by Kempster B. Miller of the Kellogg Switchboard and Supply company, his subject being "A Decade of the Treble Hello." Mr. Miller spoke of the great importance of the telephone in every-day life and of the benefits derived from the growth of Independent telephony in stimulating the Bell company to put forth its best efforts in order to meet the competition. As a representative of the Bell interests, A. V. Abbott, until recently chief engineer of the Chicago Telephone company, was called upon to respond to "Scientific Accomplishments of the Decade." He said he was glad that the Independents had created competition in the telephone field, and he hoped for a friendly rivalry between the two interests which would be beneficial to both. He spoke of the chief scientific developments from the very beginnings up to the present time and touched on the possibilities that the future might bring forth. Mr. Abbott's address was marked by many happy allusions.

Following Mr. Abbott, Professor P. B. Woodworth of the Lewis Institute, Chicago, gave a toast on "Ten Years of Electrical Accomplishments." Professor Woodworth spoke of the beginning of the street-railway industry and then dwelt upon the change in the engineers turned out by the technical schools of to-day as compared with those of 10 years ago. He said that a freshman in college now was practically as far advanced as the graduate at that time. Owing to the electrical and other engineering societies and technical journals, the professor asserted that the ambitious young man of 15 years of to day is ahead of a man 25 years of age a decade ago.

The closing toast of the evening was made by R. F. Schuchardt, president of the association, who spoke on "A Decade Hence?" Mr. Schuchardt recited the beginnings of the society and its work during the last 10 years. He predicted a bright future for the association and that it would continue to be a great help to its members in providing a sort of post-graduate course to the young engineer. The president hoped that the society would soon be able to publish its own proceedings, recommended that monthly instead of semi-monthly meetings be held and presented the wish that another 10 years would find the association in possession of its own clubrooms and with an electrical library second to none.

About 40 members and guests were in attendance at the banquet, the principal guests outside of gentlemen already named and the membership of the association being H. H. Cutler of Milwaukee and H. H. Waite and E. P. Warner of Chicago. The committee in charge of the banquet consisted of W. Clyde Jones, Francis B. Badt and W. J. Warder, Jr.

Street-railway Consolidation in Chicago.

Rumors are still current that there is to be a consolidation of the important surface street-railway lines of Chicago. It was reported last Saturday that the Chicago Union Traction company had undertaken negotiations in earnest for the acquisition of the Chicago City Railway company and that large stockholders had been asked regarding the sale of their shares. Control of the City Railway company is held by comparatively few large owners, and the purchase of the controlling interest probably could be made without a general appeal to the stockholders. It is believed that the final purpose of the Union Traction company at the time it was organized was the complete control of the street-car lines of the city, and it has been expected for some time that the deal would be taken up.

Death of J. W. Dickerson.

John Wilmer Dickerson, formerly associate editor of the Western Electrician and connected at various times with other technical journals and newspapers, died in Brooklyn on May 30th. Never of robust physique, with a spirit too energetic and ambitious for its tenement, Mr. Dickerson had been in poor health for several years. Seeking a more favorable climate for a bronchitic affection, he went to Colorado late in 1896, and although successful in attaining the object of his search, he suffered a paralytic stroke three years later, from which he never entirely recovered and which was undoubtedly the indirect cause of death, although in his last illness his disease was diagnosed as cerebritis.

The son of the late Rev. James S. Dickerson, D. D., a prominent minister and editor in the Baptist denomination, J. W. Dickerson was born in Philadelphia, January 13, 1861. In boyhood he lived in Pittsburg and Boston, and later in Chicago, where he prepared for, and in due time entered, the old University of Chicago. He did not finish the course at this institution, however, removing to Rochester, N. Y., where he entered the University of Rochester, graduating with honors in the class of 1883. By inheritance and natural aptitude the young man was attracted toward literary pursuits, and he did considerable writing for the press during his college years, entering actively into daily-newspaper work in Rochester upon his graduation. The excellence of his work attracted attention, and in 1888 Mr. Dickerson accepted an invitation to become a member of the editorial staff of the Western Electrician. This journal was then but one year old, and although its success had already been established, Mr. Dickerson did much, by his taste and skill as a journalist, in assisting in its development in the earlier years. When he resigned from the staff, early in 1891, he was the first associate editor. During this period Mr. Dickerson made many friends among men engaged in electrical and allied pursuits by his worth of character and bright, pleasing manner.

J. W. DICKERSON.

During the five years that elapsed between his resignation from the Western Electrician and his removal to Colorado, Mr. Dickerson was engaged on several electrical and street-railway journals in Chicago and New York. He gradually became interested in business pursuits, however, and when his health became impaired, withdrew almost entirely from technical journalism. He retained an interest in it, however, and contributed occasional articles to the technical press, as his health permitted, almost to the last. He took up his residence in Denver in 1896, but as his bronchial trouble improved he spent considerable time in the East, in the futile hope that his health might become entirely re-established. He had been but a few months in New York when taken with his last illness, which was of eight weeks' duration. The remains were taken to Rochester for interment.

At the time of his death, and for some years before, Mr. Dickerson was president of the Calumet Tea and Coffee company of Chicago. He was also interested in telephone and other business enterprises. He was unmarried. The surviving relatives are a mother and two sisters—Mrs. Emma R. Dickerson and Misses Julia and Grace Dickerson of Newton Center, Mass., and a brother, J. Spencer Dickerson, of Chicago.

John W. Dickerson was a true man. His ideals were lofty and his conduct clean. He was upright and honorable in all his relations with his fellows. In intellect he was exceptionally bright; his thought was nimble and keen and his talent for repartee was marked. He had a nervous, intense temperament, and was at times self-distrustful. When in health he was vivacious and merry—a central figure in any social party of which he might be a member. He was greatly devoted to his friends, indifferent to uninteresting people, but malevolent toward none. He was a careful, graceful writer; but his work in this direction gave less indication of the incisive sprightliness of his conversation than might be supposed. His personality and address were most pleasing. He left no enemies, but many warm friends whose grief is real and profound.

Peoria Electrolysis Case.

Frank L. Wean of Chicago, special master in chancery in the case of the Peoria Water Works company against the Central Railway company and the Peoria and Prospect Heights Railway company of Peoria, Ill., has recently filed an opinion in the United States Circuit Court for the Northern District of Illinois in favor of the complainant. This case, which is popularly known as the Peoria electrolysis case, was started by the filing of a petition for injunction in March, 1898, by Cornelius B. Gold, at that time receiver for the waterworks company. On May 26, 1898, Judge Grosscup of the federal court appointed Mr. Wean to take evidence and report the same to the court, together with his conclusions thereon. The case was set for hearing at Peoria on December 15, 1898, and adjournments were had from time to time, evidence being taken in Peoria, Chicago, Cincinnati, New York city, Brooklyn, Albany, Philadelphia, Pittsburg, Milwaukee and Terre Haute.

In the petition for injunction it was alleged that the railway companies were destroying the plant and property of the waterworks company by electrolysis, the prayer of the petition being for an injunction operative after a reasonable limit of time against the further operation of electric cars, until the defendants should have made use of such appliances as will prevent the grounding of electric currents and their coming in contact with the pipes and mains of the waterworks system.

The Peoria Water Works company owns the water system of Peoria, including about 85 miles of mains and 5,000 service pipes, and is operating under an ordinance granted in 1889 and amended later in the same year and in 1890. The Central Railway company and the Peoria and Prospect Heights Railway company operated all the street-railway lines existing in Peoria at the time of the filing of the petition, consisting of about 43 single-track miles of electric street railway, and the cars of all the lines were operated from the power station of the Central Railway company. None of the ordinances granted the railway companies prescribe the particular system of operating by electricity to be used.

The opinion states that there are at present 17.84 miles of streets in Peoria in which the complainant's water mains are laid and on which the defendants' street-railway lines are located and operated. Of this mileage 15½ miles of water mains were in existence before any license was granted by the city to lay street-railway tracks or to operate any kind of a street railway. After stating that the defendants' lines were operated by the overhead single-trolley system and describing that system briefly, the report continues as follows:

"The railway tracks of defendants' railways are necessarily electrically insulated from, and in electrical contact with, the earth, although in the business portion of the city of Peoria the streets upon which such tracks are laid are, for the most part, paved with a brick pavement laid upon a concrete foundation. A part of the returning electric current, after going through the car motors to the tracks, finds its way from the rails, through the ground, to the water pipes of the complainant, and makes use of the same as a part of its circuit back to the generator in the power station. Wherever this current (in compliance with the law of least resistance) escapes from these pipes into the moist earth, it sets up a chemical action, which causes a decomposition of the metal pipes that is similar to the action which takes place in an electroplating bath. This is called electrolysis.

"The soil in and around Peoria, in which the water pipes and mains of complainant's system are laid, is of a moist, sandy character, and often furnishes a path of comparatively low resistance to the electric current. Samples of soil which were taken from the immediate vicinity of complainant's service pipes show traces of lead which had been deposited there by the action of the electric current, and the metal from these water pipes is frequently found deposited in the form of some of its compounds along the path of the current from the pipe to the rails of the defendant companies.

"Samples were analyzed from pits in complainant's water pipes and from the soil in the vicinity of such pipes. The materials which came from the pits in the cast-iron water pipes were found to be the products of decomposition of the metal in the pipes, resulting from the defendants' electric current passing through the salts in the surrounding soil. This action, produced as aforesaid, has destroyed many lead service pipes of the complainant, and has resulted, so far, in pitting and weakening many of the pipes and mains of its water-distributing system.

"In the months of May and June, 1894, an extended examination of the water-piping system, then in possession of the aforesaid receiver, was made by electrical experts, and more than 1,000 electrical measurements taken, which showed that, at that time, there was in every instance a difference of potential, indicating flow of electric current between rails and pipes. This difference of potential or electrical pressure was found to vary in different cases from a fraction of a volt up to 45 volts. The measurements showed that in some places the flow of current was from the rails into the pipes, and in others, from the pipes into the rails. Actual tests, made at that time, showed a loss of metal in single service pipes of over a pound of metal per month, the observations indicating that many other pipes were deteriorating at the same rate. Excavations were made in a number of places for the purpose of inspecting the pipes to ascertain their actual condition. Many of these pipes were found to be wasting away, and there was evidence that rapid electrolytic action was taking place.

"On April 6, 1894, the receiver of the Peoria Water company, who was in possession and operating the waterworks plant, caused notification to be made to the Central Railway company: 'That the Peoria Water Works company for a long time past has been and is now daily suffering and sustaining great injury and damage to its lead and iron pipes and other underground property in the streets and alleys of Peoria; that it is put to great labor, expense and trouble in making and keeping up repairs on its said pipes by reason of the improper and unlawful use by you of the ground as a return conductor for electrical currents, and by the illegal, careless and improper use of electrical currents generally by you.' Similar notices were given to the mayor and Common Council of the city of Peoria on or about November 24, 1893, December 8, 1893, December 19, 1893, January 2, 1894, and on February 7, 1898, which said notices called upon the city for protection, under the waterworks ordinance, against damages which the notices alleged were then being suffered.

"Another examination of the water-piping system now owned and operated by the complainant, but then in the possession and custody of the said receiver was made in the early part of 1898, by the same experts who made the examination in 1894. An electrical survey was made with a view to a comparison between the conditions existing in 1894 and 1898. The experts found and reported that the destruction was taking place more rapidly in 1898 than in 1894, and that it was being caused by electric current generated by the defendants herein.

"During the progress of the taking of defendants' testimony in this case, it appeared, from the evidence, that some of complainant's iron gate boxes were located near the rails of defendants' track, and it was contended by defendants' counsel and experts that enough current was diverted by reason of the proximity of these gate boxes to account for all the electrolysis claimed by the complainant. It was contended by complainant and its experts that in no case did any actual contact exist between the gate box and the rail except in instances while a car was passing over the box. Nevertheless, 35 of these gate boxes were taken out and replaced by vitrified tile pipe, a non-conductor of electricity. In other cases, the gate boxes were entirely removed and not replaced, because not needed. This change left no gate boxes within one foot from the rails. Examination and tests made by both parties after this change in the gate boxes showed large quantities of electric current from defendants' system still traveling upon complainant's pipes.

"In June, 1899, and after considerable improvement had been made by the railway companies in the way of heavier rails and better bonding and an improved return-feeder system, another electrical survey was made of the existing conditions between the rails of the railway companies and the water mains of the complainant. This survey showed that a large volume of current was still flowing between the rails of the defendants and the pipes of the complainant, the voltmeter showing 10 different readings of 10 volts and over, the highest found being 35 volts, rails positive to pipes.

"A difference in potential of the fraction of a volt will cause electrolysis, and from the conditions hereinabove found and stated, the ultimate destruction of complainant's pipes by the currents of electricity allowed to escape from defendants' system is a question only of time and pressure.

"The evidence discloses no known method by which the complainant, by its own action, can protect its water-distributing system of pipes and mains from the electric currents of the defendants' single-trolley railways.

"The evidence discloses no complete remedy for the injury to these water pipes, except the entire removal of electric current from the water mains; such removal is impossible, so long as the return currents of the electric railways are grounded or in electrical contact with the earth. The other methods which have been suggested by the defendants in this case do not, in practice, and cannot, prevent the escape of a portion of the current into the ground and water pipes.

"The defendants can prevent the injury by controlling the current generated as aforesaid, by means of the use of a complete metallic circuit, insulated from the rails and ground, providing a channel for the return of the current to the generator as perfect as the channel that is provided to supply the power along the street for use. In the District of Columbia, outside of the city of Washington, the double trolley has been and is being installed by a number of roads, under acts of Congress, providing in substance that where the overhead trolley is used it must be the double trolley, and also, that no portion of the electrical circuit shall, under any circumstances, be allowed to pass through the earth, and that neither pole of any dynamo furnishing power to the line shall be grounded. This action by Congress was caused by the interference of the electric current of the single-trolley railways, with underground metallic structure in Washington and the surrounding territory. The overhead double-trolley system has been used in Cincinnati, Ohio, for 10 years, and has been shown by experience during that time to be practical, economical and satisfactory, and the evidence shows that by its use in this case the return current might be carried back to the dynamos without coming in contact with the earth at all, and the difficulty from electrolysis thus completely be overcome. The original cost for installation of the double-trolley system is considerably more than for the single-trolley system. While the evidence in the record as to the exact cost of changing the defendants' system from the single to the double trolley is conflicting and unsatisfactory, it is sufficient to determine the fact that such cost would not be so unreasonable and excessive as to make it impossible for the defendants to adopt the double-trolley system.

"The defendants' negative-return system is as good or better than the average used by overhead single-trolley, electric street railways in cities of the size of Peoria, and the defendants have done all that can be done, under the present state of the art, so long as the single trolley is used, to care for the safe return of their electric currents; notwithstanding this, it clearly appears from the evidence that a portion of the returning current continues to escape to complainant's piping system, and necessarily causes injury, and ultimately destruction thereto.

"At least 25 miles of complainant's water mains are laid under streets paved with permanent and expensive pavement, and practically no access can be had to these mains except when made necessary by actual breaks in the pipes. The fact of injury to these mains in this territory from the electric current of defendants is capable of demonstration, and has been demonstrated in this case, though it is impossible to determine the exact extent of the injury to the whole system at any given time.

"The ultimate facts disclosed by the evidence may be briefly summarized as follows:

"1. The injury complained of exists.

"2. The injury is permanent and continuing.

"3. The injury has been and is being caused by the defendants.

"4. The complainant can do nothing to prevent the injury.

"5. The defendants can prevent it by use of the overhead double-trolley system, or by any system which provides a completely insulated metallic circuit for the electric current.

"6. The overhead double-trolley system, though more expensive to install, has been demonstrated, by use and experience, to be as safe, economical and satisfactory in its operation as the single-trolley system."

After reciting his conclusions as to why the court has jurisdiction in the case and why the municipality has the right to grant the use of streets to a water company, the opinion concludes as follows:

"In view of the law in Illinois, relating to the use of streets, which has become a 'rule of property,' and therefore will be followed by the federal courts, it cannot be held that the use of the streets for water pipes is in any sense subservient to the use for electric street-railway purposes, assuming that both uses have been granted by the municipality in the proper exercise of its authority.

"Both parties to this suit acquired their rights in the streets by a grant under statutory authority from the city of Peoria, by ordinance passed by the Common Council. Each occupies the streets by legal authority. Each is performing a duty to the public and each is compelled, under the ordinance of the city and the law, to serve the public. Each has money and property invested in its system and plant, a considerable portion of which, in each case, occupies the streets by such legal authority. Both are entitled to the equal protection of the laws against the invasion of their rights and property by others.

"The injury which is being done to complainant's water pipes by the defendants' currents of electricity is not a mere incidental injury or inconvenience, but is a permanent, continuing injury to a legal right, which will, in effect, if the injury is permitted to go on, ultimately result in the absolute destruction of complainant's plant and property. This would amount to nothing less than the taking away from complainant of the use of its property by the defendant street-railway companies, which, if it be done under their license from the city, authorizing them to 'propel their cars by electric motive power,' would be a taking of private property for public use. The constitution of Illinois provides that 'private property shall not be taken or damaged for public use without just compensation.'

"The license from the city of Peoria to the defendants, while it grants the right to them to lay their tracks and 'propel their cars by electric motive power,' does not assume to give the 'right' so to construct or operate their systems as to damage the property of others who have equal rights to the use and enjoyment of their own property. A fortiori, this is true because of the fact that it is possible for the defendants so to construct and operate their railways by electric motive power as not to interfere with or injure the water pipes of the complainant. But even if such license did assume to grant the 'right' to operate in the manner in which the defendants are operating, regardless of injury to others, the law would not tolerate such use, because of the provisions of the constitution above quoted.

"The injury complained of in this case is the direct and immediate result of defendants' acts—as much so as if the defendants were deliberately to uncover and destroy by any other means the water

pipes of complainant. The defendants, by taking the necessary, reasonable precautions in operating their railways, would be able to avoid the injury, and, this being true, their failure to take such precautions must be considered as negligence. It is as much the duty of the defendants, then, to refrain from injuring the property of the complainant by the one method as it is by the other. The complainant is as much entitled to protection against the injury from defendants' electric currents, negligently allowed to stray upon its property, as it would be to protection from the wanton destruction of its property by any other direct means which might be employed by the defendants. The maxim, 'Sic utere tuo ut alienum non laedas,' applies even under the strictest limitations of the rule which have ever been applied by the courts in any case.

"Although the defendants are operating their railways under ordinances from the city, granting them a license to propel cars by electric motive power, and, in so doing, are interfering with the property and water pipes of complainant, such interference and injury is not damnum absque injuria, because:

"1. It is possible for the defendants so to operate their railways by electric motive power as not to injure the complainant's property.

"2. It is impossible, by any known method, for the complainant to protect its property from such injury.

"3. Where there are two methods of accomplishing a legal result, and one method will work an injury to another and the other method will not, it is the duty of the person doing the thing to use that method which will not result in injury to such other person.

"4. The failure on the part of the defendants to observe such duty constitutes negligence, and when it results in damage to another, such damage is actionable.

"The injury found to be going on in this case is the direct consequence of the unnecessary and wrongful acts of the defendants in accomplishing a legal result, that is, the propulsion of cars, and, unless the defendants are protected by their license from the city, they are liable to the complainant for such injury. These acts, unnecessary and wrongful in themselves, are not rendered lawful by the ordinance granting the use of the streets for the purpose of propelling cars by electric motive power, and, inasmuch as they work 'hurt, inconvenience and damage' to the complainant, they constitute a nuisance which is actionable at the suit of the injured party.

"The injury complained of being actionable, there can be no doubt of the power of the court to grant some remedy. The damage already done is chargeable to the defendants, and so far as such damage is capable of being definitely ascertained, the defendants should be held liable in a suit at law. But a suit and recovery at law would not stop the injury, which is, and must necessarily be, continuous under existing conditions. The very life of complainant's plant and franchise is threatened. The only adequate remedy is, therefore, by injunction, as prayed in the petition.

"The special master's conclusion is that the bill and evidence make a case of equitable jurisdiction and that an injunction should issue as prayed, subject to such reasonable conditions as to the court may seem right."

Mr. Wean's opinion and recommendations will now be taken up by some judge of the United States Circuit Court, and while the case is a local one in Peoria, if the decision be sustained, it will doubtless have a national bearing on electric-railway companies.

The decision of Special Master in Chancery Wean of Chicago in the Peoria electrolysis case, holding that the current from the single-trolley wire escaping into the ground and doing damage to water pipes creates a good cause of action, is attracting much attention in Indianapolis, from the fact that the same question has been raised in a suit by the Natural Gas company against the Indianapolis Street Railway company. An injunction is asked and $50,000 damages. The court has held the complaint good, and the case will come up for trial on its merits the first week in September.

American Battery Company's Accumulator.

The special telephone type of storage battery manufactured by the American Battery company of 172 and 174 South Clinton street, Chicago, is put up in lead-lined tanks, provision being made so that a battery of any capacity can be supplied. The plates are supported on special glass separators. In the accompanying illustration is shown a cell of the American company's type C elements in a lead-lined tank. The manufacturer states that it has equipped 218 common-battery telephone exchanges with its storage cells. The company will have a battery in operation at the Pan-American Exposition, it being a part of the power equipment of the American Electric Telephone company's exhibit.

The erection of an electric power plant for the use of sugar and rice industries is included in the plans of a proposed railway company at Thibodaux, La. L. H. Lancaster, engineer of the proposed road, says that it is expected that 70 miles of road in all will be built.

Central Company's New Telephone Instruments.

Some new designs in telephone apparatus have recently been prepared for the market by the Central Telephone and Electric company of St. Louis, Mo. Two of these designs are illustrated in the accompanying pictures. In Fig. 1 is shown the Central company's new No. 1 desk telephone. This instrument is made in the well-known Bell style, with such improvements as experience has taught were beneficial. The base and stand are heavy castings, nickel-plated over brass, making a very substantial instrument. Platinum contacts are used on the gravity hook. The transmitter is of the improved Twentieth Century type, with induction coil in the base. The receiver and connected cords are silk-wrapped. Either an adjustable hard-rubber case receiver or a solid receiver is furnished, as desired. The terminal block of the instrument is provided with binding posts and connections marked plainly.

Fig. 1.

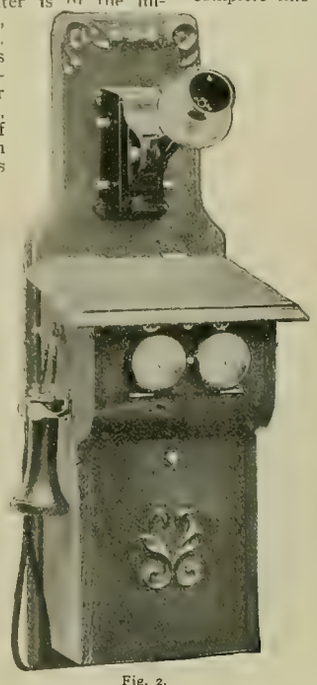


Fig. 2.

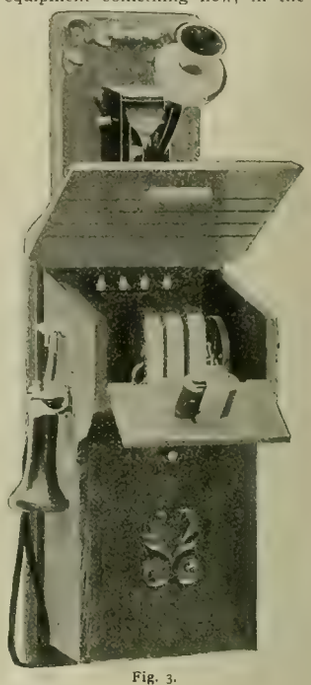


Fig. 3.

CENTRAL COMPANY'S NEW TELEPHONE INSTRUMENTS.

Figs. 2 and 3 show two views of the company's "Our Leader" telephone. The instrument is of an exclusive design of the company's, made with the view of combining efficiency, utility, accessibility and handsome appearance. All parts of the instrument are of a high-grade construction. The receiver and generator handle are on a level with the arm, while the transmitter is, of course, on a level with the mouth. Transmitter connections are made to four binding posts, so that this part can be removed in a short space of time. The rest of the working parts are in the box beneath the writing desk and are easily accessible by removing two screws and raising the lid, as shown in Fig. 3. The appearance of the instrument is said to be all that could be desired. The telephone is furnished in either golden oak or walnut, and two Columbia dry batteries are supplied with each instrument. These instruments are furnished with series or bridging generators.

AMERICAN BATTERY COMPANY'S ACCUMULATOR.

Suit Involving Strong Patent Delayed.

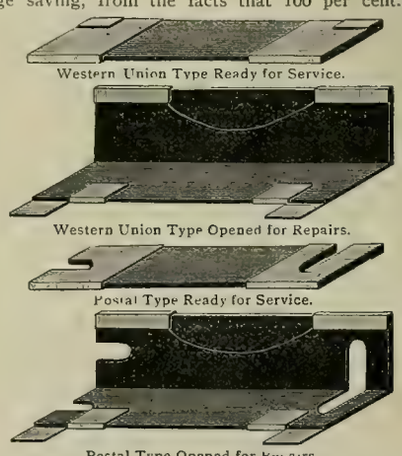
The Atlantic and Western Telephone company will have to file amended papers in its $50,000,000 suit against the American Bell Telephone company, which it has started in the United States Circuit Court at Chicago. The defendant filed a demurrer to the bill of complaint. Judge Kohlsaat has passed upon the demurrer, holding that the point of the jurisdiction of the federal court is not sufficiently set forth in the bill. He accordingly gave leave to the complainant to file an amended bill. This is a suit in which $50,000,000 damages is asked against the defendant for alleged infringement on a telephone patent of Henry C. Strong, owned by the complainant company. Mr. Strong claims that he received on February 24, 1885, letters patent for a telephone device which covers the basic principles on which the American Bell Telephone company operates.

Sterling Renewable Fuses.

The Sterling Electric company of Lafayette, Ind., one of the largest manufacturers of telephone apparatus in the country, has added to its already complete line of equipment something new, in the shape of a renewable fuse. In the manufacture of its different protective devices the company discovered that the fuses offered upon the market were not substantial, and easily broken before operating. Consequently, the company has perfected a fuse which is said to be practically indestructible. The whole of it is always ready for use, regardless of the handling, and it can be re-fused, as its operation does not destroy anything but the fuse wire itself. The fuses are made in standard sizes of 1½ to four inches, either of the Western Union or Postal type, the fuse wire having a capacity of from one-eighth of an ampere to two amperes.

The body of this new article is made of black fiber, so creased that it can be folded in a book form. This body is tipped with copper. The fuse wire is soldered between the copper tips upon the inner side of the fiber folder. After being fused it is folded together and clamped with a portion of the copper tip. In this way the fuse wire is always enclosed in a slack form. It admits of cleaning, bending, twisting, or rough handling, without destroying the fuse.

In the operation of the fuse the electric current only destroys the fuse wire. The folder can be reopened and a new fuse soldered to place between the terminals. The users of fuses of any description can see the practicability of this device and the large saving, from the facts that 100 per cent. of the fuse is good to start with, regardless of the handling, and that it is readily re-fused at practically no expense. In the accompanying illustrations are shown the Postal and Western Union types of the standard two-inch fuse opened for repairs and also the same fused, ready for service.



Western Union Type Ready for Service.

Western Union Type Opened for Repairs.

Postal Type Ready for Service.

Postal Type Opened for Repairs.

STERLING RENEWABLE FUSES.

Boston Combination Chandelier and Ceiling Fan.

The accompanying illustrations show exterior and sectional views of an interesting and novel combination ceiling fan and chandelier made by the Boston Electric Heating and Power company, Boston, Mass. Fig. 1 is an external view of the combination, while in Fig. 2, to the lettering of which references are made below, are shown the interior and working parts. (A) is the yoke of the fan, (B) the resistance, (C) the snap switch, and (D) one of the live rings by means of which the electrical connections are made. (G) is the bracket arm of

FIG. 1. BOSTON COMBINATION CHANDELIER AND CEILING FAN.—EXTERIOR VIEW.

the chandelier and (H) is the oil tube, shown open for insertion of oil. The fan (K) is attached to the lower end of the hollow shaft and the thumbnut (L) is attached to the switch spindle which projects downward through the hollow shaft.

The yoke (A) is fastened to an ordinary pipe hanger at its upper end and at its lower end are attached the motor and working parts. Connected with this yoke, but insulated from it, are two metal rings with suitable binding posts, to which the line wires are attached, these wires being carried to the switch, motor and electric lights in the arms. By this arrangement the wiring, which in a four-arm chandelier would otherwise be complicated, is of a simple construction. Within the yoke is hung the switch, which, with the resistance, gives the two speeds that are found in practice to be ample in this style of fan. Full speed is about 650 revolutions per minute and slow speed about 450 revolutions.

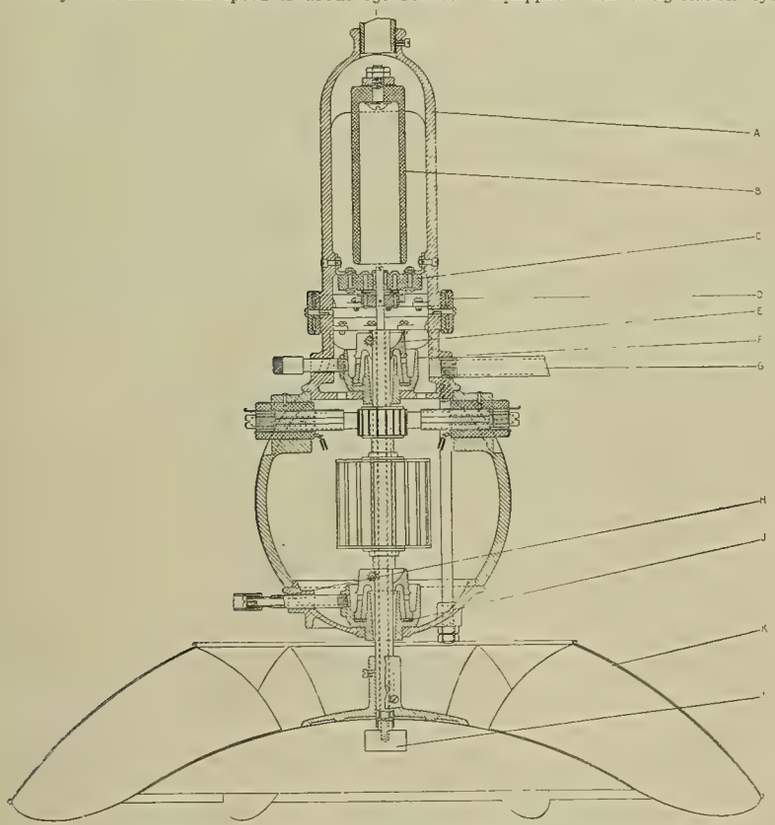


FIG. 2. BOSTON COMBINATION CHANDELIER AND CEILING FAN.—DIAGRAM OF PARTS.

Attached to the hollow shaft is the hardened tool-steel step (E), having a downwardly projecting flange which enters the composition cup (F) in such manner that while guiding the shaft it allows no portion of it to touch the bearing. The well in the center of this composition cup (F), together with the holes in the flange, prevent any oil from working up the step, and thence on to the shaft and downward into the motor. The arrangement of the oil tube is such that oil may be inserted until it overflows at the point of insertion, without a possibility of any flowing into the well in which the shaft runs. As the upper and lower bearings are practically alike, it will be seen that, no matter how careless be the oiling, there is practically no danger of getting oil into the motor or throwing it from the fan.

The lower bearing is provided with the hardened-steel washer (J), upon which the flange of the step rests, thereby supporting the entire load of the shaft and fan. The fan consists of upper and lower spun-brass disks, the upper disk having an opening in the center for the inlet of the air supply. These floats are arranged vertically about the center of rotation. The lower disk is attached to the hub, which in turn is attached to the hollow motor shaft. This arrangement of disks and floats forms a noiseless centrifugal fan of such shape that when it is revolved the air is delivered outward and downward in the form of a cone. An 18-inch fan, it is said, will cover, with a sufficient breeze, an area 18 feet in diameter, other sizes in proportion.

Western Electrical Supply Company's New Building.

At the corner of Seventh and Clark avenues, St. Louis, Mo., stands a very substantial five-story-and-basement brick building, occupied by the Western Electrical Supply company. The accompanying illustration of the building gives one a fair idea of its general appearance. The building was erected for this company in the last year, and contains every modern appliance necessary for the rapid and intelligent handling of electrical business, and is said to be the most complete occupied by any electrical jobber in the country.

The building was erected under plans and specifications approved by the company. The walls are extremely heavy, the floors and columns being calculated to carry heavy loads; the upper floors are fitted up with shelving, bins and cases, while the first floor is divided into general offices and the shipping department.

The company's offices are handsomely finished in natural oak, and present an attractive appearance. The shipping room, in the rear, is especially large and convenient, and goods can be shipped from it on three different sides. An electric elevator, capable of carrying heavy loads, is installed, and the building also has its own steam plant. The basement, 15 feet in height, is finished with a granitoid floor, and has windows on three sides, furnishing abundant natural light. The entire building is equipped with a 25-station system of the Allen-Hussey intercommunicating telephones. In addition to this building, the company also has two large warehouses. It is claimed the company carries a larger stock of electrical merchandise than any other electrical jobber in the United States.

The growth of the Western Electrical Supply company has certainly been remarkable. Organized and incorporated under the laws of Missouri, in the winter of 1891, it has grown from a small house doing a purely local business to its present magnitude, and is universally recognized as one of the largest, best-equipped and most popular supply houses in the country. The extensive stock of the company embraces practically everything used by the electrical trade, from a toy motor to a dynamo, including iron and copper wires and cables of all kinds, poles, cross-arms, arc and incandescent lamps, transformers, motors and generators of various sizes, telephones, switchboards, line supplies and construction material.

The company is exclusive territorial agent for some of the most prominent and largest manufacturers of electrical goods in the country, among whom might be mentioned: The Eddy Electric Manufacturing company, Warren Manufacturing company, John A. Roebling's Sons company, Indiana Rubber and Insulated Wire company, Adams-Bagnall Electric company, Ohio Brass company, and Emerson Electric Manufacturing company. Certain well-known brands, such as the Monarch incandescent lamp, Hercules friction tape, Wesco dry batteries, etc., are also controlled by the company.

The officers of the corporation are men of wide experience in the electrical field, and of undoubted ability. The company's business standing and credit are of the highest, and the success it has met with has not only been well earned, but well deserved. The business of the company this year opened up in a most satisfactory manner, and at the present time it is said that all of the different departments are crowded with orders.

The company has a complete set of catalogues and descriptive matter, its general catalogue being a volume composed of 1,100 pages, said to be the largest and most complete catalogue ever issued by any electrical supply house.

WESTERN ELECTRICAL SUPPLY COMPANY'S NEW BUILDING.

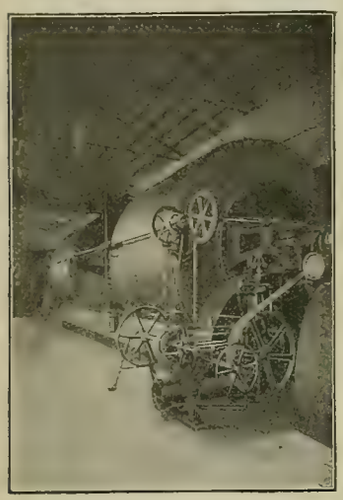
Expansion of the Stromberg-Carlson Company.

Users of high-class telephone apparatus will be interested to know that the Stromberg-Carlson Telephone Manufacturing company of Chicago has just purchased the seven-story Dunn building on the corner of Jackson boulevard and Clinton street. According to President Stromberg, it is the plan of the company to occupy this entire building, as well as another one at the back. For several years, as is well known, the Stromberg-Carlson Telephone Manufacturing company has been steadily extending its manufacturing plant, until it occupied six floors of the Dunn building. The steady and great expansion, however, of the company's business during the last year or two has made it necessary to have a much larger building. In addition to the large Dunn building, the company had already bought from Mr. Yerkes the building in the rear of the Dunn building. This will be united to the Dunn building, and in addition, two stories will be added to both the latter and to the Dunn structure. The price paid for the Dunn building is said to be in the neighborhood of $212,000, and that for the Yerkes building at the back, $25,000. As the company now has in the neighborhood of 700 hands working, and it is the purpose, according to President Stromberg, to increase to 1,500 hands, it is easy to prophesy that it will not be long before, as Mr. Stromberg says, the company is producing "a telephone a minute," that is, 600 per day of 10 hours.

The Village Board of Thorp, Wis., is making arrangements to erect an electric-light plant.

McCormick Turbines in a Mining Plant.

The accompanying illustration shows two single horizontal-shaft 54-inch McCormick waterwheels, each in a separate iron flume, discharging into a cast-iron draft chest. These waterwheels are operating in the power plant of the Boston and Montana Consolidated Copper and Silver Mining company of Great Falls, Mont., and develop 2,800 horsepower. The power is used for driving a generator and an air compressor. The speed is regulated by a Lombard governor. The gates of the waterwheels are so evenly balanced that one man is able to operate the gates of both turbines with ease. This is said to be the heaviest pair of waterwheels ever built in America. The weight of the outfit is



M'CORMICK TURBINES IN A MINING PLANT.

280,000 pounds, not including the power connections, supply pipes or draft tubes. The waterwheels were manufactured by the S. Morgan Smith company of York, Pa. This company is now installing, for the Missouri River Power company, Helena, Mont., six pairs of horizontal-shaft, 45-inch McCormick turbines in iron flumes and a pair of 27-inch turbines, mounted in the same manner. Each pair will operate under a 31-foot head and develop about 1,200 horsepower. The waterwheels will be direct-connected to Westinghouse generators, the speed being regulated by means of Lombard waterwheel governors.

COMMUNICATIONS.

Stanley Transformer Decision.

To the Editor of the Western Electrician:

To most of the statements in Mr. Charles A. Brown's comment on my letter published in your issue of May 25th, I care to make no rejoinder, except to say that Mr. Brown has a sunny disposition; most people know when a house falls on them. I quote, however, as follows: "When Mr. Johnston is prepared to show that Stanley, prior to the issue of the Slattery patent, 'had in mind the single broad feature of the length of the primary wire, as alone controlling the counter-electromotive force, which is now adjudged to be the one essential feature upon which the patent is sustained,' then his criticism will be entitled to receive consideration. At present his charge of inaccuracy rests wholly upon his voluntary ipse dixit." This statement is an attempt to shift the burden of proof, and to put me in a false position. After the Patent Office and a Circuit Court have decided that Stanley had made this invention prior to Slattery, the burden is on him who asserts that the office and the court are wrong.

T. J. JOHNSTON.

New York, May 28, 1901.

[Mr. Brown is out of town. It may be stated, however, that Mr. Johnston's rejoinder does not seem to be relevant to the bearing of the Slattery interference, as originally discussed in the Western Electrician. At any rate, both sides of the question have been fairly presented in this journal, and the incident may now be considered as closed.—Ed.]

Enterprise Appreciated.

To the Editor of the Western Electrician:

I am obliged to you for sending me a copy of your issue of the 25th instant, containing the telegraphed reprint of the paper which I read in New York before the American Institute of Electrical Engineers upon Mr. Edison's new storage battery. I was informed that the Western Electrician had shown sufficient enterprise to have this paper sent to its office by wire, but expected to find the publication sadly perplexed in consequence. The excellent way in which it appears, however, speaks volumes for the intelligence and attention which it must have received at your end of the line.

A. E. KENNELLY.

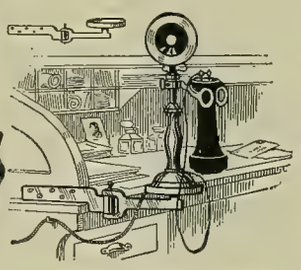
Philadelphia, May 31, 1901.

American Toll Company's Call Register.

The American Toll Telephone company of Cleveland, Ohio, has lately added to its already complete line of pay stations a new call register for measured service. The Bell companies have for years considered this part of their service very profitable to them, and these small instruments are in use in very large numbers. As yet the Independent companies have not had access to an instrument of this kind, but the above company is in the market to supply them and has already taken large orders for its machine.

The device, illustrated herewith, is built on different lines than the register used by the Bell companies. It cannot be manipulated in any way and it is said to be impossible to obtain signals by rapping the box on the side. This call register notifies operator and keeps an accurate account of all outgoing calls, thus saving all disputes between subscriber and the central exchange, as the register is in plain view of the subscriber. This part of the telephone service is acknowledged to be one that may be investigated by Independent companies with much profit to themselves and satisfaction to patrons. The instruments are sold at a very reasonable figure, and can easily be attached to any telephone.

AMERICAN TOLL COMPANY'S CALL REGISTER.



GRIGGS ADJUSTABLE SWINGING TELEPHONE BRACKET.

International Association of Municipal Electricians.

At a meeting of the executive committee of the International Association of Municipal Electricians held in Philadelphia this week the following topics of papers to be read at the sixth annual convention of the association, which will be held at Niagara Falls, N. Y., September 2d, 3d and 4th, were selected and assigned:

"The Need and Value of a Set of Rules for Outside Construction," by P. H. Trout, Jr., Lynchburg, Va.

"Underground Electrical Construction from a Municipal Standpoint," by Edward F. Schurig, Omaha, Neb.

"The Protection of Fire and Police-telegraph Wires from High-tension Currents and Lightning," by W. M. Petty, Rutherford, N. J.

"Improved Storage Battery for Municipal Purposes," by J. W. Aydon, Wilmington, Del.

A paper will also be read by a well-known electrical engineer, dealing with the advisability of placing high and low-potential conductors in the same conduits and manholes.

The committee consists of Morris W. Mead, president, of Pittsburg; John W. Aydon of Wilmington, Del.; Adam Bosch of Newark, N. J.; Frank P. Foster of Corning, N. Y., and Frank C. Mason of Brooklyn.

After adjournment, the committee, by invitation, called on Chief Walker of the Electrical Bureau of Philadelphia, and secured from him a partial promise to appear at the coming meeting of the association, and give the members a talk on "The Lights and Shadows of Municipal Experience."

Toll-line Agreement in Central Illinois.

Five Independent telephone companies of Central Illinois have signed an undertaking by which they agree to exchange service over their toll lines for a period of 10 years, commencing June 1st. The companies that are parties to this agreement are the Macon County Telephone company of Decatur, Logan County Telephone company of Lincoln, McLean County Telephone company of Bloomington, Home Telephone company of Champaign, and Farm and City Telephone company of Farmer City. These companies control about 300 miles of toll lines, have 210 toll stations and a list of about 3,500 subscribers.

The territory covered by the service of the companies comprises the counties of Macon, Logan, McLean, Champaign and Dewitt, and is thoroughly connected by through lines and lines for local business. W. B. Burke of Decatur, manager of the Macon County Telephone company, was the father of the movement that resulted in the agreement.

Four Modern Independent Exchanges.

The following are descriptions of four interesting telephone systems. The telephone exchange installed at Monmouth, Ill., is regarded as one of the best constructed and equipped exchanges in the Independent field. This exchange was installed and constructed by the well-known telephone contractors, Jones & Winter of Chicago, and they have not spared expense in making it a model plant. There are several miles of underground conduit and all wires are cabled that will admit of it. The poles used are of large, heavy Norway pine. The company commenced to give service to a portion of its patrons about May 15th. It began operations with 300 subscribers, but the demand for service is now coming so fast that it will soon be unable to supply the wants of the subscribers.

The Queen City Telephone company of Sedalia, Mo., which commenced operations in January, 1901, has proved a great benefit to the telephone users of that city. The construction of the plant is modern and first-class in every respect. The service is what is known as full-metallic. The company's apparatus and exchange equipment include a standard flashlight transfer switchboard and distributing boards, combined cable terminals and protectors, pole-top terminals, cables, line-fuse protection and instruments of standard construction. The company commenced operations with 400 subscribers, the service being of such a character and so satisfactory that it has been unable to supply the demands of its new patrons. It is fully expected that before the close of this year 1,000 subscribers will be connected with this new exchange.

In Racine, Wis., the Citizens' Telephone company is now an absolute fact and is giving service to its patrons. This company was organized by local citizens, there being upward of 400 of the most prominent business men identified with it as stockholders. This fact insures the popularity and success of the enterprise. The officers of this company are: President, John B. Simmons; vice-president, E. B. Belden; secretary, J. C. Breese; treasurer, C. R. Carpenter, and general manager, Will Van Middlesworth. In the construction of the plant, nothing was spared to make it permanent, substantial and first-class in every detail. The main portion of the outside construction is underground work, and the service is full-metallic. One of the novel features in connection with this exchange is the prompt care and attention given country subscribers. The patrons commenced to receive service about 30 days ago, there being 700 instruments connected on the opening day. The remote residence districts and farmer subscribers are cared for by the use of selective-signal, non-interfering, party-line telephones, enabling the company to serve four and eight subscribers upon single metallic circuits. This apparatus has proved quite an advantage to the company in enabling it to reach the outlying districts rapidly at a nominal expense. The mark set by the management of this exchange for the end of the year is 1,500 subscribers.

Springville, N. Y., offers something which is unique and novel in the Independent telephone field, and that is an exchange which is composed entirely of party lines. The Springville Telephone company was organized and commenced operation in October, 1900. As it was compelled to meet party-line competition with the Bell Telephone company, it decided to meet it with a like service, and commenced to cast about to see if it could not furnish its patrons a better service than that furnished by the Bell company. The Springville company has to-day in operation 150 subscribers, each one of which is upon a selective-signal party line. The service is in every way satisfactory to the patrons, and the company's treasurer, Dr. Waite, writes that, in his opinion, it could not be improved upon. He deems the selective-signal telephone the coming instrument of to-day. This company is enjoying the same rapid growth that other Independent companies of a like size are favored with.

The switchboard equipments, protective devices, terminals, instruments, etc., for all of these four exchanges were furnished by the Sterling Electric company of Lafayette, Ind.

Griggs Telephone Bracket.

Everyone having a curtain desk will readily see the merit of the Griggs telephone bracket, illustrated herewith, as by its use it is not necessary to tip or lift the telephone off the desk when the latter is to be closed. The bracket is easily attached to the desk, is always in place when wanted and is easily pushed out of the way when not needed. The device consists of a jointed swinging arm bracket, holding a disk on which the telephone is placed. A slight move swings it in or out of use. It is constructed of steel and is nickel-plated, thus adding to the appearance of a desk. It is a durable attachment, which cannot be easily broken. This bracket is manufactured by the Griggs Manufacturing company, 79 and 81 Fifth avenue, Chicago.

The American Elevated Railroad company is planning to build a third-rail electric road from Philadelphia to Atlantic City, N. J. With this system it is expected that the time from New York to Philadelphia will be greatly shortened. George Westinghouse is largely interested in the company controlling the system.

Street-railway Development in New York.

[From the New York Sun of May 30th.]

Within the next two weeks the work of installing the underground electric system upon the Seventh avenue line will be begun. Early in the summer the building of the Kingsbridge extension of the Metropolitan street railway's lines will be started. Contracts for these improvements have already been let, and while the officials of the company are not yet prepared to state what other operations are contemplated, it is probable that by this time next year the 100 miles or so of lines upon which horse cars are still running will have been almost entirely changed to electric power. H. H. Vreeland, president of the Metropolitan company, does not hesitate to express his belief that in the underground electric system the solution of the surface-transit problem has been reached and that it will be many years, if ever, before that system will be superseded. Consequently, it is his intention to transform all the lines controlled by the Metropolitan company into electric roads.

Since Mr. Vreeland was placed at the head of the Metropolitan company seven years ago $35,000,000 has been expended in the purchase of other street-car companies in this city and in converting the old lines from horse and cable traction to electric power, and the company is prepared to spend, if necessary, as much more in extending its system in the upper parts of the city and in improving existing lines. Pointing to the big cable plant with its enormous driving wheels, its powerful boilers and engines standing silent and motionless in the Houston street power house, Mr. Vreeland said:

"Look at that plant. It's as good now as when it was put in in '92 at a cost of $800,000. Well, it's just junk now. When it stopped at 8 o'clock last Saturday night nearly $1,000,000 worth of assets were wiped right out. That plant is only scrap iron now and the price per ton we will get for it will just about pay for its removal. We hope to make some salvage on the engines. It's the same with the plants in the Fiftieth street and the Lexington avenue power houses.

"The value of the two was about another $800,000. The changing of the Broadway and Lexington lines from cable to electricity therefore meant a dead loss to the company of about $1,600,000. That, however, is only a part of the loss which must be put down in our ledger. At the outset our cable system cost us $16,000,000. Of that amount there is salvage in the way of rolling stock, tracks and other property of about $10,000,000, so that the discarding of the cable power by the company meant practically the burning up of $6,000,000. In the Fourteenth street curve alone $500,000 was spent for the cable devices underground, which to-day are useless and must be torn out. In the case of the Third avenue road, another $8,000,000 worth of property was sold as junk, so that in round figures about $14,000,000 of capitalization has been erased from the credit side of the company's books."

So far from mourning this wholesale depletion of assets, Mr. Vreeland spoke in a spirit of elation.

"Our equipment at the present time," he went on, "is second to none in the world, and the people of this city are benefiting by what we have accomplished, because they travel more rapidly, and are moved without inconvenience from one part of the city to another for one fare.

"Look at the transit situation here in 1892, when the syndicate which now owns the Metropolitan company began buying, and think what has been achieved since then. The problem that faced us at that time would have been an easy one if we could have used the overhead trolley. But that New York would not have, and it became necessary to evolve some motive power which would meet the requirements of the city's needs. For the last seven years we have experimented and spent money, and we are satisfied that in the underground principle we have a method of propelling street cars that is perfection in every way. Some people are saying that if Edison's new light storage battery will do all that is claimed for it, it will do away with trolleys and channel rails, and that with self-contained power cars there will be no need of power houses for generating electricity. There is nothing new in Edison's battery. Batteries of somewhat similar description have been exploited in this country and in Europe, but were not found practical for commercial purposes."

Mr. Vreeland readily answered some of the criticisms which New Yorkers have made with reference to his company. As to the discomfort caused to seated passengers by persons standing in front of them in the aisles of open cars, he frankly admitted that it was an evil.

"The overcrowding of cars," he said, "is due to the peculiar geographical formation of Manhattan. Travel in the rush hours is all in one direction. It is an actual fact that if every lineal foot of track in this city was filled with cars placed bumper to bumper their seating capacity would not accommodate two-thirds of the people who wish to travel uptown between 5 and 6 o'clock at night. If a regulation was passed by the city authorities prohibiting standing in cars thousands of people would either have to walk home or wait until the rush ceases. Moreover, it would be necessary to have a policeman on every car to enforce the ordinance. If I issued an order to-morrow instructing conductors not to permit people to stand, 25 per cent. of the men would have blackened eyes to-morrow.

"The elevated and surface lines of this city carry more passengers in the course of a year than do all the steam railroads of the country combined. The New Jersey Consolidated Traction company does not carry upon its whole 320 miles of tracks as many people as we do on the Broadway line alone. The revenue of the Philadelphia companies is about $10,000,000 a year, that of the entire Brooklyn Rapid Transit system is $11,000,000 a year. The revenue of the Metropolitan company is $15,500,000 yearly and we have to provide for all that business on this narrow little island. Theatergoers are continually growling at what they call the insufficiency of our service at night. They forget that the theaters between Fourteenth street and Long Acre square will seat 39,000 persons. When the theaters close thousands of persons are thrown on the streets within a space of about fifteen minutes, and the cars most of them seek are those on Broadway. And yet people grumble at the inadequacy of our service."

Latimer Clark Library.

In donating the fine electrical library of the late Latimer Clark, with its 7,000 titles, to the American Institute of Electrical Engineers, Dr. S. S. Wheeler made the following conditions, which were accepted by the Institute:

First—The library to be kept insured against loss by fire as fully as it may be practicable to determine its value, and an annual appropriation of $1,500 to be provided for its maintenance.

Second—A complete catalogue raisonne to be published in the name of the Institute, reciting the conditions of gift and explaining the features of interest of each book for the convenience and information of members. This catalogue to be prepared at once, and a bound copy of it to be placed in the hands of each member of the Institute.

Third—The library to be in charge and control of a library board or committee made up of members of the Institute, and not more than one-quarter of the whole number of members of this committee to be allied with any one commercial or other interest.

Fourth—The library to remain in New York city, and to be a reference library, free to all, including non-members, and available for consultation at least three days in the week, and some evenings and some Sundays, as soon as the Institute is in permanent quarters.

Fifth—Rare books—that is, books which it is practically impossible to replace—to be exhibited under glass with suitable explanatory cards, and to be subject to closer examination only at the library, and upon suitable introduction of the visitor to the library committee or their representative, the librarian, and under such other precautions as will positively assure the preservation and safety of the books.

And further, it is my earnest desire that the Institute shall, within five years, raise a sufficient fund by subscription, and provide itself with a permanent home for its meetings and library, and that this home shall be centrally located, reasonably safe from fire and not heavily mortgaged.

In case of the failure of the Institute to comply with the substance or spirit of these conditions, or with the desire expressed above for a permanent home, the library shall revert to me or my heirs or assigns.

Electrical Features of Press Club Excursion.

An excursion on Lake Michigan of more than usual interest will be given by the Press Club of Chicago on Friday afternoon, June 14th, to Waukegan, on the fine steamer Northland, belonging to the Great Northern Steamship company. The vessel will reach her dock that day on her first trip between Chicago and Buffalo, in which service she is to remain during the season. The excursion given by the Press Club will be the only one the boat will take out during the summer. The Northland is 386 fet long, 44 feet wide and has a depth of 26 feet. Her tonnage is 5,000, and her engines represent 7,000 horsepower. The boat has all modern conveniences, and the trip to Waukegan should afford a most pleasant afternoon's enjoyment. Among those who will be guests of the club on this occasion are Governor Richard Yates and staff, Mayor Carter H. Harrison and his cabinet, Major-general E. S. Otis and staff, and others of prominence.

An X-ray outfit will be on the boat, and visitors can inspect their own bones, and see through wood and other substances. Joseph C. Schwab, president of the new Northwestern Wireless Telegraph and Telephone company, promises an exhibit of wireless telegraphy from the boat's deck, if the instruments can be procured in time for installation.

Linemen's Strike in New England.

A few days ago a telephone cable on First street, Cambridge, Mass., was cut. It contained 30 wires and was owned by the New England Telephone company. Officials of the company suggested that striking linemen did the cutting, but the latter denied it and suggested that it was done at the instigation of the company in order to prejudice the public. The cut cable connected with the county buildings in East Cambridge, but the cutting did not seriously inconvenience subscribers. The wires were repaired on the following day. A few nights previously a trunk line across the Charles River was cut in four places. The New England Telephone company's division superintendent at Lowell, Mass., reported that eight striking linemen returned to work early last week, and that about as many new men have been employed by him.

The San Angelo Street Railway and Power company has been formed at San Angelo, Texas, for the purpose of constructing and putting in operation a street railway.

Electrical and Industrial Exposition at Milwaukee.

The directors of the Milwaukee Industrial Exposition association of Milwaukee, Wis., are this year planning to have an electrical and industrial exposition that will surpass all previous efforts. The exposition, which will be the association's twentieth, will be open for a period of three weeks, from September 7th to 28th next. It will be held in the permanent exposition building at Milwaukee. It is the intention of the management to make the electrical and mechanical departments the main features and attractions of the exposition. Charles G. Armstrong of Chicago has been selected as manager of the electrical department, and he is bending all his efforts to make the show a worthy one. In addition to the exhibits, there will be numerous popular lectures on electricity and kindred subjects. The exposition building and grounds will be brilliantly illuminated by festoons of incandescent lamps and a beautiful electrical cascade or waterfall will be one of the chief features. Among the other attractions will be a telephone exchange in operation, wireless-telegraph and Roentgen-ray apparatus, electric cooking devices, searchlights, scenic theaters, etc. Arrangements have been made with the Milwaukee Electric Railway and Light company to supply current at reduced rates. Either alternating or direct current may be had at 110, 220 or 500 volts. It is expected that some electrical conventions will be held during the exposition season. Inquiries concerning the electrical department should be addressed to Mr. Armstrong at Milwaukee, care of the exposition association.

The Machinists' Strike.

During the last week the strike begun some days ago among the machinists of the country has affected Chicago to quite an extent. On May 31st about 1,000 men went out in this city, tying up some of the largest machinery firms. At a recent meeting of the administrative council of the National Metal Trades association in Chicago, it was decided to refuse to grant the 12½ per cent. advance in wages asked by the machinists. This action was later indorsed by the Chicago Association of Machinery Manufacturers. The situation will doubtless remain about as it is until the meeting of the National Metal Trades association, which is to be held in New York city on June 11th. At this writing the annual convention of the International Association of Machinists is in session at Toronto, Ont., where plans are being formed for conducting the strike. Outside of Chicago the situation has not improved materially, although a few firms have yielded to the strikers' demands and taken the men back. One of the largest electrical firms to be affected is that of the Crocker-Wheeler company at Ampere, N. J., where 500 employes struck.

Projected Kansas City-St. Joseph Railways.

Two companies are planning to build electric lines between Kansas City and St. Joseph, Mo. The necessary capital has been raised by one company, but it has no franchises, while the other company has obtained the franchises, but has not raised the money. The Kansas City Journal, in regard to the projects, says in part: "One of the lines, known as the overland route, is being promoted by local parties, and the other, backed by Messrs. Denison, Pryor & Co. of Cleveland, Ohio, is known as the river route. The first is the more direct route, but from an engineering standpoint is the more difficult to construct and costly to operate. The second line will serve the people of Atchison and will pass by the Beverly coal mines, following closely the Missouri River. The field seems a good one, but the conditions do not seem to warrant more than one line, and at present it does not seem certain which one of the two it will be."

Pan-American Exposition Notes.

The expectation is that the thermopile will be exhibited in the Edison space before the month closes. Vice-president W. E. Gilmore of the Edison Manufacturing company is expected at the exposition before long, and it is probable that soon after he arrives the thermopile will be seen.

Mr. S. J. Bear, in charge of the American Electric Telephone company's exhibit, takes much pride in the sculptor's work about his booth, especially in one of the little figures that adorn the second story, for in the features is represented the pretty face of Mr. Bear's little girl, taken from a photograph.

Superintendent George F. Sever of the Electricity building and exhibits was called to New York early last week to assist in the preparations for the graduating exercises at the Columbia University. This is the first time Superintendent Sever has been absent from the exposition since early in April. He returned on Wednesday.

The Story of Edison and the Inventors' Institute.

Daily newspapers have the news that Thomas A. Edison is planning to establish an institute in Paris for the benefit of impecunious inventors. Why Paris, is not stated. However, Mr. Gourand, the European agent for Mr. Edison, is said to be authority for the statement. The institute is to be in active operation within a year and a half, according to the story. Mr. Edison will donate all the machinery, a completed fitted laboratory and a reference library. There will be no restrictions as to nationality, race or creed. It is stated that every deserving man who is an inventor, or who is struggling with some invention his lack of means prevents him from completing, will be welcomed at the institute and aided. This, of course, means an undertaking of great magnitude. It is expected, moreover, that the institute will have branches for all the various sciences, one department being entirely devoted to electricity, another to chemistry, etc.

New Office Building for the General Electric Company.

Following the many recent additions to its plant at Schenectady, N. Y., the General Electric company is now erecting a new office building in that city. The edifice will be over 200 feet in length and more than 100 feet wide. It will be five stories high and will be equipped with every modern appliance for heating, lighting, ventilation and sanitation. The main walls of the building will be of brick, with terra cotta ornamentation and marble trimmings about the doors and windows. The offices are to be finished in maple wood and marble and the halls are to be laid in mosaic and ceramic tile. All parts of the building will be connected by a complete telephone system, and a system of pneumatic tubes is planned for delivering mail. Three electric elevators are to be placed at convenient places in the building. The first floor of the building is to be occupied by a restaurant and the remaining four floors will be used entirely for office purposes. The contract price for the building is $225,000, but it is expected that the furnishings and other appliances will raise the cost to $250,000.

Proposed Omaha Electric Merger.

The consolidation of the street-railway and electric-light and power properties of Omaha, Neb., and Council Bluffs, Iowa, is planned, and it is said that now the consolidation only hinges upon the terms of purchase. The new incorporation is scheduled to include the Omaha Street Railway company, the Omaha and Council Bluffs Railway and Bridge company, the Omaha Thomson-Houston Electric Light company, the Council Bluffs Electric Light company, the Omaha Water company, the Council Bluffs Water company, the Suburban Railway and Traction company and the Platte River Power Canal company. The combination will probably be capitalized at $20,000,000.

The Platte River canal is projected to be built across the country from a point 15 miles above the mouth of the Platte River to a junction with the Missouri River a few miles below the confluence of the two streams. This canal will be 25 miles long and will divert enough of the water of the Platte River to furnish 30,000 horsepower.

Power Plant at the Wisconsin Dells.

It is proposed to make the Dells of the Wisconsin the site of a large waterpower plant, and to further the project a 17-foot dam is to be built across the Wisconsin River, just below the resort. The power rights have been secured by P. L. Spooner, and by authority of the state Legislature he will construct the dam at Kilbourn, Wis. The improvements will cost about $300,000, and the plan is to furnish power, light and heat for Kilbourn and Madison. The Madison street railway, which was recently purchased by Mr. Spooner, may be operated by power furnished from the Dells. The air-line distance from Kilbourn to Madison is about 50 miles, but a plan to connect the summer resorts on the chain of four lakes in the Madison district is proposed, and if this is carried out the length of transmission from Kilbourn to Madison will be increased to about 65 miles.

Edison Storage Battery Company.

Press dispatches state that at a meeting held in Newark, N. J., last week, Thomas A. Edison was elected president of the recently organized $1,000,000 Edison Storage Battery company. John F. Randolph of New York was elected secretary and treasurer. The meeting was in the office of Howard W. Hays, general counsel for Mr. Edison. Mr. Edison and representatives of nearly all the subscribers for the stock of the company were present. No directors were chosen nor was any definite time fixed for a meeting for that purpose.

CORRESPONDENCE.

New York Notes.

New York, June 1.—The Hall of Fame of the University of New York was formally dedicated in the afternoon of May 30th. Twenty-nine tablets to the memory of famous Americans were unveiled by representatives of patriotic and other societies. Among the tablets unveiled were one to the memory of Robert Fulton, unveiled by J. J. R. Grees and Charles Warren Hunt, representing the American Society of Civil Engineers; one to the memory of Eli Whitney, unveiled by Professor Robert H. Thurston, representing the American Society of Mechanical Engineers, and one to the memory of Samuel F. B. Morse, unveiled by Carl Hering, Charles P. Steinmetz, Gano S. Dunn and F. Wiley Dunn, representing the American Institute of Electrical Engineers.

Mayor Van Wyck has attached his signature to the resolution of the Municipal Assembly which approves the plan of the Rapid Transit Commission for a tunnel under East River. The tunnel will connect the boroughs of Manhattan and Brooklyn, and will cost $8,000,000.

The Union Railway company, which operates a trolley system in the Borough of the Bronx, has filed a certificate of extension of route with the secretary of state. The company wishes to extend the track from the terminus at Jerome avenue across the Central avenue bridge at One-hundred-and-fifty-fifth street and the Harlem River to connect with the northern terminus of the Eighth avenue surface line of the Metropolitan street-railway system and with the viaduct to Washington Heights.

The New York, New Haven and Hartford Railroad company has secured an injunction against the Union Railway company, to prevent it from crossing its tracks at grade. This action has brought the work of connecting the Westchester avenue line of the system with the Unionport branch to a sudden stop, as it is necessary for the tracks to cross those of the New York, New Haven and Hartford Railroad company before they can cross the new Bronx River bridge at Westchester avenue.

President Vreeland of the Metropolitan Street Railway company is reported as saying that it will be impossible to use fenders on the cars that run on Broadway. There are many sharp turns and the radius of curves is so small that cars passing each other, if they carried fenders, would not be able to clear.

The work of changing the operation of the Broadway line from cable to the underground electric system was commenced last Saturday at 8:30 p. m. There was under the surface of Broadway between 4,000 and 5,000 moving parts, consisting of wheels, cables, etc. These all had to be removed before the appliances for electrical traction could be put in place. The work was done in very fast time. The force which so quickly accomplished the change numbered 2,000 men during the greater portion of the time. Just 24 hours after the last cable car had been taken from the tracks, the first car of the underground system ran from the company's car stable at Fiftieth street to the Battery and back. On Monday morning the whole line was thrown open in time for the early morning traffic. The entire system works admirably, and a very heavy business is being done.

The rapid-transit-tunnel strike is practically at an end. The last obstacle in the way of the prompt settlement of the strike was removed to-day by the Central Federated Union, which gave its committee full power to act. On the first day of the strike 519 men quit work, throwing a great many more men out of employment. Before the strike took place 5,076 men and 414 teams were working on the tunnel. Yesterday there was less than 4,000 men working, and most of them had taken the place of strikers.

The Metropolitan Street Railway company will in June commence the construction of an electric underground system on Seventh avenue, in order to enable better time to be made by avoiding the congestion occurring on the Broadway and the Sixth avenue lines. Work on the new lines in the Bronx will also be pushed as rapidly as possible.

M. L. G.

Canadian Intelligence.

Ottawa, Ont., June 1.—Montreal capitalists, who control the Gatineau and Pontiac railways and the new interprovincial bridge connecting the cities of Ottawa and Hull, are negotiating for the purchase of the Hull and Aylmer electric railway, which will enter Ottawa over the new bridge when the Montreal people get control. It is said that the price asked for the electric road is $1,000,000.

The council for the township of Sandwich West, Ont., has passed a by-law granting a franchise to run a line of the South Essex electric railway through the township. The proposed railway will run from Windsor to Kingsville, by way of Amherstburg, and it is expected it will be completed this year.

Negotiations are under way for the construction of a line of electric railway up the Lievre River, Que. There is abundant French capital behind the scheme. What is proposed is to construct a line of electric railway from Buckingham, 100 miles up the river, to Rapide L'Orignal, the numerous falls on the route affording ample power for the generation of the necessary electric energy, not only for the railway, but for phosphate-mining purposes, which it is intended to carry on in the Buckingham district. Ulric Rouville, a Parisian capitalist, who owns about 40 acres of these mining lands, is the promoter of the railway, and has laid the plans of his project before the Dominion government for the purpose of obtaining a subsidy.

A. J. Macdonald of Montreal has just been appointed general superintendent of the street-railway system of the City of Mexico. Mr. Macdonald, who is a young man of about 30 years of age, is at present in charge of the center division of the Montreal street-railway system, in the employment of which he began as a conductor. He will have an excellent field for the display of organizing capacity in Mexico, for in that city the street-railway system is operated partly by horse cars and partly by electricity. The railroad company proposes to convert its dual system entirely into an electric road.

A. V. W.

New England News.

Boston, Mass., May 31.—In the House of Representatives, Tuesday, the committee on metropolitan affairs reported a bill providing for the construction of the Washington street subway in this city. The bill substantially follows the plan proposed by the Boston Elevated Railway company. It provides that the subway shall be constructed by the Boston Transit Commission, with funds supplied by the company; that the railroad commissioners shall decide as to whether the company shall issue bonds or stock, and act as a board of appeal in disputes between the transit commission and the company; that the subway be turned over to the city of Boston upon completion, on condition that the company be granted its exclusive use for 40 years from that date. The amount of stock or bonds the company can issue is limited to $6,000,000. The bill also provides that only citizens of the United States shall be employed on the work and that the wage rate shall not be less than that paid the employes of the city of Boston.

Without debate the Senate this week rejected the bill restricting combinations of persons engaged in the electric-light business and placing such combinations under the supervision of the Gas Commission.

The bill providing for the consolidation of the Boston and Edison Electric Light companies was passed to be engrossed in concurrence by the Senate.

On Tuesday about 500 members of the Boston Bank Officers' association were given a complimentary ride over the Charlestown section of the Boston elevated road. The party was conducted by Transportation Superintendent J. E. Rugg of the Boston Elevated Railway company's staff. Superintendents Neff and Tripp took the party through the terminal, setting-up department, and car house of the company.

The Massachusetts Automobile Club is planning an invitation run for automobiles, to be held on June 17th. It is suggested that the run be to some point 20 miles from Boston, where a dinner is to be served. After dinner there may be an informal series of trials, to be followed by the run back to Boston. All automobile clubs and individual owners in neighboring cities will be invited. It will not be a trial of speed, the intent being to get together as many automobilists as possible.

At a special town meeting the citizens of Mattapoisett, Mass., voted to accept the selectmen's location for the New Bedford and Onset electric railroad. The proposed route avoids the water front, along which the company desired a right-of-way, a proposition that was opposed by the summer residents.

The Peak's Island Electric Railway company has submitted new articles of association to the Maine railroad commissioners. The company proposes to build and operate six miles of road on Peak's Island, Portland, Me., harbor.

The work of building the Essex County street railroad through Topsfield, Mass., will be begun next Monday. The company expects to build one mile of road per week. The road will extend from Danvers to Boxford and Georgetown, Mass.

It is stated that the gross earnings of the Massachusetts Electric Companies are 10 per cent. larger than they were last year.

B.

Southern Developments.

Charlotte, N. C., June 1.—G. Alexander, H. C. Smith, A. S. Rice and others have been granted a franchise to construct an electric railway over the turnpikes of Scott County, between Georgetown and Cynthiana, Ky.

The Toccoa Falls Electric Light and Power company will be prepared within a month to furnish electric lights to the town of Toccoa, Ga. The power house is situated at Toccoa Falls, two miles distant. Several factories will be supplied with power.

A deed of transfer has been made conveying to the New York Trust company, represented by James E. Spencer, the Rialto Mills property on the Appomattox River at Petersburg, Va. It is rumored that the Richmond Passenger and Power company is interested.

Work has been started on a $17,000 electrical laboratory for the Technological School at Atlanta, Ga.

S. M. Smith of Pennsylvania has been investigating the waterpowers on the Chattahoochee, near Atlanta, Ga., and it is said that he has secured valuable rights. Other persons are reported to have se-

cured options, and extensive electrical developments may follow.

The board of aldermen of Greensboro, N. C., has granted a franchise to the Greensboro Electric company to install an electric-railway system in the town. M. D. Barr and John Karr of New York and others are the incorporators of the company. A contract for lighting the city has also been entered into.

The power house of the Durham (N. C.) Traction company is about completed. The company proposes to light the city and operate an electric line.

It is rumored that Isadore Newman of New Orleans and associates have secured control of the property of the Birmingham Railway, Light and Power company, and that they will soon assume management. The company owns about 100 miles of electric lines. L.

From the Buckeye State.

Columbus, Ohio, June 1.—The most important electric-railway deal in this state for months was the consolidation of the Cleveland, Chagrin Falls and Eastern and the Cleveland and Chagrin Falls lines with the Cleveland and Eastern, which is owned and controlled by the Everett-Moore syndicate and in which E. G. Tillotson is also interested, so far as this deal is concerned. This leaves only the Cleveland, Elyria and Western road, under the control of the Pomeroys, out of the combination of Cleveland interurban roads, and it is said they are opposed to consolidating with any other company or syndicate, from the fact that their property is paying well and they are satisfied. The syndicate purchased 1,836 shares in the two roads and the consideration, as given, is $400,000. The companies were both reorganized at once, the old directors and officers being replaced by those interested in or connected with the syndicate in some manner. The new officers of the Cleveland, Chagrin Falls and Eastern are as follows: President, E. W. Moore; vice-president, H. Clark Ford; secretary and treasurer, E. G. Tillotson; manager, R. L. Palmer. The officers of the Cleveland and Chagrin Falls road are: President, H. A. Everett; vice-president, W. H. Lamprecht; secretary and treasurer, E. G. Tillotson.

The City Council of Niles, Ohio, has decided to sell the municipal lighting plant and in the future will buy the service from some other company.

The Summit county commissioners have granted Thomas L. Childs a franchise to build a road from Akron north to Cleveland. Work is to be commenced in six months.

The Muskingum county commissioners have granted the Newark, Zanesville and Coshocton Railway company a franchise to build a road from the western line of the county to Zanesville, and also lines running out of Zanesville in two other directions. Work must begin by January 1, 1902, and be completed within a year from that time. A franchise was also granted to Black & Taylor to build a road to the eastern county line. The Black Diamond Traction company was given a franchise to build lines from Zanesville to the Morgan county line, from Zanesville to the Perry county line, and from Zanesville to the Coshocton county line. Besides this, it has the right to build various branches about Zanesville and to the main lines at other points. The Zanesville Electric Railway company has been granted a franchise to use the Sixth street and Monroe street bridges for extensions that will be built.

The stockholders of the Chillicothe-Hillsboro Traction company met at Chillicothe a few days ago and decided to increase the capital stock of the company from $10,000 to $1,000,000, and a number of the eastern capitalists who will furnish the money are to be taken into the directorate. It now seems that the company means business.

The employes of the People's Railway company at Dayton threatened to strike when their present agreement expires unless the company should recognize the union, but the matter was settled by the State Board of Arbitration.

It is said that the Pennsylvania Railroad company has given the Village Council of Crestline notice that if the latter allows more than one electric line to cross the railroad company's tracks it will move its large shops from there to Mansfield.

It is reported that a company of Cleveland capitalists will soon be incorporated to build an electric line from Salem to East Liverpool.

The Village Council of Bellville has sold $8,000 in bonds to secure money to build an electric-light plant.

It is announced that the Ohio Valley Interurban Railway company is being organized in Cincinnati to build a road from Cincinnati to Portsmouth, with branches running north and east. John Kilgour of the Cincinnati Street Railway company is said to be interested in the new company, and the Franklin Bank of Cincinnati is believed to be looking after the finances.

It is reported that an agreement has been reached between the Detroit and Toledo Shore Line and the Detroit and Toledo Short Line, so that there will be no ruinous rates in competition. The companies will cover about the same territory.

Work has been commenced on the Cincinnati, Dayton and Fort Wayne road near Celina.

The Scioto Valley Traction company has made application for a lease of portions of the Hocking Canal, between Columbus and Lancaster. An old railroad company that has never made a move toward building holds a lease on the property, if the contract has not been voided.

General H. A. Axline, president of the Urbana, Mechanicsburg and Columbus Electric Railway company, says that arrangements have been made to begin work on the line at once.

An ordinance has been introduced in the Cleveland council to allow the Big Consolidated road to extend its line on Bank street to the Union depot.

The Salem, Lisbon and East Liverpool Traction company, with a capital stock of $10,000, has been incorporated, to build a line connecting the three towns mentioned in the name. The incorporators are H. Whitford Jones, F. N. Hait, Charles H. Taylor, George B. Billman and H. H. Poppleton.

The Columbus, New Albany and Johnstown Railway company has closed a contract with the Columbus Railway company to enter the city over its lines.

The commissioners of Miami County have granted the Miami Valley Railway company a franchise to use the public road from Piqua north to the county line.

The Portage county commissioners have granted J. A. Blackburn and George W. Taylor a franchise to build an electric road from Garrettsville to the Trumble county line.

The City Council of Fostoria has granted the Ohio and Northwestern Electric Railway company a franchise to operate in that city.

The Toledo, Fostoria and Findlay road has received 14 55-horsepower motors for its new cars. Four of them will be placed on the car known as the "Flyer" and two each on the others.

The Ohio Brass company of Mansfield has been awarded the contract for furnishing the overhead material for the Miami and Erie Transportation company, on its line from Cincinnati to Dayton, the price being $28,000.

E. M. Kerlin has been granted a franchise to build an electric road from Fremont to Port Clinton. There is a great deal of rivalry among the various companies which wish to reach Port Clinton.

The Columbus, Winchester and Lancaster Traction company has been granted a franchise by the City Council of Lancaster to build its line into that town. O. M. C.

Information from Indiana.

Indianapolis, June 3.—Attorney-general Taylor has declined to give an opinion as to whether the act of the last Legislature, authorizing councils of cities and towns of certain population to appoint boards of electric-light commissioners, is optional or obligatory. He advises a test suit in court, as his opinion would not be binding.

Work on the new electric-light plant at Richmond has been begun. Instead of issuing bonds, the necessary money has been borrowed.

The electric headlight on the Clover Leaf flyer prevented a bad wreck near Bluffton recently. A cow was lying on the track asleep, and the engineer saw her in time to prevent derailing the train, which was running at the rate of 40 miles an hour. Had the locomotive been equipped with the old-style headlight, it would have been impossible to have seen the animal in time to have prevented a serious wreck.

Rather than be compelled to move his electric-light plant from its present location at Fairmount, Gilbert Larue offered to furnish the town with 40 arc lights for the streets free for a period of 10 years. The town board refused to accept the proposition. Two years ago Larue sold the plant to the town board for $18,000, in payments of $150 per month. The board was changed a year afterward and the contract repudiated. The new board made Larue a written tender of the plant, which he refused to accept, and brought suit to collect the money due him. The court not only refused to give judgment, but knocked out the deal completely, on the two per cent. constitutional limit of indebtedness. Since that time Larue has made many efforts to compromise, and has at last succeeded. He gets $1,400, one-third the amount due him, takes back the machinery and is to move the plant off the town's ground within 90 days.

The incorporation of the Union Traction company, under the laws of New Jersey, with a capitalization of $15,000,000, is responsible for another revival of the story that a movement is on foot to consolidate the street-railway systems of a number of large cities, including that of Indianapolis. The fact that Randall-Morgan and the Widener-Elkins syndicate of Philadelphia are among the most prominent of the incorporators of the new company, and that they are interested in the Cincinnati, Indianapolis and other large street-railway companies, has helped to spread this impression. It is reported that there is a plan to combine the lines in Detroit, Cincinnati, Cleveland, Toledo and Indianapolis under one head.

Important extensions of the College avenue and the Pennsylvania lines of the local traction company are now being made, one to the state fair grounds and the other to Broad Ripple Park.

Employes of the Union Traction company of Anderson, with representatives from Marion, Muncie and Indianapolis, on the night of June 1st, marched to the home of Charles Berry and presented him with a $175 watch and chain. Berry's resignation as general superintendent of the Union Traction company becomes effective on June 15th. His successor has not been announced. Mr. Berry is highly regarded by the officers and employes of the company.

The electric linemen employed by the Indianapolis Street Railway company have returned to work. They are to work 10 hours a day, but are to receive a sufficient amount above the $2.50 scale to repay them for the extra hour. They will receive time and a half for overtime and double time for holidays and Sundays.

The constitutionality of the three-cent-fare law for Indianapolis was argued before the Supreme Court during the week. Those who heard the argument are inclined to the belief that the law under which the present local company was organized, and which impliedly repeals the three-cent-fare law and authorizes the charging of five-cent fares, will be overruled by the court and the three-cent-fare law declared to be in full force and effect. It was argued that the Indiana constitution forbids the creation of corporation by special legislation. It is evident that the local company's management is uneasy and put the hearing off as long as possible.

The steam-railroad companies running into Indianapolis have entered into competition with the interurban roads for suburban business. They have put on additional trains, reduced the fares to meet electric-car fare and provided commutation tickets.

The opening of the Indianapolis and Franklin electric road from Greenwood was made last week. President Irwin took an excursion party over the line and formally dedicated the extension.

A threatened strike of all the Terre Haute and Brazil electric-railway employes was settled to-day. The former company, which controls both systems, agreed to an increase in the wages of certain employes by July 1st. F.

Northwestern Notations.

Minneapolis, Minn., June 1.—The Supreme Court of Minnesota has upheld the decision of the lower court in the matter of the city of Stillwater, Minn., against the Twin City Rapid Transit company. The city sought to annul the franchise of the company for failure to do certain things, among them being to extend a line to South Stillwater. The lower court held that South Stillwater, as a village, had no power to grant a charter of the kind proposed. The Supreme Court now indorses this view.

An extension has been granted by the attorney-general of Wisconsin in the hearing for the annulment of the charter of the Duluth-Superior Traction company in Superior, Wis. It is understood that the company will seek an amicable settlement of the matters in dispute.

The inside wiremen among the electrical workers of Minneapolis have gone on a strike for a union scale of wages and an eight-hour day, with time and a half for overtime and double time for Sunday and holiday work.

Work has been started at Seattle, Wash., for the proposed electric line to Ballard. It is hoped to have cars running by the second week in July.

The Des Moines Edison Electric Light company will materially enlarge its proposed underground system in Des Moines, Iowa.

The promoters of the projected electric railway from Wausau to Merrill, Wis., are arranging for the right-of-way and seeking out the most feasible route.

The Board of Public Works of Seattle, Wash., will require that all poles in the city must be painted, if they have stood for more than six months.

The stockholders of the Union Electric company of Dubuque, Iowa, have elected new officers from the reorganized board of directors. The company is making all arrangements for extensive new equipment, new machinery and improved service.

The Board of Trade of Mankato, Minn., proposes to continue an agitation until a street-railway system can be secured.

It is reported that the electric-light plant taken out of the village of Roseau, Minn., will be put in at Badger, Minn. It was too small for Roseau.

Machinery has been ordered for a new electric-light plant for Redfield, S. D.

Residents of East Houghton, Mich., want the Houghton Street Railway company to extend a line to that suburb.

The Sauk County Traction and Power company has been incorporated to build an electric line between Portage and Baraboo, Wis.

The electric-light company of Red Lake Falls, Minn., contemplates extensive improvements to its plant, including a new dynamo.

Hoos Bros. have been given a contract at Centralia, Wash., to furnish waterpower with which to operate the city electric-light plant. If it proves to be a success, the city will discard its steam plant. R.

PERSONAL.

J. C. Neely of the Kellogg Switchboard and Supply company of Chicago has just returned from a trip of some weeks' duration, during which time he visited all the exchanges installed by his company.

Prof. F. W. Wood, assistant professor of physics in the University of Wisconsin, has been called to the staff of Johns Hopkins University at Baltimore. Professor Wood will probably be made assistant to Dr. Joseph Ames, who has directed the work of the Department of Physics since the death of Professor Rowland.

Mrs. Alfred Stromberg, wife of President Stromberg of the Stromberg-Carlson Telephone Manufac-

turing company, started from Chicago for Sweden June 3d. Mrs. Stromberg is accompanied by her four children and will visit her old home in Stockholm, remaining abroad during the coming summer.

B. R. T. Collins, chief engineer of the Harrison street station of the Chicago Edison company, is a lieutenant in the Illinois Naval Militia, and he was in command of the training ship Dorothea on her recent trip from Philadelphia to Chicago. Lieutenant Collins served as ensign on the Scorpion during the Spanish-American war.

G. H. Atkin and M. J. Budlong have opened a western branch for the Electric Vehicle company of New York at 267 Wabash avenue, Chicago. Both gentlemen are well known to the electrical fraternity. Mr. Budlong was formerly treasurer of the Siemens & Halske company, while Mr. Atkin was for 10 years with the General Electric company and later secretary and treasurer of the Woods Motor Vehicle company.

It was announced at the annual commencement of the Columbus Art School of Columbus, Ohio, on May 28th that Emerson McMillin of New York, the well-known head of the McMillin gas and electric-light plants, had offered to give a site on East Broad street, valued at $30,000, and a sum not to exceed $100,000, for the erection of an art museum, providing an equal amount was raised by the people of Columbus by popular subscription.

J. R. Nutt of Akron, Ohio, who is interested in half a dozen electric-railway companies and several Independent telephone companies in Ohio, has accepted the position of secretary and treasurer of the Savings and Trust company of Cleveland, one of the largest financial institutions in that city. This will not change his official capacity with any of the other companies that he is connected with, except the Central Savings Bank of Akron, of which he was secretary and treasurer.

GENERAL TELEPHONE NEWS.

A system of telephones is being installed at Lumpkin, Ga.

The Bell Telephone company has obtained a franchise for a telephone system at Richmond, Va.

The Northern New York Telephone company has been purchased by the Hudson River Telephone company for $100,000.

An ordinance has been passed authorizing the Southern Bell Telephone and Telegraph company to do business in the city of Richmond, Va.

The monthly statement of the Mexican Telephone company for March showed a total number of subscribers of 3,549, an increase of 48 during the month.

A toll line will be built from Greensboro to Raleigh, N. C., by the Southern Bell Telephone company. W. T. Gentry is general manager of the company.

D. W. Axley, J. T. Patterson and others have been granted articles incorporating the Cherokee Telephone company of Murphy, N. C. The capital stock is $2,500.

Notice of increase of capital stock has been filed by the Citizens' Telephone company of Grand Rapids, Mich. The capital will be increased from $550,000 to $1,000,000.

The directors of the Chicago Telephone company have voted to issue $1,000,000 of additional stock on October 1st. It is expected that $2,000,000 more stock will be issued this year.

A number of Cleveland (Ohio) and Elmira (N. Y.) capitalists have incorporated the Citizens' Telephone company of Elmira, N. Y., with a capital stock of $250,000. The company will operate in Elmira and Chemung County.

The Bell Telephone company has announced its intention of constructing a 90-mile long-distance telephone line between Raleigh and Greensboro, N. C. Other lines are also under consideration. A line has also been started between Asheville, N. C., and Spartanburg, S. C.

The long-distance lines connecting the cities of central Germany with Frankfort, Kalk, Mühlheim, Cassel and Weisbaden, in the western part of the country, have been opened to the public. The charge is one mark (23.8 cents) for every three minutes' conversation to any one of the above-named places.

The Cumberland Telephone and Telegraph company has decided to increase its capital stock to $7,500,000. Part of the added capital will be used in completing a line now in course of construction between Nashville, Tenn., and Louisville, Ky. Lines from Shreveport, La., to New Orleans, and from New Orleans to Beaumont, Texas, are also to be built.

The Erie Telephone company's notes for $7,500,000, representing the loan due January 10, 1902, have been sold. At the start, $1,500,000 was withdrawn for investment, an option on $1,200,000 was given to certain interests, and $4,800,000 was offered to the public by a bankers' syndicate. The amount offered the public has been sold and the option has been exercised.

Application has been made to Commissioner Kearney of the Department of Public Buildings, Lighting and Supplies of the city of New York by the Atlantic Telephone company for a permit to use the subways and to string wires. The company named controls the franchise granted by the former city of Brooklyn to the New York and Eastern Telephone company, and says that it has a capital of $5,000,000 paid in.

ELECTRIC LIGHTING.

J. W. Shelor has been granted a franchise at Walhalla, S. C., for the construction of an electric-light plant.

A franchise has been granted McMillan & Simpson at Holden, Mo., for an electric-lighting and heating plant.

The office of the electric-light company at Marshfield, Wis., was recently damaged by fire to the extent of $4,000.

At a special election held at Frankfort, N. Y., it was decided to borrow $18,000 for the purpose of erecting an electric-light plant.

The town of Globe, Ariz., will be supplied with electric power from a plant which is to be erected on Salt River, 20 miles above Globe.

The stockholders of the Citizens' Light and Power company of Rochester, N. Y., have increased the capital stock from $150,000 to $2,500,000.

Two applications have been filed with the City Council of Fullerton, Neb., for an electric-light franchise, one by T. Lee and one by E. D. Gould.

Increase in the capital stock of the Newmarket Electric Light, Power and Heat company of Newmarket, N. H., has been made from $10,000 to $22,000.

T. H. Gillmer, W. Wallace and E. W. Gillmer have petitioned the Warren (Ohio) council for a 30-year franchise for the erection and maintaining of a public heat and power plant.

The Cleveland (Tenn.) Water and Electric Light company has sold its electric-light and power plant to a local company, composed of J. H. and G. L. Hardwick, G. Cate, J. A. and T. D. Steed.

Bids will be received until June 12th for installing electric-light machinery and furnishing arc lamps, etc., at Sharpsburg, Pa. F. A. Smith, E. Roesler and G. D. McMorran constitute the committee.

Bids will be received by C. Taylor Leland, 421 Chestnut street, Philadelphia, Pa., for the installation of an electric-light plant for the Delaware City Light and Water company, including dynamos, wire and poles.

ELECTRIC RAILWAYS.

An electric line is proposed between Milton and Owenton, Ky., a distance of 35 miles.

Contracts for the building of a street railway six miles long in Biloxi, Miss., will be let in a few weeks.

A. P. and A. J. Goddard, the owners of the Freeport (Ill.) electric street-car line, are making arrangements to extend the system to various parts of the city.

The Metropolitan Rapid Transit Railway, Light and Power company, Birmingham, Ala., will build an electric power plant soon. E. F. Enslen is treasurer of the company.

Right-of-way for a trolley line from Allentown, Pa., to Palmerton, Carbon County, has been secured by the Lehigh and Carbon Electric Railway company. The line will be 20 miles long.

A. W. James, J. H. Duhlman, A. Smalley and others have incorporated the Findlay and Marion Electric Railway company at Findlay, Ohio. An electric railway will be built between Marion and Findlay via Upper Sandusky.

The Coal Belt Electric Railway company proposes to build an electric belt line from Marion, Ill., through Johnson City, Herrin and Carterville, and from there back to Marion. The road will pass through rich coal fields all the way.

Arrangements have been completed for the construction of the Saginaw Southern railway, extending from Saginaw to Jackson, Mich., via St. Charles, Chesaning, Owosso and Lansing. The company is organized with $1,000,000 capital stock.

The Lima, Delphos, Van Wert and Fort Wayne Traction company has been incorporated at Lima, Ohio, by Cleveland and Lima capitalists, with a capital stock of $50,000. The line will parallel the Pittsburg, Fort Wayne and Chicago branch of the Pennsylvania Railroad system.

It is understood that the Hampton Roads Railway and Electric company, which has a franchise to build an electric road in Newport News, Va., that will connect with Old Point Comfort, has just purchased $40,000 worth of electrical machinery, to be installed in the new power house.

The sale of the Detroit and Pontiac railway to the Detroit United Railroad company was consummated May 31st. The road is 35 miles long, and from now on will be run as a part of the United Railroad system. The purchase is said to be another step toward a consolidation of all the suburban trolley lines with the Detroit United Railroad company.

New car shops are to be built by the Rochester (N. Y.) Railway company, at a cost of $200,000. Plans are now under consideration for a one-story structure 173 feet wide by 200 feet long.

The stockholders of the Ballston Terminal Electric railroad, Ballston Spa, N. Y., have voted to increase the capital stock from $300,000 to $1,500,000. The road will extend from Ballston Spa to Amsterdam, N. Y., a distance of 20 miles.

A company has been organized at Findlay, Ohio, to connect Findlay and Fort Wayne, Ind. The line will touch Benton, Pandora, Columbus Grove, Ottawa and Cavitte. Dr. W. H. Boggs of Columbus Grove, Dr. M. H. May of Pandora and J. H. Whistler are among those interested.

AUTOMOBILES.

On June 15th the Automobile Club of New England will hold a race meet at Clyde Park, Brookline, Mass. There will be speed contests between special racing automobiles of French and American patterns and regular and special types of steam, gasoline and electric road carriages. Entries are expected from all over the country.

The Paris-Bordeaux automobile race was run May 29th and was won by M. Fournier in eight hours, 44 minutes and 44 seconds. The course was 555 kilometers and 500 meters (345 miles) long, and an average speed of 63 kilometers, 720 meters an hour, was maintained by M. Fournier. His highest speed on open roads was 100 kilometers an hour.

Alexander B. Winton and Charles B. Shanks of Cleveland, Ohio, who started across the continent from San Francisco in an automobile, have abandoned the attempt. Their machine got stalled in the sand hills near Winnemucca, Nevada. Mr. Winton says it is impossible for an ordinary automobile to cross the sandy deserts of Nevada.

PUBLICATIONS.

A price-list, containing descriptive matter of flexible conduit for electric wiring, has been recently issued in folder form by the St. Louis Electrical Supply company of St. Louis, Mo.

The Jeffery Manufacturing company of Columbus, Ohio, is sending out to the trade throughout the country copies of a circular which contains a large number of illustrations of the company's elevating and conveying machinery and electric and pneumatic coal-mine equipments.

A new catalogue has just been issued by the Chicago Fuse Wire and Manufacturing company of Chicago on tested fuse wire and links. The publication has been prepared with considerable care with the idea especially in view to consider convenience in ordering, particularly where special sizes are required.

Beautiful samples of the engraver's art are distributed by the Franklin Engraving and Electrotyping company of Chicago in a folder bearing the title "A Message from Franklin." The work shown is of particular interest to manufacturers of electrical equipment, and is really of the highest order of excellence.

The storage batteries manufactured by the Gould Storage Battery company of Depew, N. Y., are well illustrated and described in a recently issued catalogue. Besides a general line of cells, with views of the plates, there are listed and illustrated special batteries for railroad-train and yacht lighting, automobiles and portable use.

Recent bulletins issued by the Fort Wayne Electric Works of Fort Wayne, Ind., are descriptive of different types of Wood apparatus. They include open series, direct-current arc lamps of the shunt type, measuring instruments, constant-current dynamos for arc lighting, with improved regulators, cut-outs for arc circuits, and primary fuse boxes.

The Electric Storage Battery company of Philadelphia has recently issued a special bulletin for Pan-American visitors, illustrating and briefly describing in its 24 pages various applications of the Chloride accumulator to electric lighting and power. The illustrations are large and very clear, and peak and regulation diagrams help to explain the operation of the batteries.

The Illuminating Publishing company of Cincinnati has published a pamphlet entitled "Is Gasoline Lighting Dangerous?" Its 50 pages are given up to extracts and clippings recounting explosions of gasoline and acetylene, the object of the publication being to point out the danger to human life and property resulting from the use of those fluids for illuminating purposes.

The advertising department of the Joseph Dixon Crucible company, Jersey City, N. J., has just published a handsome specimen of modern catalogue making. The publication is a catalogue of the graphite productions of the Dixon company, and its 77 pages are replete with illustrations and descriptions of crucibles, flake and special forms of graphite for lubricating purposes, lead pencils, etc. Views of the different plants, mines and mills of the company are shown. The cover of the catalogue is especially attractive, as it is printed in a striking

copper-bronze color, the clay-modeled design being representative of a crucible-steel plant.

S. Rentell & Co. of London publish a book on "Conduit Wiring and Erection," by L. M. Waterhouse. The little volume aims to set forth the best and most economical methods of interior conduit construction and plans for wiring. Special reference is made to the efficiency of the Simplex system of steel conduits, which is believed to give the best results for interior work.

SOCIETIES AND SCHOOLS.

S. G. McMeen, engineer of the Central Union Telephone company of Chicago, gave an address before the students of the Armour Institute of Technology on May 29th on "Modern Telephone Practice."

S. P. Grace of the engineering staff of the Erie Telephone and Telegraph system, with headquarters at Detroit, delivered a course of lectures on "Telephone Engineering" last week to the students of the engineering department of the University of Michigan at Ann Arbor, Mich.

The University of Chicago has secured about a quarter of a block of property fronting on Ingleside avenue, just north of Fifty-eighth street, Chicago. The purchase has been made so as to provide more room for the new power house soon to be erected. It is said that $32,000 was expended for the property.

A course in drawing, designed especially to meet the requirements of teachers, has been prepared by the International Correspondence Schools, Scranton, Pa. Drawing is of considerable importance to teachers, a number of states requiring applicants for teachers' certificates to pass an examination in it, and it is probable that other states will do likewise. The schools' drawing course will qualify teachers not only to pass such examinations but to fill positions successfully as instructors in drawing.

The Rev. Dr. Frank W. Gunsaulus, who a year ago resigned as president of the Armour Institute of Technology of Chicago, has been induced to resume the position at the head of the school. Two new buildings are to be erected on land contiguous to the site of the present structure. The first to be erected will be a shop building to contain the pattern shops, machine shops and foundries, and will entail an expense of from $50,000 to $100,000. A memorial building for P. D. Armour, Sr., will be the next erected. It will provide quarters for the electrical, mechanical, chemical and civil-engineering courses, and will cost considerably more than the shop building. In the future coeducation will be no part of the school's work. Professor Victor C. Alderson, who has been acting president, will remain as dean of the Institute.

MISCELLANEOUS.

The local union of electrical workers of Atlanta, Ga., has made a formal demand upon their employers for a nine-hour workday and an increase of 25 cents a day in wages.

One of the new features that have been added to the New York Central's Empire State Express is that of lighting the coaches by electricity generated by an attachment to the axles of the running gear.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 26th for the installation of a conduit and wiring system for the post-office building at Menominee, Mich. Specifications may be obtained at the office of the superintendent of construction at Menominee, or at the office of James Knox Taylor, supervising architect.

A plot to defraud the Washington (D. C.) Traction company has been detected by the company. Counterfeit tickets of dangerous similarity to the regular tickets have been found, and a confession has been made by one of the conductors. He said that he had used counterfeit tickets printed in England. Several thousand dollars is believed to have been made by the counterfeiters. This is the company whose employes were caught recently raking tickets from the furnace, where they had been put to be destroyed, and using them again.

Arthur Budds, a Hartford (Conn.) boy, received, through his body, a current of electricity having an electromotive force possibly as high as 10,000 volts. He is still alive and has a fair prospect of recovery. In drawing himself up on a shed, he took hold of a power cable from the station of the Hartford Electric Light company, which carries 10,000 volts. He was unable to let go, and before he could be rescued, his hands were fearfully burned, one finger being burned off. One newspaper account says that the cable was insulated, so that the strength and voltage of the current passing through the boy's arms are uncertain.

MANUFACTURERS AND DEALERS.

The Electric Appliance company, Chicago, is putting out a high-grade bridging telephone, which is especially recommended for farmers' line work, where a low-priced, but first-class, instrument is desired.

The Manhattan Electric Supply company of Chicago and New York reports that it is having a very heavy demand for the well-known Mesco dry battery, and that it will be pleased to quote special prices on application. This battery is being used by many of the largest telephone companies, and is said to be giving the best of satisfaction.

The Lambert Schmidt Telephone Manufacturing company of New York city announces that it has just purchased all the tools and material of the Bruckner Electric company of the same city. This addition, combined with the large amount of tools and machinery which the Schmidt company has on hand, gives it exceptional facilities for turning out special apparatus of the most modern pattern.

TRADE NEWS.

The Goudey-McLean company has been incorporated at New York city, to manufacture electrical machinery. The capital is $3,000. The directors are E. E. Goudey, L. W. Miller and Robert McLean.

Among the commodities imported by Germany from the United States in the year 1900 were 343 tons of electrical machines, 200 tons of steam engines, 574 tons of blowing machinery, 331 tons of pumps and 20,249 tons of agricultural machinery and implements.

The Electric Storage Battery company of Philadelphia, manufacturer of the Chloride accumulator, has placed its Pennsylvania sales office under the direction of E. L. Reynolds, who for a number of years has been associated with the company in its New York office.

The Sutton-Steele Electrical Mining and Milling company has been incorporated at Dallas, Texas, with a capital stock of $100,000, to manufacture tools, machines and implements for mining and milling. The incorporators are H. M. Sutton, I. Jalonick, E. G. Steele and S. A. Leake.

The figures given below are taken from the report of United States Consul Holloway regarding the imports and exports of Russia, in direct trade with the United States, for the year 1900. Among the commodities exported are: Copper, 2,320,000 pounds, valued at $342,475; machines and apparatus of iron and steel, 2,040,000 pounds, valued at $229,690, and parts of machines, 880,000 pounds, valued at $74,160. The total exports from Russia to the United States were valued at $1,790,280, and the imports at $21,661,515.

The B. F. Sturtevant company of Boston is contemplating the erection of an entirely new plant in the vicinity of Boston, where good shipping facilities, water supply, etc., may be secured. The plant itself will, of necessity, consist of a power house, large foundry, blower, heater, forge, engine, electrical and galvanized-iron shops, with administration building, pattern shop, etc., conveniently located. Between five and 10 acres of floor space will undoubtedly be required to meet present requirements, while the available land for future extensions must be from 15 to 20 acres.

The Gould electric-vehicle battery, made by the Gould Storage Battery company of New York city, while constructed by the hardy electrochemical formation out of the pure rolled-lead plate, the latter being spun to increase the surface in the ratio of over 20 to 1, is remarkable for the fact that the watt efficiency is said to be equal to the highest attainable output from "pasted" types of battery. It is said that the Gould high-output battery makes it possible to drive a well-constructed vehicle 100 miles with a battery weighing about four pounds per mile. The Gould shops are a living witness to the fact that the Gould battery is looked upon with growing favor.

BUSINESS.

The Peru Electric Manufacturing company of Peru, Ind., reports large shipments of Pemco rosettes. The company is a strong believer in the theory that it pays to advertise a good article.

The Jones Bros. Electric company of Cincinnati has ordered a 450-horsepower, tandem-compound engine, arranged for direct connection to a generator, from the Ball Engine company of Erie, Pa. The Dayton Malleable Iron Works of Dayton, Ohio, have also purchased a 175-horsepower engine, arranged for direct connection, from the same company.

The Central Electric company of Chicago is western agent for the Falcon Electric Manufacturing company's arc lamps, fan motors, panel boards and plugs and receptacles. The company has advertised these arc lamps and fan motors extensively, and now wishes to call attention to the other articles mentioned. The panel boards are highly finished and conform with the underwriters' requirements. The plugs and receptacles are made in any finish and are said to be neat, compact and durable.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued May 28, 1901.

674,860. Telephone-circuit System. Ellis F. Frost, Washington, D. C. Application filed June 27, 1900.

In this system a number of central offices, a number of telephone lines, a bus-bar at each of the central offices, and a trunk line which is adapted to connect the telephone lines are combined with a common-return line extending between the telephone lines, consisting of the local common-return line and the bus-bar proper to each central office. A line extends between the central offices which is connected to the bus bar.

674,861. Telephone-circuit System. Ellis F. Frost, Washington, D. C. Application filed June 27, 1900.

A number of telephone lines, a bus-bar, a source of electric energy, one pole of which is connected to the earth and the other pole of which is connected to the bus-bar; a common-return line for the telephone lines which is connected to the bus-bar, and any of the telephone lines adapted to be connected to the common-return line, are combined with a microphone, a condenser and an induction coil, the primary of which is connected in series with the microphone and is shunted by the condenser and connected to the earth and inductively to the telephone line.

674,862. Telephone Switchboard. Ellis F. Frost, Washington, D. C. Application filed June 27, 1900.

This invention combines a number of telephone lines, a bus-bar, a source of electric energy, one pole of which is connected to the earth, the other pole of which is connected to the bus-bar, and a common-return line for the telephone lines connected to the bus-bar. There are also an operator's telephone line and a second bus-bar which is connected to the first bus-bar through the operator's telephone line.

674,867. Circuit-operating Device. Percy C. Howe, Boston, Mass. Application filed March 12, 1900.

A terminal is fastened to the base of this device. A curved thermostatic strip is fastened at one end to the terminal and is free at the other end. An independently adjustable terminal is mounted on the base. A spring-pressed and movable terminal is mounted on the base and is interposed between the free end of the thermostatic strip and the adjustable terminal. A movable contact member is fastened at one end to the first-mentioned terminal and is adapted to be operated manually independently of the thermostatic strip to connect two of the terminals.

674,890. Static Machine. Henry E. Waite and Harry F. Waite, New York, N. Y. Application filed April 10, 1901.

Stationary plates, rotating disks and collecting combs of an influence machine are combined with a casing therefor having a removable door carrying a charging machine, an adjustable connection which is placed between a collecting comb of the charging machine and an armature on a stationary plate of the influence machine. There is an adjustable connection between another collecting comb of the charging machine and a collecting comb of the influence machine.

674,927. Electrode for Electrolytic Ceils. Max Mauran, Niagara Falls, N. Y., assignor to the Castner Electrolytic Alkali company of Virginia. Application filed March 16, 1900.

A series of parallel wrought-iron bars or rods is provided with intermediate spacing pieces for holding them suitably separated, and a terminal of cast-iron is cast around and embeds the ends of the wrought-iron bars or rods. The terminal is provided with a shank extending at an angle to the length of the bars or rods. When the bars or rods lie horizontally in the bath the terminal may extend upward therefrom.

674,930. Electrolytic Cell. Max Mauran, Niagara Falls, N. Y., assignor to the Castner Electrolytic Alkali company of Virginia. Application filed March 26, 1900.

An electrolytic oscillating cell is provided with stationary supporting frames upon which the cell is movably mounted. An actuating shaft for the cell is mounted in bearings. There are actuating connections from the shaft to the cell, and means are provided for adjusting the supports of the cell upon the frame.

674,931. Electrolytic Cell. Max Mauran, Niagara Falls, N. Y., assignor to the Castner Electrolytic Alkali company of Virginia. Original applications filed March 16, 1900, and March 26, 1900. Divided and this application filed June 14, 1900.

An electrode has a broad lower face formed by the flanges of the inverted T section of the cell. A short shank extends along the upper side of the anode. The upper part of the shank is recessed to engage and interlock with a cement mass.

674,933. Electrolytic Cell. Max Mauran, Niagara Falls, N. Y., assignor to the Castner Electrolytic Alkali company of Virginia. Original applications filed March 26, 1900, and June 14, 1900. Divided and this application filed October 16, 1900.

An electrode is provided with a number of projections for terminal connection. A tortuous connector for the projections surrounds and is soldered thereto.

674,934. Electrode for Electrolytic Cells. Max Mauran, Niagara Falls, N. Y., assignor to the Castner Electrolytic Alkali company of Virginia. Application filed March 16, 1900. Renewed April 27, 1901.

This device is composed of a number of strips or bars, each bent upon itself to extend out of the bath or the cell, and all have their ends welded together.

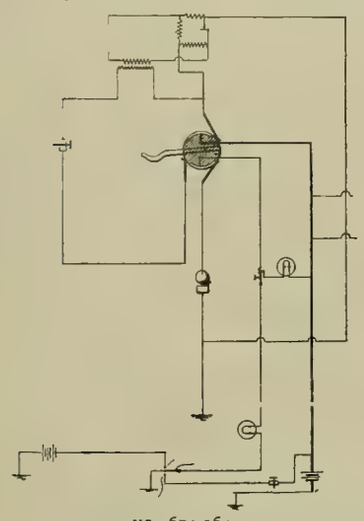
674,942. Automatic Current Regulator. Severn D. Sprong, Long Branch, N. J., assignor of one-half to James H. Harnden, Brooklyn, N. Y. Application filed March 16, 1901.

An oscillating balanced-beam mechanism is actuated by an electric current to regulate automatically the current

This is combined with an electromagnet which has its coil suspended from and supported by the outer ends of the beams of the beam mechanism, its core being suspended from and supported by the opposite ends of the beams, whereby the parts are mutually and automatically balanced.

674,947. Automatic Regulating Switch. Frederick J. Tolchard, Paignton, England. Application filed October 29, 1900.

A battery is connected in series. Two motors rotate a shaft in opposite directions. A voltmeter puts one or the other of the motors into action according as the voltage rises above or falls below the proper point. There are cams on the shaft, and levers are successively operated by the cams. Switches are operated by the levers and each puts into circuit a different number of the battery cells.



NO. 674,964.

674,964. Telephone-circuit System. Ellis F. Frost, Washington, D. C. Application filed June 27, 1900.

A telephone-line circuit, a call-bell circuit, a receiving-telephone circuit, a microphone-transmitter circuit and a switch are combined with a line in operative relation thereto constituting a common return for the telephone-line circuit and constituting for the transmitter circuit a battery-supply circuit grounded at the central office and at the subscriber's station. (See cut.)

674,981. Controlling Electric Motors. Eugene C. Parham, Brooklyn, N. Y., assignor to the Lorain Steel company of Pennsylvania. Application filed September 23, 1899.

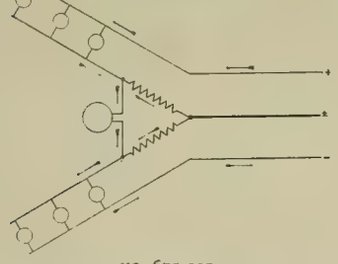
The motors are combined with artificial resistance for connection in series. There is a shunt coil for connection in multiple with the field coils. A controlling switch which has contacts and connections is arranged to start the motors from a state of rest with their fields connected in series with each other and the artificial resistance and their armatures connected in multiple with each other and in series with the field coils. Subsequently further movement of the switch gradually removes the resistance and connects the shunt coil in multiple with the fields.

675,001. Apparatus for Connecting Electric Meters in Three-wire Circuits. John R. Dick, Brighton, England, assignor to the Mutual Electric Trust, Limited, Brighton, England. Application filed March 9, 1900.

A three-wire circuit comprises a neutral conductor split into branches. There are resistances in each branch equal to each other, and a measuring instrument is connected thereto. (See cut.)

675,027. Controller for Electric Cars. Walter W. Tice, Rahway, N. J., assignor of one-half to George H. Tice, Perth Amboy, N. J. Application filed August 1, 1900.

The essential parts of this device are the controller, a brake connection, a shaft or rod, a train of cogged gearing connecting the shaft, and a controller including pinions. There is also a rotary cog-wheel having a continuous series of cogs to engage one of the pinions and a discontinuous series to engage the other of the pinions.



NO. 675,001.

675,033. Electric Arc Lamp. Curt A. M. Börner, Berlin, Germany. Application filed July 24, 1900.

The positive and negative electrodes each consists of a number of carbon pencils insulated and separated from each other in parallel rows. The pencil points when fed together occupy a staggered relation. An electric circuit includes in series the outermost pencil on one side and the outermost pencil on the opposite side.

675,038. Electric Railway. Philip Farnsworth, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed May 31, 1900.

Individual alternating successive sections of a normally dead sectional service conductor are connected by parallel branches to a feeder and return, respectively. A switch is provided for each of the feeder branches, and a coil is provided in each of the return branches. A collector is carried by the car whereby current passes from a previously energized section. It is in shunt to the car circuit through the two coils in the parallel branches to return from one of the sections to close the switches which connect both adjacent sections with the feeder.

675,049. Circuit-breaker. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 21, 1901.

Movable main and shunt contacts are pivoted together. A spring controlling them gives a normal bias toward an open position. A spring-actuated latch is provided for locking them in closed relation to corresponding fixed contacts. A tripping device for the latch is adapted to be set and released by opposite movements of the handle. There is also an operating lever. (See cut.)

675,050. Electric Railway. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric company of New York. Application filed February 21, 1901.

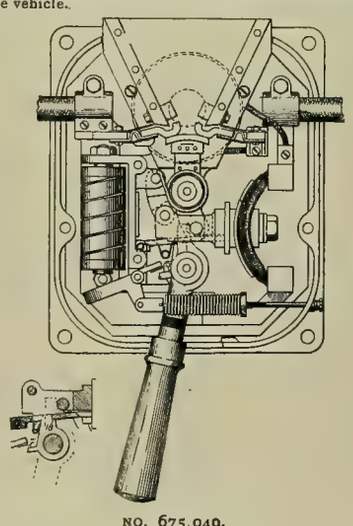
A feeder is combined with conductor sections. Switches are provided for connecting the feeder with the sections. Coils are connected between auxiliary sections, and the return for actuating the switches. A resistance is carried by the car. Means are provided for automatically cutting the resistance into circuit with the successive switch coils after they have been energized.

675,056. Magnetic Separator. Thomas A. Edison, Llewellyn Park, N. J. Application filed June 12, 1897.

This device has an oblong bar magnet wound over the length of the bar and arranged in a horizontal position so as to present a laterally extended polar face. This is combined with means arranged to feed the mixed magnetic and non-magnetic material directly to the polar face of the magnet. Means are provided for automatically and separately receiving the magnetic and non-magnetic particles continuously separated by the magnetic action. (See cut.)

675,065. Device for Operating and Controlling Electric Automobiles. Frank F. Loomis, Akron, Ohio, assignor to the International Fire Engine company, New York, N. Y. Application filed November 3, 1900.

A revoluble shaft has a pinion to mesh in a toothed member of the fifth wheel, and a handle for operating it. An enclosing revoluble concentric hollow shaft has a radial arm to draw a brake rod, a handle for turning it and a ratchet to retain the handle at a determinate position. An enclosing shaft is revolubly mounted on the brake shaft. Bearing ranks of switch blades are variously connected to produce different degrees of electrical energy to operate motors to cause the vehicle to move forward or backward. These features are combined with electrical contacts arranged to be simultaneously connected with ranks of the blades, which are variously determinately connected with batteries. The field magnets and armatures of the motors are arranged to drive the vehicle.



NO. 675,049.

675,066. Fire-alarm Device. Nels Mallander, Minneapolis, Minn., assignor of three-fourths to William H. Kaercher, John A. Olson and William Johnson, Minneapolis, Minn. Application filed May 21, 1900.

A thermometer comprises a case, a graduated dial and a movable finger or pointer. This is combined with an adjustable electrode mounted for movement within the case for co-operation with the pointer and provided with a part projecting through a slot of the dial to indicate its position. A stem projects from the electrode and works outward through the case. A friction device is applied to hold the electrode where set, and circuit connections comprise an alarm or bell and a battery or source of energy, and include the finger or pointer and the adjustable electrode.

675,086. Electric-railway Signal. William H. Council, Williamsville, Ill., assignor to the Miller Signal company, Chicago, Ill. Application filed April 19, 1900.

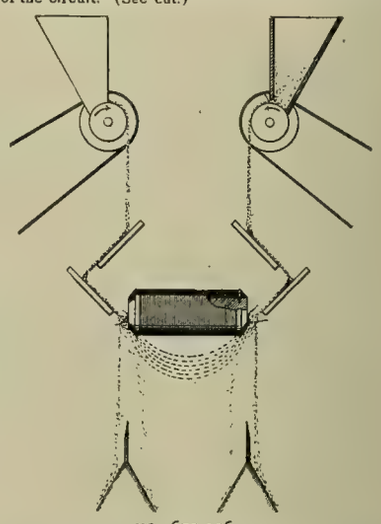
An insulated rail or rail section in the track rails is provided at each block-signal station on each side of the track, with the insulated rail or rail section on one side undivided and the insulated rail or rail section on the other side divided into two parts or members insulated from each other. An incomplete electric circuit is provided for each part or member of the insulated divided rail or rail section and the track rails on its side of the track. There is an electric circuit for the track rails at each end of the block. There is also a complete electric circuit for each block independent of the track-rail circuits at the ends of the block. Means are carried on a train for completing the incomplete circuit of the divided insulated rail or rail section with the passage of a train on to and over the insulated divided rail or rail section of the block.

675,114. Electric-motor Control. Bennet C. Shipman, Wilkinsburg, Pa. Application filed June 25, 1900.

A source of current supply and a controlling mechanism is adapted to operate the motors as motors to drive, or as generators to brake, and to return such generated energy to the system. A circuit-opening device is placed in such electric circuit, adapted to open automatically under certain predetermined abnormal conditions. Means operated by the controlling mechanism are adapted to close such circuit-opening device at predetermined points of its operation.

675,158. System of Electrical Distribution. Albert S. Hubbard, Belleville, N. J., assignor to Charles A. Gould, Port Chester, N. Y. Application filed April 5, 1900.

An alternating-current generator is combined with a consumption circuit which has its respective sides connected to one side of the alternating source and oppositely directed electrochemical rectifying devices included in the connections to its respective sides. A connection includes translating devices from the other side of the alternating source to one side of the consumption circuit, and there is an exciting coil for the alternating-current generator connected with the alternating generator through the electrochemical rectifying device on one side of the circuit. (See cut.)



NO. 675 056.

675,162. Magnetic Separator. Benjamin Noble, Detroit, Mich., assignor of one-half to John G. Dietz, Detroit, Mich. Application filed August 27, 1900.

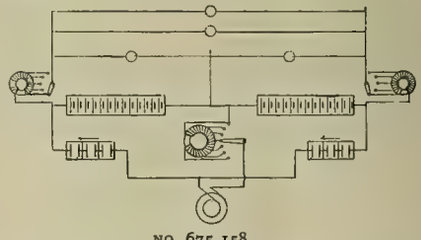
Iron studs are secured to and project radially from an iron cylinder and are arranged to form a circumferential and longitudinal series of pairs. Coils upon the studs are connected in electric circuit to form magnets alternately of opposite polarity in both circumferential and longitudinal series. All of the magnets are magnetically coupled by the cylinder, whereby a substantially complete magnetic circuit may be formed by the separated magnetic material bridging between any pair of opposite poles, and a non-magnetic sheathing surrounding the studs and coils.

675,177. Electric Switch. George B. Thomas, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing company, Hartford, Conn. Application filed February 15, 1901.

An electric switch is provided with stationary contacts and a stop piece. A rotary part consisting of a sheet-metal plate, which is formed with contacts at the ends, and a separate metallic piece having a nose to engage the stop piece and embraced and held by the plate, are combined with the switch.

675,293. Controller for Electric Motors. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed August 27, 1898.

Stationary contacts, an oscillatory lever and contacts actuated thereby are combined with arms pivoted on stationary centers. Links have pivotal connections with the lever and with the free ends of the arms. Stop devices are provided for limiting the approach of the arms. A single tension spring is connected to the arms between their pivots and the point of connection with the links.



NO. 675,158.

675,294. Electrical Controlling Apparatus. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Application filed February 2, 1900.

A series-wound electric motor which has a resistance permanently in shunt with the armature, and a variable resistance also in shunt with the armature and in parallel with the permanent shunt, is combined with a movable switch member operating to control the variable resistance and also the main circuit.

675,351. Safety Speed-limiting Means. Garrett W. Hendricks, Indianapolis, Ind., assignor to the Hendricks Novelty company, Indianapolis, Ind. Application filed March 14, 1901.

An electricity-generating machine has a stop member provided with an antifrictional contact face. A conical pulley operates in contact with the stop member. A spindle or shaft is connected with the stop member. A main base slidingly supports the stop member and an adjusting means is connected with the spindle and is adapted to be released from operation whereby to relieve the action of the stop member. The generator shaft is supported upon a supplemental base and carries the conical pulley, and means are provided for elastically pressing the conical pulley against the stop member.

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, JUNE 15, 1901. No. 24

Electrical Equipment of Lightship No. 72.

Cape Hatteras shoal, besides being one of the most dangerous menaces to navigation in the world, is also the most difficult to guard. Nevertheless, no duty of the government is too arduous to perform nor no dangers of service too terrifying and hazardous for its lightship men. Numerous attempts to lay the foundations of a lighthouse at this point have all failed. No floating buoys have outlived the terrible and frequent storms, and the first lightship there proved too small. The new steam-propelled lightship, known as No. 72, shown in the picture on the next page, is the stanchest vessel of its kind afloat. She is 112 feet between perpendiculars, 28 feet six inches in breadth, and about 15 feet in depth. The two steel masts have a tensile strength of 55,000 to 60,000 pounds. The distance from the 12-foot water line to the focus of the lights is 59 feet. The steel hull is divided into five watertight compartments by steel bulkheads, and should three of these fill the other two compartments would suffice to keep her afloat.

The electrical equipment was built and installed under the exacting specifications usually prepared by the government. The generating sets and switchboard, illustrated herewith, are located in an enclosure on the main deck, over the engine room, the latter being reached by a hatchway and ladder leading to the engine platform. Suitable doors are provided for access to the electrical machinery from the main deck. The two generating sets each consist of an 8½-kilowatt, multipolar, generator, built by the E. G. Bernard company, Troy, N. Y., direct-connected to a vertical inverted two-cylinder engine, the cylinders being five inches in diameter, with a four-inch stroke.

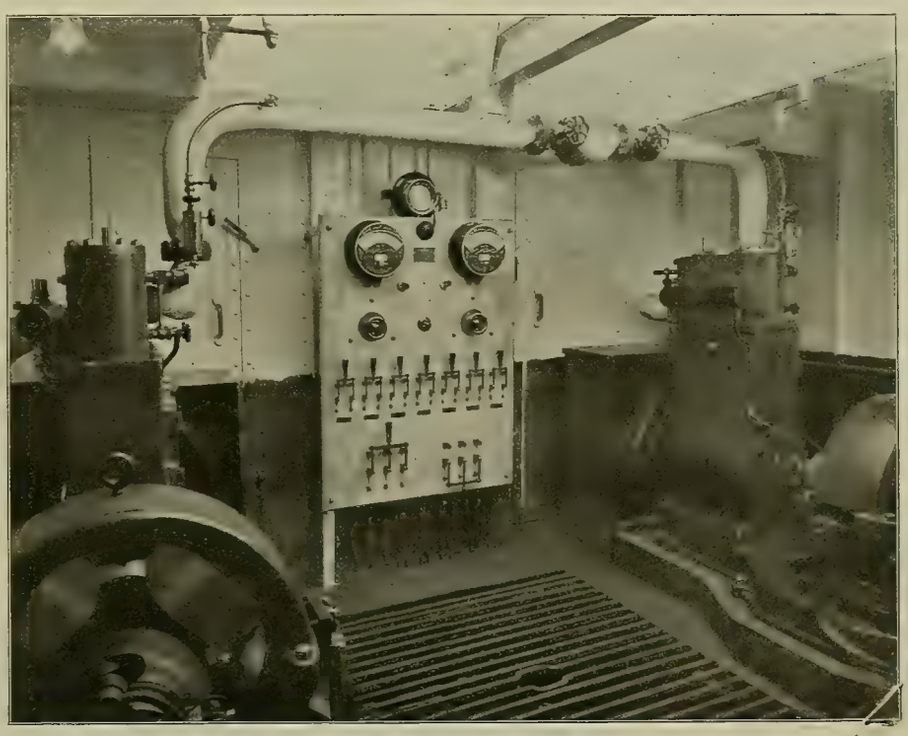
The two generating sets are placed on lead-lined platforms or boxes, perfectly oiltight and firmly secured to foundations on the deck of the vessel. These box foundations are made of four-inch Georgia pine, laid with the grain running fore and aft of the vessel, and held together by dowel bolts five-eighths inch in diameter. Around this foundation is a strip of white pine two inches square, fastened with screws, leaving a space of three inches between the foundation frame of each generating set and the inner edge of the strip. The lead used for lining weighs 10 pounds to the square foot. Both engines receive steam from the boiler from one pipe provided with two-inch branches to each engine, each branch being provided with a valve, so as to shut the steam from one pipe while using the other, and thus avoiding condensation. All the steam and exhaust pipes are of No. 8 copper. Each engine exhausts through a 2½-inch pipe into the condensing system, all connections being independent. All the valves are of brass. The steam and exhaust pipes and valves and fittings are neatly covered with one-inch magnesia sectional covering, served in No. 6 canvas covering and well coated with white-lead paint.

Inch-and-a-half pink Tennessee marble is used for the switchboard, which carries the following-named switches and instruments: Two triple-pole, single-throw, 75-ampere knife switches and seven double-pole, single-throw, 30-ampere knife switches, with fuses. The 30-ampere switches are marked by name-plates to indicate the circuits, as "Cabin Aft," "Cabin Forward," "Engine Room," "Aft Hold," "Forward Hold," "Mainmast" and "Foremast," respectively. An equalizing bar is provided for throwing the generators in multiple. There is a round-pattern Weston voltmeter, reading 0 to 125 volts, used for both units, and a Weston round-pattern ammeter, reading from 0 to 100 amperes, a ground detector and a pilot lamp. There are two Carpenter enamel field rheostats. All the connections on the back of the board are of extra-heavy drawn copper. The board is held securely to the ironwork of the vessel by angle irons. This board was also built by the Bernard company.

Of course, the principal office of the ship is to show powerful masthead lights as a warning to navigators. These lights are flashed by a device attached to each generator at the commutator end. This device consists, essentially, of a circuit-breaker, revolving on a horizontal shaft, set at a right angle with the generator shaft. The disks of the circuit-breaker are three in number, 4½ inches in diameter, on a shaft seven-eighths inch in diameter. This shaft carries a worm gear, with 138 teeth, which engages a worm revolving with and practically a continuation of the generator shaft. The frame containing the bearings for the shaft of the circuit-breaker is fastened to the outboard pedestal of the generator by a single stud, upon which the entire device may be swung in a vertical plane, thus allowing the worm gear to be engaged or disengaged at will. A thumb nut is provided for clamping the circuit-breaker in either position. This greatly improved device was designed by the Fore River Ship and Engine company of Quincy, Mass., which built the ship. It was approved by the government and adopted instead of the device called for in the specifications. It does away with belts and pulleys and secures a positive action by worm gearing. The three disks have a speed of two revolutions per minute. On the outer surface of one disk are copper strips, whose length determines the duration of the flash or time the lamps are illuminated. One of the remaining disks has copper strips of the same general character as on the disk just described, the only difference being that the length of these strips determines the interval between the flashes. The remaining disk has a continuous copper strip all the way around. The copper strips carry 30 amperes without heating. The disks are insulated from each other and have suitable brushes for collecting the current in such a way that the very instant the masthead lights are turned off the resistance for masthead lights is turned on, and vice versa.

Two resistance coils (one for each generator) are connected in series with the masthead lights and the circuit-breaker, so that when the lights are on the resistance will not be in the circuit, but the instant the lights are turned off this resistance is at the same instant automatically turned on, thus providing a steady load on the engines. The total resistance is equal to that of six 100-candlepower, 100-volt Edison lamps.

The vessel is wired for about 80 16-candlepower, 100-volt lamps, with Edison base, and six 100-candlepower, 100-volt lamps, three on each mast. All lamps are incandescent. The entire wiring for lamps is without a splice in any part, and none of the wire used is smaller than No. 14 B. & S. wire gauge. All the wiring is in molding, and the molding and capping is held in place by brass screws. None of the wiring comes in contact with any of the deck beams. Instead of passing over or around the beams, the wiring is invariably carried through them, they being drilled and fitted with rubber tubing. In passing through bulkheads or decks, watertight stuffing tubes are used. In each room there are one or more lights, protected by a porcelain cut-out and controlled by a 10-ampere snap switch. There are several marine portable lights in the engine room. Each of the lights on the masts has a marine watertight switch and receptacle, so that it can be turned on or off independently of the rest.



ELECTRICAL EQUIPMENT OF LIGHTSHIP NO. 72.—GENERATOR SETS AND SWITCHBOARD.

Ample precaution has been taken to guard against accidents to the lighting plant and its equipment. A spare armature, several sets of generator brushes, a number of marine keyless sockets for masthead lights, about 100 100-volt, 16-candlepower lamps, and 50 100-volt, 100-candlepower lamps, etc., are kept in stock. It is estimated that the lights will be visible on clear nights for a distance of about 20 miles, and about half that distance in stormy weather.

It is quite possible that in course of time the lightship will be equipped for wireless telegraphy, enabling it to keep in touch with the mainland at all times, and thus greatly increasing its usefulness.

Pole Lore.

A monograph on forest extension in the Middle West, just issued by the Department of Agriculture, contains some interesting information about telegraph, telephone and electric-power and light poles. The timbers most used for these purposes are tamarack, white cedar and red juniper. Their value is fully known, and if the supply could hold out, nothing would displace them. Their life in the ground is about 10 years, so that every decade sees one generation of poles worn out and another cut to replace it. To the poles required for renewal is to be added the number required for new lines and systems. The total is very large. The telegraph lines of the country require nearly 600,000 poles annually, at a cost of not less than a million dollars, and the telephone and electric-car lines and light systems use as many more. The price of poles for such uses varies greatly, ranging from $1 to $50 each. If an advance in the price of post timbers is to be expected in the next 15 years, a much greater advance may be expected in timbers of this class. A post may be grown comparatively quickly, and in an exigency almost anything can be used; but a telegraph pole must be long, straight, and of good quality. Timbers that fulfill these conditions are few, and a number of years are required to grow them. When the natural supply runs low, high prices will prevail.

Stockholders of Central Union Company Asked to Increase Stock.

President John I. Sabin of the Central Union Telephone company of Chicago has issued a circular letter addressed to the stockholders of the company, setting forth the fact that the company stands in immediate need of $3,000,000, and that unless the amount is forthcoming the progress of the company must stop. Mr. Sabin says in his letter:

"After two months' investigation—the last month in charge as president—I find that it is imperatively necessary that at least $3,000,000 be provided without delay—that is, one-half immediately and one-half before the close of the present year, 1901, with a call for another $1,000,000 during the first half of the year 1902, and one more for the same amount during the last half of 1902, making a total of $5,000,000 (this sum in addition to the net income during the period named). The issue of bonds under present mortgages has reached its limit. The net revenue will not allow extensions rapidly enough, and, while there have been a great many proposed modes of getting the money, in my opinion the most practical is one of the following three:

"(1) For you to agree to a voluntary assessment of $20 a share immediately, $20 per share before December 31, 1901, and $20 per share during 1902; or (2) for you to agree to loan the company the same funds at the same time at four per cent. interest; or (3) for you to agree to purchase your share of the unissued capital stock of this company at par. The amount is $3,000,000.

"If a great majority, practically all of the stockholders, will not agree to one of these three propositions, nearly all the work must stop, and that simply means going backward instead of forward. There is no use crying over spilt milk, or abusing one another for things not accomplished. The people of the states of Illinois, Indiana, Ohio and Iowa want telephone service. Will you supply it, or must some one else? Are you doing it, with less than 70,000 stations? No. When you have 300,000 exchange stations then you have a good start; not before. When you have 150,000 exchange stations at proper rates, you will have a plant upon which you can earn something with which to build up the second 150,000. (Your territory needs 300,000 stations.) With your present 70,000 stations, the great majority of them at insufficient rates, thousands of them absolutely without charge, you cannot build up anything except opposition.

"You are not satisfying the public, because your system does not reach far enough. There are scores of villages and small towns, taken as a whole, that should have over 50,000 telephones, and in which the Central Union Telephone company has not one single instrument. The opposition is not satisfying the public. The property is yours, not mine. Do you want to build it up to its proper standard? Time is the very essence of value to your property. What you want done must be done now. Later on, and a very little later on, at that, will be too late."

Electric Railways in Germany.

Statistics published by the Electro-technical Journal show that on September 1, 1900, 99 German cities had electric railways, and it is estimated that on January 1, 1901, 107 cities were so supplied. In 1891 there were but three such cities; in 1895, 32, and in 1899, 88. On September 1, 1900, there were 1,703 miles of track, 5,994 motor cars and 3,962 attached or trailer cars. The aggregate power of the electrical machines was 75,608 kilowatts, against 52,509 kilowatts in 1899. The overhead-trolley system is used almost universally.

The Guarini Repeater System for Wireless Telegraphy.

By A. Frederick Collins.

An illustration of action and reaction in the scale of gigantic electrical factors is seen "through a glass darkly" when the telegraphic systems employing wires for overland, and cables for submarine, transmission of electrical impulses and the recent wireless methods for reproducing Morse signals by etheric waves are compared.

As is well known, the propagation of electrical waves over wires in free air is effected to great distances with but little difficulty, whereas their transmission over submerged cables is extremely limited. Now, the very opposite of these conditions exists in wireless telegraphy. The obstacles encountered in projecting Hertzian waves overland are most discouraging, since the greatest distance at which their presence can be manifested would seem to be not more than 15 miles, while to offset this deficiency, great distances can be covered with considerable ease over bodies of water.

LIGHTSHIP NO. 72.

In these opposite systems of telegraphy we may trace the omnipresent law of compensation, not in the one restoring the electrical equilibrium of the other, but in the grand scheme of civilization itself.

When the first announcement of the new telegraphy was made to the public, the holders of Western Union and Postal Cable securities were considerably agitated, for what is regarded as the impossible to-day may be a commercial reality to-morrow. They were not kept long in suspense, however, for the true status of the possibilities of space telegraphy were speedily deduced, and its value found to be—as the above statement shows—almost wholly confined to water. This accounts for the British officers' neglect to use the instruments transported to South Africa for the war in the Transvaal. Not only is the distance between given points on land exceedingly limited for available transmission, but 80 or 100-foot masts are accouterments of military warfare that render the service it offers worth less than the advantages it gives. It is little wonder then that the instruments the English government sent were "lost."

But at sea these same Marconi "sets" have made the pace, and it is beyond the pale of anything that could possibly be accomplished by wires. There are now a number of systems of space or wireless telegraphy, and those depending upon the Hertzian waves are the Marconi, the Tommasi-Jegon, the Slaby-Arco, Blondell and the Guarini.

All these workers have been assiduous in applying their inventive ability to effect syntonization of receivers and transmitters; they and many others have worked to reduce the antenna, or conductor leading to the air, to a shorter length than that now demanded by the present known laws, and again all have striven for extreme distance. Of the latter Mr. Marconi seems to have been the most successful; Professor Slaby of France has made wonderful advancement in the matter of selectiveness, while Mr. Guarini has been foremost and practically alone in the commendable effort to produce commercial results on land. This he has done—not by obtaining a greater initial distance of projecting the waves at the transmitting station, but by the very sensible method (though more or less mechanical) of establishing relay or repeating stations between cities he desired to connect with the new system, namely, Brussels and Antwerp, a distance of 25 miles (41 kilometers).

In this Mr. Guarini was again fortunate, since the space between the two places was not great, though by actual tests it was proven by the inventor much too far for direct transmission. This the Belgium inventor overcame by introducing the feature that made the Morse wire system one of universal utility—the relay—though in the case of wireless telegraphy it is a much more cumbersome and complicated affair.

In the description of the Guarini apparatus that follows I shall use the word "repeater" to designate the entire system of retransmission in contradistinction to the term "relay," which I shall employ to designate the appliance thus known in this country.

The repeater Mr. Guarini interposed between the two cities was placed on the tower of St. Rombert in the village of Malines. In repeating wireless messages he has demonstrated the practicability of combining a receiver with a transmitter, and such a combination is shown in Fig. 1. At a casual glance and on first thought it would seem comparatively easy to effect such a union, but when the reflex action of the transmitter is noted and the fact that the repeater's emission of etheric waves is many times greater than those received, and that the element of time must be taken into consideration, it is plain that, after all, there is an extensive field of thought and investigation worthy of the scientist, as well as from a strictly commercial point of view.

The combination Guarini has produced and the mode of operation may be judged from the diagram of the apparatus in Fig. 2. The receiving device consists of the radio-conductor, or coherer (1), as it is more frequently termed in this country. From one of the conductor plugs of the coherer, the strip of copper (2) enclosed by the sheath (3) leads to the mast. The copper sheath with the slot, interior copper strip, etc., is shown in the detailed drawing, Fig. 3. (A) represents the antenna and (B) a cross-section, showing the copper strip and insulating supports. From the opposite conductor plug a wire leads to a copper plate buried in the earth (4) (Fig. 2). The copper strip (2) receives the etheric waves and the copper plate (4) accumulates the electro-static oscillations and guides them to the filings in the coherer, where they form a union with the etheric waves, and the result is the phenomenon of cohesion.

FIG. 1. GUARINI REPEATER SYSTEM FOR WIRELESS TELEGRAPHY.—REPEATER APPARATUS WITH COPPER PROTECTORS REMOVED.

Disposing thus of the extraneous wave system, the internal circuits will now be described. From the oppositely disposed conductor plugs wires lead to the relay (5) and the battery (6), these being in series with the coherer. A second circuit is made operative by the relay magnets, and the armature of the relay acts as an automatic key, the circuit thus formed including the battery (7) and a Ruhmkorff coil (8). The tapper (9) is operated from a derived or shunted circuit. To one of the oscillator balls forming the spark gap (10) a wire leads to the second earth plate (11), and from the second and opposite oscillator ball a copper strip (12), with

an outer copper sheath, similar to the one described connected with the coherer, leads to the mast, or vertical standard. The object of these sheaths, which in both cases are connected electrically with the earth, is to reflect or transmit to the earth all waves of an extraneous nature, or, in other words, all those waves not finding their way through the slot in the sheath; this is especially necessary, owing to the close proximity of the repeater-transmitter to the repeater-receiver. The slots in the sheaths just mentioned are placed in such position as to allow the waves coming or going in the proper direction to enter or emanate, as the case may be. The receiving and the transmitting strips of copper are insulated from each other, as well as the receiving and transmitting apparatus themselves, by means of copper hoods.

The action of the repeater in actual use is as fol-

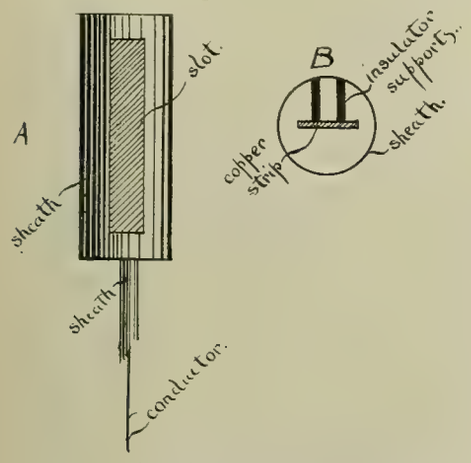


FIG. 3. GUARINI REPEATER SYSTEM FOR WIRELESS TELEGRAPHY.—DETAIL OF ANTENNA.

lows: The etheric waves from the Brussels transmitter radiating toward the Malines repeating station enter the slot in the sheath facing it, and are led to the coherer, when with the amalgamation of the static charge, the resistance of the metallic filings is very much lowered, permitting the current to flow through the first circuit operating the sensitive relay which is wound to a very high resistance. The relay armature, now attracted, closes the second circuit, which in turn actuates the coil; or the addition of a relay sounder (13) is supplied when the intermediate stations are to be made aware of the nature of the message, and this necessitates an extra or third circuit, which is operated by the battery (14). As the spark passes across the gap, the energized Hertzian waves are projected, via the copper strip, toward Antwerp only, for the slot in the sheathing faces in that direction.

It is evident that a message so repeated could be transmitted across a continent. For a repeater system from New York city to San Francisco 250 or 300 repeater stations would be necessary. As there is an appreciable length of time that elapses between the cohesion of the filings and the disruptive discharge at the oscillator, due to the inertia of the relay, the interrupter and the tapper, as well as the counter-effects of magnetic lag in the inductance coil, it would require a period of an hour or more to send a message across the United States.

In the matter of preventing the outgoing waves from retarding the weaker incoming ones and the resultant destructive reaction, Mr. Guarini has exercised considerable ingenuity. This he has done by guarding the receiver and transmitter, constituting the repeater, with enclosed copper cases; it is difficult to isolate the instruments entirely, owing to the necessary connection existing through the relay.

While the principle involved for obtaining selectiveness by means of slotted sheaths is rather crude, it has proven more successful than the complicated ones employed by Professor Slaby and others, who depend on the absolutely scientific arrangement of the coefficients. Mr. Guarini's employment of the sheaths is merely a makeshift, but in the infancy of overland transmission of intelligence by wireless methods, it serves its purpose, and will undoubtedly continue to do so until the syntonization by a more legitimate means is possible, or at least until the laws regarding its solution are better understood. The question of operating wireless systems overland is of sufficient importance not to be ignored. At the present time there are hundreds of places where it could be utilized to an advantage—places where artificial or natural barriers prevent the construction of aerial-wire lines. But the first cost of repeaters, such as Mr. Guarini uses, would be in many cases prohibitive to their installation. This would not apply if the repeaters could be located 100 miles apart, as at sea, where it would be possible, yes, even feasible, to form a chain between the continents of America and Europe by arranging buoys with the apparatus enclosed for repeating.

Before wireless telegraphy will become commercially popular on land there are four things that must be done for it: (1) to effect syntonization perfectly and by simple means; (2) to lessen the first cost of the apparatus; (3) to do away with the masts; (4) to increase the speed of transmission. As to the first, the mechanical analogue of diapasons vibrating in syntony with another similarly tuned is, as has been stated frequently before, a beautiful one for Hertzian waves. It is an analogy easily comprehended and readily applied theoretically. But in practice it is an infinitely hard problem. To lessen the cost of the apparatus means to simplify it almost to the point of the ordinary Morse instruments. A knowledge of the relationship between the electrostatic oscillations and the Hertzian waves will in all probability render the mast a useless accessory. Speed will be gained by simplifying the receiving device, using, for instance, a telephone receiver and a carbon coherer.

To my mind the future of the whole scheme of etheric wireless telegraphy rests upon reduction of its parts and its initial cost.

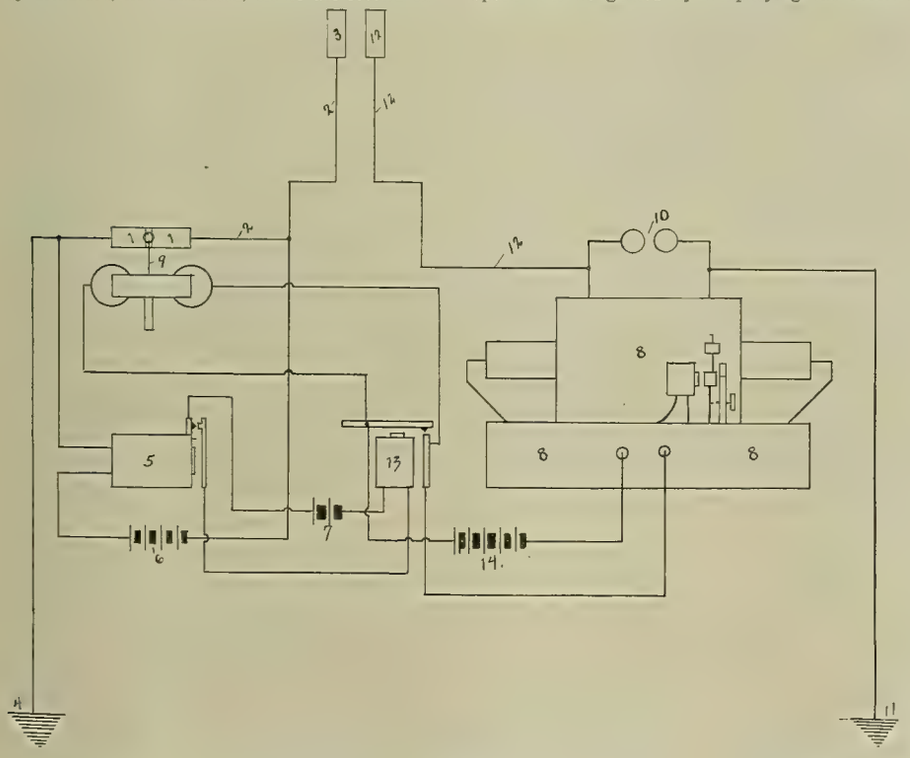


FIG. 2. GUARINI REPEATER SYSTEM FOR WIRELESS TELEGRAPHY.— DIAGRAM OF CONNECTIONS.

The Concord Electric company of Concord, N. H., has filed articles of incorporation with the secretary of state, the capital stock being $400,000. The incorporators are William H. Whitney and Charles H. Stone of Boston, and Fred C. Demond, Allen Hollis and George L. Osgood of Concord. The company will take over the property of the Concord Land and Water Power company as soon as the necessary formalities can be completed. It is not expected that the matter will be entirely arranged before July 1st.

Telephoning the Roar of Niagara.

The roar of the falling waters of the Falls of Niagara is now transmitted to New York, Buffalo and other distant places by long-distance telephone in connection with the Bell service. In order to accomplish this a long-distance transmitter has been installed in the Cave of the Winds under the Falls. This transmitter is enclosed in a small box and has a megaphone attachment to gather the sound of the tumbling waters as they plunge over the cliff and break on the rocks below. The point where the telephone has been placed is right where the thundering waters pour over the precipice, and could the users of telephones have transmitted to them the scene about the spot, they would view rainbow land, for all about the telephone transmitter there are rainbows galore. In the illustration, the light streak in front of the megaphone is made by a rainbow of great beauty.

TELEPHONING THE ROAR OF NIAGARA.—TRANSMITTER IN CAVE OF WINDS.

In the illustration the transmitter and attachment are seen standing on a ledge of rock in the spray cloud of the Cave of the Winds. Running off from the bottom will be seen the wires that extend to the Niagara Falls Bell exchange, the line being carried across Goat Island on trees and over the bridges to the mainland, where the pole lines of the Bell company are reached. The switchboard in the Niagara Falls exchange makes it possible for the operator to make connection with outside places for the transmission of the roar. In the Bell booth in the Electricity building at the Pan-American Exposition the noise of the thundering waters will be heard with great distinctness, and will no doubt form an interesting feature of the telephone exhibit.

Changes in Personel of Central Union and Chicago Telephone Companies.

Due to the recent succession of John I. Sabin to the presidency of the Central Union and Chicago Telephone companies, the following changes and appointments have been made in the personnel of those corporations. The officers of the Central Union Telephone company are now as follows: President, John I. Sabin; general manager, M. J Carney; secretary and treasurer, W. S. Chapman; auditor, E. G. Corneau; general solicitor, L. G. Richardson, and superintendent of construction and maintenance, Robert Cline. The following appointments were made, to take effect June 1st: Private secretary to president, John A. Mallon; assistant general manager, George B. Bush; engineer, A. J. Steiss; superintendent of equipment, F. W. Alston; electrician, S. G. McMeen; General canvasing agent, C. E. Nestor, and assistant auditor, E. G. Drew. The office of general superintendent was abolished.

The officers and directors of the Chicago Telephone company are as follows: President, John I. Sabin; first vice-president, Byron L. Smith; second vice-president, Arthur D. Wheeler; general manager, A. S. Hibbard, and secretary and treasurer, C. E. Mosley; chairman of the board of directors, John M. Clark. The board consists of Byron L. Smith, J. Russell Jones, Robert T. Lincoln, Arthur D. Wheeler, A. A. Sprague, Chauncey Keep, John I. Sabin, C. E. Perkins, Joseph P. Davis and Alexander Cochrane. The president has appointed as engineer, A. J. Steiss, superintendent of equipment, F. W. Alston, and general canvassing agent, C. E. Nestor.

Pan-American Exhibit of General Electric Company.

The General Electric company has a comprehensive exhibit, occupying the northwest corner of the Electricity building at the Pan-American Exposition. The principal feature of the exhibit is the 5,000-horsepower transformer plant which transforms all of the current used by the exposition company in the lighting scheme of the buildings and grounds. This transformer plant is practically a typical modern substation, and occupies an important position among the various features of the exposition. In Fig. 1 a general view of the company's exhibit is given, showing in the foreground the transformer plant and also one of the nickel-steel forged rings to be used for the new Niagara Falls generators now being made by the General Electric company.

This company has confined itself to exhibits presenting a few of the most novel and recent developments in the practical field, showing such apparatus and appliances as have been perfected in the last few years and become recognized as of real importance commercially.

The compensated type of generator exhibited, which is one of the company's most recent productions in the development of alternating-current apparatus, is so connected that it illustrates the interesting fact that this machine automatically maintains accurate voltage regulation under all the varying conditions of inductive and non-inductive loads. The C. R. regulator is placed in the primary circuit of the transformer and is used to illustrate in a very practical manner the use of this form of regulation. Thus the most modern method of generating and controlling alternating current is shown in practical operation.

While referring to the compensated type of alternator, it is of interest to examine the 200-kilowatt generator of this class which the company exhibits. It is unique in design, being a 36-pole machine of the revolving-field type and having an exciter mounted on the pillow block, operated from the generator shaft by gear and rawhide pinion. This machine illustrates a construction which has been successfully used on large machines of different capacities with considerable success. It is designed for direct coupling to the engine shaft, but is here shown with the separate pillow block where the engine bearing would ordinarily be. The series alternating system attracts a great deal of attention, and in order to illustrate thoroughly the operation of these transformers, the company has installed a small transformer having glass sides, to permit full examination of the interior of the apparatus while in operation. This small transformer operates two or three arc lights and series incandescent lights on the same circuit, thus illustrating the flexibility of this system, which permits the use of arcs and incandescents in series.

One of the most interesting of the modern developments in lighting is the series incandescent street system made by this company, which is shown in practical operation by means of a small reactive coil, with the series incandescent lamps mounted on a panel beside it. These lamps may be cut out by means of small switches, thus enabling one to watch the operation of the reactive coil and the effect on the other lamps remaining in the circuit.

Visitors looking for information on arc lamps find a most interesting and novel display in the General Electric company's space. The exhibit comprises a group of the company's standard interchangeable type of arc lamp, arranged with glass casings surrounding the mechanism and very dense inner globes, which permit a full examination of the arc without any strain on the eyes. By this arrangement, the lamp may be turned on and off, and the entire working of the lamp mechanism may be observed under various conditions of the arc. These lamps form an interesting group in themselves, as they show to what extent the interchangeable idea has been carried by this company in arc-lamp manufacture.

There are shown three multiple lamps for 110 volts alternating and direct current and 220 volts direct current, respectively, and three others for series alternating, series direct-constant-current and 500-volt railway work. All of these lamps use the same outer and inner globes, and each of the two groups mentioned are so nearly similar in construction as to convey the impression to the layman that they are alike. As a matter of fact, the difference between these lamps is only in three or four parts, which are in themselves interchangeable. The development of enclosed-arc lighting has been carried into the constant-direct-current field. For this work the most popular machine is undoubtedly the large type Brush arc generator, with multiple-circuit attachment, by means of which a number of different circuits may be operated from one machine; one of these machines, of 125 lights' capacity, is exhibited.

In the company's exhibit of electric-railway motors (Fig. 2) is an actual working example of the train-control system of this company, with two GE-66 railway motors and controllers, representing all the apparatus required for operating a single car. It illustrates in a practical manner the fact that this system applies equally well to one car or to several in one train.

The company's sectional third-rail system is also fully illustrated by an actual installation of contact rails and sectional switches. The contact shoes are so mounted, on small wheels, that they may be moved along the rails, and the various conditions of the operation of this system fully understood.

One of the popular features of the Electricity building is the four-motor equipment with electric brakes, shown in this company's space. Two standard trucks for each electric car are shown, supporting a platform on which are supported all the devices of a standard car equipment. The trucks are driven by four GE-67 36-horsepower motors, equipped with electric brakes. These are operated by two B-19 controllers, located one at each end of the frame on the trucks. Current is taken from a section of grooved trolley wire, which is actually installed, with various line material made by the company. An interesting fact illustrated here is that when the motors are running at full speed, the trolley arm may be pulled down and the electric brakes thrown on, the wheels coming immediately to a standstill, thus showing that these brakes work independently of the trolley circuit.

A standard type electric air compressor, known as the C.P.-12, operatively connected, is shown. The fact that compressed air is so useful for cleaning about car houses is practically illustrated in the company's space, where this method of cleaning and dusting is used.

The latest forms of railway motors of various capacities manufactured by the General Electric company are also shown in the space. The wide use of the company's standard appliances has necessitated the development of a wide range of instruments, switches, etc., for use on switchboards of all classes of electrical work, and a very interesting exhibit of this material has been made. Of course, the large switchboard in the transformer plant comprising both high and low-tension panels, with the oil-break switches, is of exceptional interest. However, this switchboard being in service during all the open hours of the exposition, renders it difficult for visitors to inspect the fittings as fully as they might desire. The same may be stated of the several switchboards for different apparatus in the working part of the company's exhibit. Therefore, this company has made a special exhibit (Fig. 3) of switchboard appliances on blue Vermont marble panels conforming in design to the standard switchboards. This contains samples of each of the various types of standard measuring instruments made by the company, with recording wattmeters, frequency indicators and other notable appliances of recent development. There are switches and circuit-breakers of various designs, for high and low-tension work, an oil-break switch being arranged so that the fullest examination may be made. One of the company's new cabinet panels is also shown.

The company's line of small motors is indicated in the display of alternating and direct-current motors

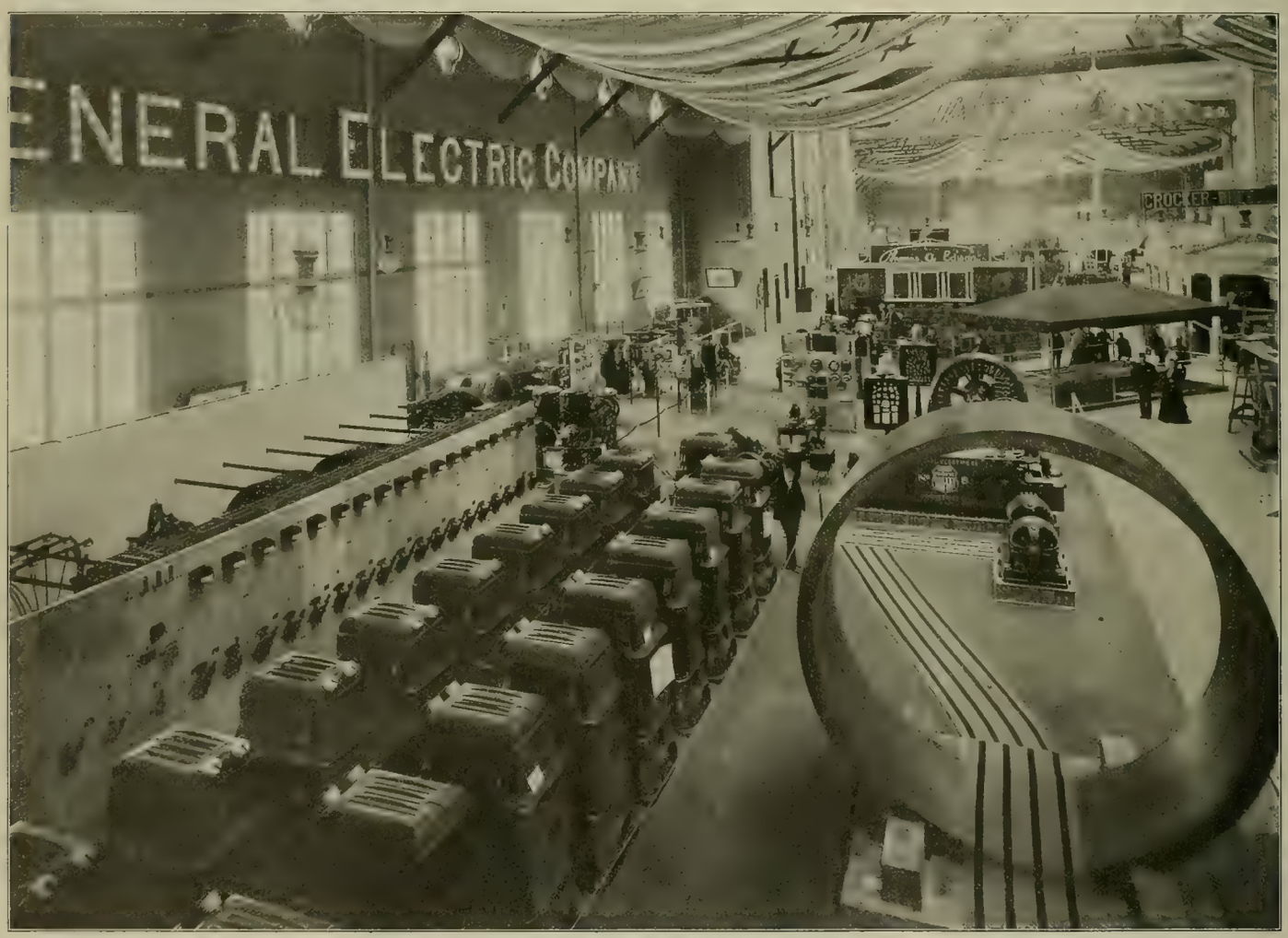


FIG. 1. PAN-AMERICAN EXHIBIT OF GENERAL ELECTRIC COMPANY.—VIEW IN ELECTRICITY BUILDING, SHOWING TRANSFORMER PLANT IN FOREGROUND.

for various apparatus, many of them being operatively connected to machines of various types for household and shop use. The exhibit also contains a motor-generator set of the type extensively used for charging automobiles.

Probably the most interesting practical application of electricity to mining work is represented by the modern electric mining locomotive. The General Electric company manufactures a wide range of these for all kinds of mining work and exhibits a typical locomotive, of which a large number are used in the coal mines of the Union Pacific Railway company. This exhibit is shown in Fig. 2. The locomotive weighs 10 tons. It is made for a 30-inch gauge and for operating on 500-volt circuits. It is known as L.M.-104-A-2 and is fitted with two

FIG. 3. PAN-AMERICAN EXHIBIT OF GENERAL ELECTRIC COMPANY.—PORTION OF EXHIBIT.

GE-61 four-turn, form A, standard railway motors and an R-37-B controller. The controller and brakes and the sanding devices are all controlled from one point where the operator sits. One of the details of construction which attracts practical mining men is the removable brakeshoes, which may be quickly removed and replaced without affecting any other part of the brake gear. This locomotive is fitted with headlights and all of the modern appliances which go to make up a complete outfit.

There is shown an electric hoist manufactured by the Lidgerwood Manufacturing company and fitted with a standard GE-52 250-volt, two-turn motor and R-14 controllers. The company also exhibits a typical electric mining pump, with a 50-horsepower indicating motor. This pump is a 6½ by eight-inch horizontal, triplex, single-acting plunger machine.

In the Machinery building the General Electric company shows a 10-horsepower motor, operatively connected to a four by six-inch, triplex, single-acting Deane pump, delivering 49 gallons a minute against 169 pounds' pressure. Another interesting operative exhibit of electric pumping machinery is shown in the base of the Electric Tower, where a General Electric three-horsepower, 500-volt, direct-current motor operates a four by six-inch vertical triplex Knowles pump. This electric pump furnishes water for the restaurant part way up in the Electric Tower.

This company has installed alternating-current apparatus representing a typical station, according to modern ideas for furnishing light and power and embodying a number of novel features. Each part of this group is interesting in itself. Twenty-five-cycle current is taken from the exposition transformer plant, located in the company's space, transformed from 1,800 volts to 360 volts by three type H, oil-cooled transformers, and then used to operate a synchronous motor of type ATE, eight-pole, 150-horsepower, 550 revolutions. This motor is belted to one of the company's most recent developments in alternating-current machinery, and known as a compensated type, form P, alternating generator. The particular machine exhibited is rated as an ATE, eight-pole, 100-kilowatt, 900-revolution, 2,500-volt generator.

The switchboard, of the company's standard construction, comprises a high-tension panel, with oil switches, a recording wattmeter, a generator panel with regular instruments, and one feeder panel. The panels are of blue Vermont marble, and in themselves make a most interesting exhibit.

As a load for the compensated generator, the company has installed a complete equipment of its series alternating-current street-lighting system of enclosed-arc lamps. This is supplied by a 75-light, constant-current transformer, which operates about 70 series enclosed-arc lamps, located in three rows over the main aisles in the Electricity building.

All of the apparatus in this operative exhibit above described is arranged in one group in the center of the company's space, as illustrated in Fig. 4, and the operation may be clearly followed and studied by those interested.

The operation of the constant-current transformer is a matter of considerable interest to electrical men, and to afford opportunity for careful study of this apparatus, the company exhibits a five-light transformer, the sides being fitted with glass panels through which the movement of the coils may be observed.

The operative exhibit of the company's marine apparatus, shown in Fig. 2, simply hints at the large line of this material which it manufactures. The marine generating set shown consists of an engine of the single-cylinder, enclosed type, eight inches in diameter, with a six-inch stroke, direct-connected to a 15-kilowatt, six-pole, 400-revolution, 110-volt generator. The engine is particularly interesting, and its design insures satisfactory operation for a number of reasons, the most obvious of which is the self-oiling feature secured by the enclosed base. This set is similar in size to those supplied by this company to a great many lake and river steamers, and, in fact, to moderate-sized vessels of all classes. A standard switchboard for use with a generating set of this size is also exhibited.

There is shown a searchlight projector of the size widely used for commercial purposes, and which is

FIG. 5. PAN-AMERICAN EXHIBIT OF GENERAL ELECTRIC COMPANY.—HEADQUARTERS.

similar in design to the large searchlights furnished by the company to nearly all the vessels in the United States navy, and one of which is mounted on the Electric Tower at the exposition. The searchlight exhibited is one of the 13-inch size. It is installed in such a manner as to illustrate the so-called pilot-house control method of handling the projector, which enables the pilot to operate the projector placed on top of the pilot house without leaving his wheel.

When a modern steamer is provided with an electric-lighting system, it is customary to also have electric running lights, and this company has perfected a safety device for use in this connection which attracts considerable attention. The possibility of one of the running lights being extinguished, for any reason whatever, has to be carefully guarded against. With oil lamps, this can be done only by the man on watch forward, but with electric lights, a satisfactory device is possible which removes the responsibility from the lookout, and places it where it belongs, in the pilot house. The arrangement is as follows: Each of the running lights may be provided with two lamps and wired to a telltale device located in the pilot house. Should one of the lights become extinguished, this telltale device at once begins to buzz, and a lamp is lighted, thus calling the attention of the pilot, both by sound and by sight, to the fact that one of the running light has become extinguished. He is then able, by throwing a small switch on the telltale board, to light the second lamp in the running light and give orders to replace the extinguished lamp. Thus a sure indication that the running lights are burning is always present in the pilot house. At the company's exhibit the operation of this telltale device is shown in a very interesting manner, the red, green and white running lights being mounted on the wall and so arranged that one of the lights will be cut out at

FIG. 6. PAN-AMERICAN EXHIBIT OF GENERAL ELECTRIC COMPANY.—MODEL OF WORKS.

intervals, this fact being immediately indicated on the telltale device. On this marine installation, many of the various wiring appliances for marine service manufactured by the company are used.

In another part of the grounds the General Electric company makes an exhibit of interest to shipbuilders. This is in the space occupied by the Lidgerwood Manufacturing company, in the ordnance group at the south end of the grounds, where an electric deck wench is shown, operated by a GE direct-current motor and controller.

Fig. 5 of the accompanying illustrations shows the headquarters booth of the company, while in Fig. 6 is given a view of the model of the General Electric company's works at Schenectady, N. Y.

Telephone Company Liable for Condition of Poles.

A telephone company's duty of inspecting its poles and equipment has been clearly shown in the suit brought by Patrick McGuire, a former employe of the Bell telephone company, at Rochester, N. Y., against that company. McGuire was employed as lineman, and under his foreman's direction, he climbed a pole on which the company's wires were strung for the purpose of tightening them. While so engaged the pole broke, and he was precipitated to the ground. In McGuire's suit against the company for damages for the injuries he received, it was conceded that the defective condition of the pole caused the accident. The telephone company used the poles of the Rochester Gas and Electric company, and this pole, which belonged to that company, had been found by its foreman months before the accident to be decayed and unsafe. A judgment on a verdict in favor of the plaintiff was unanimously affirmed by the Appellate Court, and that decision was recently upheld by the Court of Appeals. The opinion of the court holds that the telephone company, though not owning the pole, owed a duty to its linemen to see to the proper inspection of the poles, to see that they were capable of supporting the men while at work. Care on the part of the company in providing a reasonably safe place for the men to work involved such inspection, notwithstanding the pole belonged to the other company.

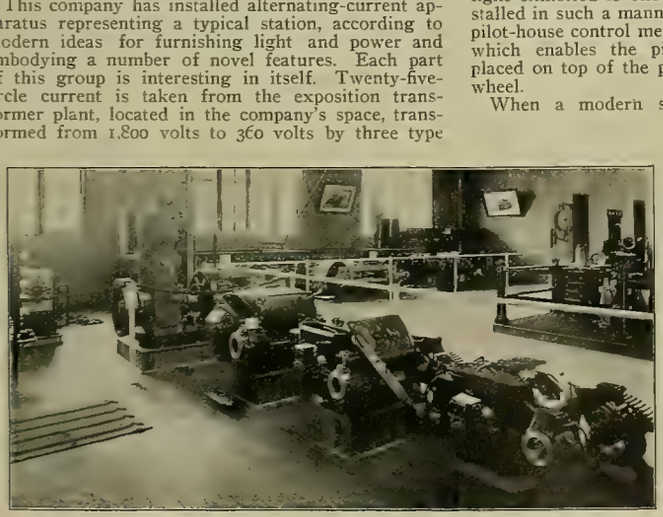


Fig 2. Railway and Marine Apparatus.

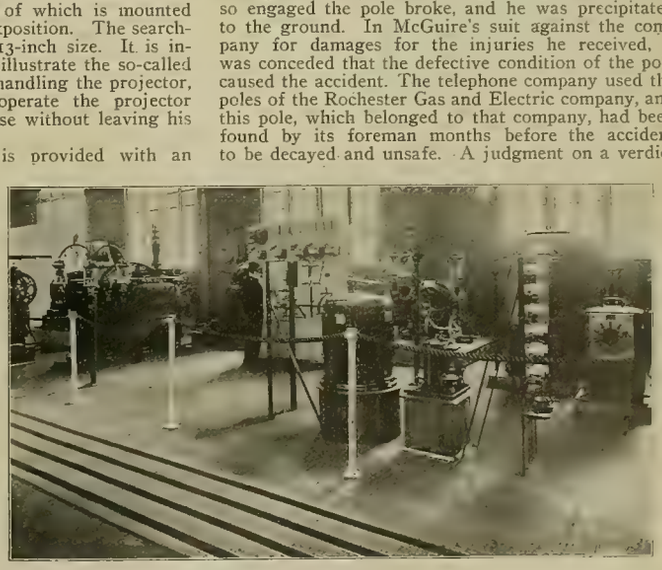


Fig. 4. Part of Operative Exhibit.

PAN-AMERICAN EXHIBIT OF GENERAL ELECTRIC COMPANY.

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CONVENTIONS AND EXPOSITIONS.

Canadian Electrical association, Ottawa, Ont., June 19th to 21st.

Association of Railway Telegraph Superintendents, Statler's Pan-American Hotel, Buffalo, N. Y., June 19th, 20th and 21st.

Independent Telephone Association of Wisconsin, La Crosse, Wis., June 25th and 26th.

Northwestern Electrical association, Sheboygan, Wis., June 26th and 27th.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

American Institute of Electrical Engineers (general meeting), Temple of Music, Buffalo, N. Y., August 20th to 24th.

Ohio Electric Light association, Put-in-Bay, Ohio, August 20th to 22d.

Pennsylvania State Street Railway association, York, Pa., September 4th.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Roentgen Society of the United States, University of Buffalo, Buffalo, N. Y., September 10th and 11th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition Charleston, S. C., December 1, 1901, to June 1, 1902.

Visitors to the Pan-American Exposition will find the Western Electrician's space in Section F 2 in the Electricity building, where they will be cordially welcomed.

It is curious to note the difference between the actual appearance of the Electric Tower at the Pan-American Exposition when electrically illuminated at night and the forecast of that appearance as made by the artists of the exposition staff last year. A comparison of the pictures showing the anticipation and the reality—such, for instance, as those published in the Western Electrician of October 6, 1900, and May 18, 1901—shows that while the artists made pretty pictures to show what might be expected, they had no conception of the surpassingly beautiful effect, as of delicate lace woven from threads of golden light, that has actually been achieved. Whether, as has been asserted, even the electrical designers builded better than they knew, it is certain that they builded better than anything the exposition authorities, through their very efficient department of publicity, were able to predict. It is probable that no one realized the entrancing beauty of the spectacle before the illumination actually was accomplished. This is not to say that the result was reached by simply haphazard good fortune, for exactly the reverse is true; the design was carefully studied out in its minutest details. It was exactly because the opportunity and the man were so well met that the result could only dimly be foreseen, even by those familiar with the beautiful illuminations of the past. With an electrical motif from the start, the plan was broad and intelligent. Success was won by careful, legitimate efforts; but, nevertheless, the achievement seems to have surpassed all expectations.

That untiring advocate of a transpacific cable, to be owned and operated by the United States government, Captain George O. Squier, has a recent article in a geographical magazine in which he says that, judged solely from commercial and technical viewpoints, a cable by way of Alaska, the Aleutian Islands and Japan possesses many advantages. The spans would be much shorter, the cable would be laid in comparatively shallow waters, and a considerable local traffic might be developed. But it is obvious that for political and military reasons it will be necessary to connect the advance island possessions of this country in the Pacific with the United States, and to have a cable entirely under American control in war as well as in peace. Captain Squier thinks that perhaps the best solution of the matter will be to lay cables by both the Hawaiian and Alaskan routes, one serving as a duplicate for the other. This plan has undeniable advantages, but the expense would doubtless prove prohibitive. It recalls in some particulars the project of Collins and Sibley, advocated 40 years ago, for a land line to Bering Strait, with a short cable to connect with Siberian land lines, making direct connection with Europe. The laying of the Atlantic cable gave a quietus to the projected Collins line after considerable work had been done; but the project is feasible now, as it was then, and with the development of Asiatic Russia, there may yet come a realization of the dream of the daring telegraph promoters of the early 60's. Nothing is more certain than that several lines of telegraphic communication are destined to connect the opposite sides of the Pacific. The United States, that has produced a Cyrus Field and a Hiram Sibley, should not lag in this important work.

In point of actual attendance at the convention sessions, the fifth annual meeting of the Independent Telephone association in Buffalo this week was perhaps the most successful in the history of the organization. The number of persons attending the convention was perhaps 250 or 300, and of these a very large proportion was present at the meetings in Convention Hall. It had been feared that the high Pan-American prices prevailing at the hotel where the headquarters of the association were established and the recent ruling of the advisory board disqualifying members in arrears of dues would keep many exchange operators away from Buffalo, and this was perhaps true to some extent; nevertheless, the meeting was a successful one, the morning sessions being well attended and the members hurrying to the exposition and Niagara Falls in the afternoons and evenings.

The papers and addresses were practical rather than technical, dealing chiefly with the commercial side of the business. Judge Thomas gave in his annual address a carefully prepared resumé of the history of telephone-patent litigation since 1893. This report is given in full in the convention report on another page and is well worth reading, particularly in view of the recent Berliner decision. Secretary Sheerin, in his paper, made the point that the farmers' lines, of all classes of service, needed first-class equipment because of the difficulty in making repairs. Manufacturers should educate the farmers and small-exchange owners in this respect, he said, and not provide shoddy apparatus for their use. Mr. J. B. Ware dwelt on the importance of the commercial farmer's business to the medium-sized city exchange; however, the farmers' mutual telephone service for purely social purposes was to be deprecated as a menace to toll-line service in the country conducted on business principles. Mr. C. W. Kline described the work of the Independents in the East and said that he expected the time to come when telephones will be as common as shoes and twice as necessary. Mr. T. J. Fricker made a plea for the telephone girl, who, he said, makes or breaks the exchange and should have all possible comforts, without overwork. Messrs. Stanton, Critchfield and Fisher also made valuable contributions to the discussions, and on the whole the convention was helpful and valuable.

Mr. Theodore C. Search, president of the National Association of Manufacturers, gives, in his annual reports as president of that organization, very valuable summaries of the industrial progress of the country. His address at the sixth annual convention of the society, held in Detroit last week, was no exception to the rule. It is long—about 11,000 words—and contains much valuable information. Mr. Search sees no abatement in the hopeful outlook for American manufactures. "A year ago all of us were straining our vision in efforts to foresee the future, to determine how far and how long these conditions of prosperity would continue; and the lapse of 12 months apparently has brought us no nearer to the point from which the end can be seen. There seems to be no waning of the general prosperity of the country, and conditions that could breed panics are not manifest as yet." A table shows that exports of manufactures from the United States have risen from $68,279,764 in 1870 to $433,851,756 in 1900. It is a curious fact, however, that the proportion of manufactured goods to other exports was highest in 1865—33 per cent. In the nine months ended March 31, 1901, the United States exported manufactures to the extent of $304,891,344, being 27 per cent. of the total exports. Mr. Search devotes much attention to commercial reciprocity. He says that "reciprocity is the one factor that is of the utmost value to us in the present stage of our export trade," and again: "I believe I do not overestimate its importance when I say that the continuance and further extension of our magnificent export trade in manufactured products depends more upon our willingness to barter privileges with our foreign customers than upon any other influence that we can discern at the present time. We can yield much that will be of value to others without causing loss or injury to our own interests." The adoption of reciprocity treaties is urged. Many other subjects, such as the creation of a department of commerce and industries, amendment of the interstate commerce law, improvement of the consular service, parcels posts, and the like, are considered. This important and valuable paper is too long to be printed in the Western Electrician, but it has been published in pamphlet form, and possibly non-members of the association may obtain copies by addressing Mr. Search or the secretary of the association.

INDEPENDENT TELEPHONE ASSOCIATION.

The fifth annual convention of the Independent Telephone Association of the United States of America, held on Tuesday, Wednesday and Thursday of this week in Buffalo proved to be a notable gathering of telephone men. The programme was well carried out, and the attractions of the Pan-American Exposition and Niagara Falls added to the pleasure of the visitors. The headquarters of the association were at the Iroquois Hotel, while the sessions of the convention were held at several blocks' distance in a building known as Convention Hall. There were few exhibits at the hotel or hall, but of course, the larger manufacturing companies have fine displays at the exposition, as described in last week's issue of the Western Electrician.

It was half-past 12 o'clock on Tuesday, June 11th, when Judge J. M. Thomas of Cleveland, the president of the association, called the convention to order and stated that Mayor Diehl, who was announced to deliver an address of welcome, had not yet put in an appearance. The president then began to deliver his annual address, but he had spoken but a few words before the mayor of Buffalo, Hon. Conrad Diehl, was announced. His Honor entered amid great handclapping. He was introduced by Judge Thomas and was received with enthusiastic applause. Mayor Diehl welcomed the delegates heartily. He said that competition in telephone service was an important matter. It was not alone the life of trade, but in the telephone business it meant a betterment in service—a real benefit to mankind. Mr. Diehl spoke of the Pan-American Exposition and referred to the commerce and attractions of Buffalo. In Buffalo, he said, electricity played an important part. He offered to the visitors the freedom of the city in the fullest sense of the term. President Thomas responded in fitting terms. The whole incident of the mayor's entry and speech of welcome was most pleasant and cordial.

Judge Thomas then delivered his annual address.

President's Address.

All will agree that the committee entrusted with the selection of the place for the fifth annual convention of the Independent Telephone association of the United States of America used commendable judgment in choosing the beautiful city of Buffalo, as, with its natural advantages and its great Pan-American Exposition, no other city in the United States could have offered a more desirable place for the convention.

Representing, as this organization does, progress in telephony, it is fitting that we meet in Buffalo where we may study the progress made by the great American countries in art, science and their many and widely diversified industries. We are not only afforded another opportunity of considering further development of our own business, but, between sessions and after this convention adjourns, will be entertained and enlightened by a study of results in all the various fields of private and public progress.

While we are busy with the affairs of this convention and the pleasures which have been arranged for us, we should not forget to thank the local committee of arrangements for its labor.

The last year has been one fraught with important events in the telephone world, and the great work that has been accomplished is the highest commendation that can be offered to the great army of workers in the field. Having been in close touch with all the great Independent organizations of the country, and, knowing their present status, I do not hesitate to say that all doubt of the permanency of the Independent telephone movement has passed. Doubters have become its advocates, while the voice of the false prophet is no longer heard in the land and his writings have been placed in the archives of oblivion, bearing the inscription above its portals, "Failure."

The work in the Middle West, North and South, the greatest fields of activity in telephone development, is to be followed by very active development in the extreme eastern and western sections of the United States, and in a short time the organizations, now nearing perfection in those sections, will show a development that will be highly gratifying to those of us who for several years have labored in the fields now more fully developed.

In speaking of the conventions held by this organization, I have heard several gentlemen who have attended them say that the general tone more resembles political conventions than conventions of allied business interests. I have always agreed with that statement, with a limitation that they have been somewhat like political conventions would be with the politics eliminated. Like public conventions, we have never lost sight of the principles of progress and fair dealing with the people, and being so different from meetings of the men who control the Bell companies, this impression has found lodgment in some minds. But this spirit, being the surest sign of the fundamental principles of progress, we desire that it shall always be the keynote of all conventions of the organization.

There has been much inquiry, not only on the part of those who have control of this field of investment, but also by those desiring to enter, as to the underlying principles that actuate the development of this movement. To fully and properly answer that inquiry requires a careful study of the entire history of telephony, and would require more time than those of us who are actually engaged in construction and operation have been able to give to the subject; but a glance over certain events and certain policies will be of interest and profit to persons seeking the knowledge desired by the prudent man before investing in the building of telephone properties.

The telephone being one of the greatest utilities discovered and put into practical use by man, and being entirely new, and the only means of reproducing articulate speech at a distant point, gave the inventors a right to protection for 17 years under the United States statutes, which rights the inventors could keep or sell to others, if they so desired.

Bell's invention, the first put into practical use, and which at one time was a useful and satisfactory transmitter, being what we generally term a magneto telephone, gave place to a more effective instrument, the product of the minds of several inventors, but brought into perfection by that great inventor, Thomas A. Edison, who discovered the fact that carbon electrodes held in constant contact, but so arranged as to admit of variable pressure in conformity with sound waves, the result of articulate speech, thus regulating the flow of an electric current through them produced by a battery in connection therewith, gave a fuller and more perfect transmitter than Bell's invention.

After this discovery Bell's invention was fast supplanted as a transmitter by the more effective microphone, but its use as a receiver in connection with the microphone has been universal. For the purposes of this investigation the great volumes of records and briefs in litigation between inventors, or their assigns, will be of very little service, and, therefore, we pass to such facts as will enable us to understand more fully the history leading up to the beginning of the Independent telephone movement.

The first, or fundamental, Bell patent expired in March, 1893, and the second Bell, or magneto, telephone patent expired in January, 1894; and between these dates we find the work of establishing Independent systems began. November 17th, 1891, the Berliner patent was issued on an application filed June 4, 1897. The claims of this patent were intended to be broad enough to cover all constant-contact battery transmitters, and these were believed to be all battery transmitters of commercial value.

In May, 1893, the Edison carbon-transmitter patent was issued on an application also filed in the year 1877, and it should be remembered that both the Berliner and Edison patents were owned by the American Bell Telephone company. This patent was for the use of carbon electrodes in a battery transmitter. No other material has been found as a practical substitute for carbon.

These two patents were for 17 years from the date of their issue, and if either or both of them had been found valid, it would have continued the Bell telephone monopoly to the year 1908 or 1910.

When the Berliner patent was issued, Milo G. Kellogg obtained a certified copy of the record of the application in the Patent Office, and, after a careful study of the same for several months, became convinced that the patent was invalid for several reasons and would not be sustained by the courts, if intelligently litigated. He also realized that unless its validity was attacked in some unusual manner, it would remain as a menace to prevent any extensive competing use of battery transmitters, and when it came to be litigated, if such a case should arise, the defense was likely to be weak and ineffective, and the patent, therefore, likely to be sustained, and thus the Bell monopoly would continue to the end of the term of the patent. He then conceived the idea that the question was one of great public importance, and that the patent, having, as he believed, been improperly granted, the government itself should begin a suit to test its validity, on the basis of annulling or revoking it. It was certain that a patent could be revoked on the ground of fraud, but it had not been adjudicated whether a patent could be revoked on grounds of invalidity. The proper channel for bringing a suit to annul or to revoke a patent was through the attorney-general in the name of the United States, against the party or his assigns claiming the right of monopoly under the patent.

He prepared a brief of about 150 pages, giving the various grounds on which he believed the patent was invalid, and in November, 1892, presented the same to the attorney-general. After the matter had been considered, and with the approval of President Harrison, a bill was filed by the attorney-general in 1893, in the name of the United States against the American Bell Telephone company. The first decision in the case was by Judge Carpenter, who declared the patent invalid for two reasons, but did not pass on the other grounds of invalidity which were raised. These two reasons were, first, fraud in obtaining the patent, and, second, the fact that a patent had been granted to Berliner on the same invention in the year 1880. The case was carried to the United States Circuit Court of Appeals, which held that the only ground on which the patent could be canceled or annulled was that of fraud, and that the other claims of the bill could only be set up as defense in a suit brought by the owner against an infringer. This court found that no fraud had been proved, and that, therefore, the patent could not be ordered canceled. The Supreme Court, on appeal, took the same view of the case.

After the decision of Judge Carpenter in the Circuit Court, the few companies which had begun to manufacture and build exchanges took new courage and many others entered the field, and this new impetus assured our present great success in spite of all that has been done to discourage us.

After the decision of the Supreme Court in the government case, the testimony was completed in the infringement cases which the American Bell Telephone company had in the meantime (August 5, 1895) brought against the National Telephone Manufacturing company and the Century Telephone company. The defenses in these cases included the same grounds of invalidity set up in the government case, except that of fraud, and the decision of Judge Brown, recently handed down, practically sustains all the defenses except one.

The Edison patent on the use of carbon in the transmitter was no doubt valid; but the question arose concerning it as to the effect on its life of section 4887 of the Revised Statutes. The application for this patent was filed before Edison had taken out any foreign patents on the invention, but the patent itself was issued after he had taken out foreign patents, and, in fact, after such foreign patents had already expired. With one interpretation of the meaning of section 4887, the foreign patent would limit the life of the United States patent, and the patent had already expired at the time of its issue. The interpretation of this section had already been raised in regard to other patents, but had never been passed upon by the Supreme Court, and it was uncertain what the decision there would be.

There was pending before that court a suit known as the Bate Refrigerator company versus Ferdinand Sulzberger et al., in which this particular question was involved. This case was one of minor importance, but on the outcome of it depended the question as to whether the Edison carbon patent, owned by the Bell company, and some important electric-light patents owned by the General Electric company, should extend for 17 years, or had already expired. When this comparatively unimportant Bate refrigerator case came to a hearing before the Supreme Court, the side which was favorable to the Bell company's contention was most ably and elaborately presented. Mr. Storrow, chief counsel for the American Bell Telephone company, and other noted lawyers presenting very able briefs on the subject. The other side was also well represented, especially by Mr. Wetmore of New York. There was, however, nothing to show that there was practically anything more at stake than the contest between the Bate Refrigerator company and Sulzberger. At the hearing, however, a request was made, and granted, that Hon. Charles H. Aldrich, formerly solicitor-general, be permitted to file a brief in the case on behalf of Milo G. Kellogg, as "one whose interests as an inventor of telephone appliances, and as a stockholder in companies operating telephone exchanges and manufacturing electric-light and other apparatus, would, in his opinion, be disastrously affected by an interpretation favorable to complainant of section 4887, Revised Statutes." Mr. Aldrich's brief, thus filed, pointed out to the court the great interest involved in the suit and the legal grounds for an interpretation of the section which would, in fact, limit and make the Edison patents ineffective. The Supreme Court decided the case in favor of defendant, holding that, under section 4887, United States Revised Statutes, the expiration of a foreign patent limited the grant under our laws to that time; and as far as the statutes then stood, the Edison carbon patent became a dead issue.

However, while this Bate case was pending before the Supreme Court, several bills to amend section 4887 were introduced in Congress, the effect of which, if passed, would be to give life to the Edison patent for 17 years from the date of its issue. The real animus and source of the instigation of these bills were not apparent. The fact of their existence and the real motive and effect of same came to Mr. Aldrich's knowledge, and he prepared a memorial to Congress on the subject entitled "The American Bell Telephone Monopoly and the Pending Legislation in Its Interest." A copy of this memorial was sent to every member of Congress. The effect of the same was that the real motive for the proposed legislation was exposed, and thus the bills were defeated.

But to show how adroitly the affairs of the American Bell Telephone company were managed we must now consider a few facts which were the result of the thought of great minds employed to prolong the monopoly. Edison having applied for foreign patents, and they recognizing the danger of limiting his rights under section 4887, Revised Statutes, should their efforts fail to repeal or annul it, the Berliner application for a patent was, by shrewd manipulation, kept pending in the Patent Office for 14 years, and he, so far as we have discovered, made no application in a foreign country under the statutes of which the patent in this country would be limited, but only in such countries the laws of which would not bring it under our court's interpretation of section 4887, in view of the danger growing out of the Edison foreign patents. After the Berliner

caveat and application had passed to the ownership of the American Bell Telephone company, which could not claim a constant-contact telephone that would reproduce speech, but a make-and-break transmitter which would reproduce musical sounds, this able corps of experts in the pay of the company managed, after this delay of 14 years, to obtain a patent by amendment, claiming just the invention that Mr. Berliner had disclaimed in his caveat and original application.

After the decision in the United States Supreme Court, in the government case, through the efforts of J. B. Leatherbee, treasurer of the National Telephone Manufacturing company, Edward P. Payson of Boston, a very able and conscientious lawyer, proceeded with the arduous task of completing the proofs to sustain the defenses set up in his answer to the bill of complaint in the case of the American Bell Telephone company against the National Telephone Manufacturing company.

Mr. Payson gave to this case a great portion of his time and his best thought from the time of his retainer in 1895 to the time the case was fully submitted to the court in November, 1899.

Judge R. S. Taylor, having been selected by the government as one of the counsel in its suit, and being very familiar with the questions involved, was retained to file a brief and make an oral argument in the case against the National Telephone Manufacturing company, on behalf of the defense.

On February 27th last Judge Brown of the United States Circuit Court, District of Massachusetts, handed down his decision, after considering the case from November, 1899, to that time; and from his rescript, indicating his deep study of the questions involved in this important case, the impartial words of the learned judge clearly indicate his conviction as to the deep-laid scheme to prolong a monopoly.

We certainly should appreciate the efforts of these men who have so ably resisted the efforts of the representatives of the American Bell Telephone company to retain that which had by law passed to the people, and no voice should be heard except in highest commendation of their work. Their intelligent and arduous labors have defeated the skill and cunning of those who were employed to try to deceive our patent officials and our courts. I feel at this time it is not only the duty but the pleasure of this organization to make public acknowledgment of their services.

This combined effort has resulted in the decision of Judge Brown, in which he holds:

First—"That at the date of the application, June 4, 1877, Berliner had not made the invention covered by the patent issued to the American Bell Telephone company on November 17, 1891."

Second—"That the invention designated in the patent is radically different from the invention described in the application."

Third—"That the invention was previously patented by Berliner."

Fourth—"That Edison was the prior inventor."

Judge Brown agrees with the well-known position of all telephone inventors that Berliner, so far as his claim to a microphone is concerned, invented nothing.

These facts, together with the policy of the Bell companies in dealing with the people, have been the chief incentive to invest in this field. The people were anxious for relief from their arbitrary methods and have always welcomed an Independent company.

Having proven our legal right to give telephone service by good and efficient methods, and having demonstrated our ability to compete with the old companies, it becomes now a question of working together for one common end; and it is important that at this meeting we consider such questions as will lead us to unity of action. The present year will add much to our present strength by placing a large amount of money at our disposal.

In closing, I wish you all a profitable year, and thank you for your many courtesies.

Tuesday's Business.

After the reading of the president's address, which was loudly applauded, Judge Thomas urged prompt attendance at succeeding sessions. He said that sufficient time should be given to the sessions so that the true impression might go out that the members of the convention really considered matters of importance.

H. D. Critchfield of Mount Vernon, Ohio, moved that the state delegations be instructed to name their members of the executive committee at the next session.

Mr. Critchfield also moved that the association extend its thanks to the gentlemen named in the president's address as aiding the Independent telephone movement. On the amendment of E. B. Fisher of Grand Rapids, Mich., a committee, consisting of H. D. Critchfield, President Thomas and Secretary Sheerin, was appointed to draw up an appropriate resolution.

This concluded Tuesday's session. In the afternoon and evening the delegates pursued pleasure and profit at the Pan-American Exposition.

Wednesday's Events.

After some routine opening business on Wednesday morning, J. D. Downer of Chicago, who is in charge of the Western Electrician booth at the Pan-American Exposition, called the attention of the association to the fact that the director-general of the Pan-American Exposition would doubtless be glad to meet the members and greet them in a body, as had been done with other associations meeting in Buffalo. It was accordingly voted to accept the suggestion and to meet Mr. Buchanan in the Electricity building at 3 p. m. on the next day.

Mr. S. P. Sheerin of Indianapolis, the efficient secretary of the organization, then read an excellent paper on "Village Exchanges and Farmers' Lines." It was discussed by J. B. Ware of Detroit, W. W. Morrison of Bryan, Ohio, T. J. Fricker of Ashtabula, Ohio, and others. In a future issue the Western Electrician hopes to present the paper and the salient features of the discussion.

Mr. C. W. Kline of Hazleton, Pa., read a paper on "Independent Telephone Development East of the Alleghenies," in place of Charles E. Wilson of Philadelphia, who had been requested to write on the topic. Mr. Klein's paper was a glowing account of the work in the East. Mr. C. E. Stinson of Rochester, N. Y., supplemented the paper by an account of the fine Independent telephone exchange in his city.

Invitations to hold next year's meeting in Philadelphia or in Rochester were referred to the advisory board. Milwaukee boomers were also at the convention "touting" for their city.

In the afternoon a large number of the convention attendants enjoyed an excursion to Niagara Falls and the Gorge, going partly by boat and returning by electric railway.

The Situation in Philadelphia.

Charles E. Wilson of the Keystone Telephone company of Philadelphia was too busy to prepare a paper on the general subject of Independent telephony in the East, as requested, but he gave an interesting little talk on the Independent work in Philadelphia, nevertheless. Mr. Wilson is a well-known electrical man, having been connected with the Fort Wayne and Siemens & Halske companies in Chicago and Philadelphia. He said that the large telephone system of the Keystone company in Philadelphia would be ready for service next October. The cable system installed will have ultimate capacity for 30,000 lines in Philadelphia County. Two exchanges are building. Over 4,000 five-year contracts have been secured, new orders being booked at the rate of 75 or 80 a day. The company considers that it will have the most modern plant in the United States, from an engineering point of view. Kellogg switchboards will be used, the Keystone company designing its own telephones. The rates adopted are as follows:

Business houses, $80; two-party lines, $52.

Residences, $48; two-party lines, $36.

The present Bell rate for unlimited service is $160 a year. However, much of the Bell service is by measured rate. The Bell company puts in telephones free in Philadelphia, Mr. Wilson said; that is, it gives six months' free service in consideration of a year's contract. Its six and four-party lines are unsatisfactory. The Bell company had 10,025 telephones in Philadelphia on January 1st. The population of the city is 1,320,000.

Thursday's Session.

Thursday was a busy day. L. W. Stanton of the Federal Telephone company of Cleveland read a paper on exchange service, illustrated by diagrams showing the number of calls per operator. Mr. Curtis of Sandusky, Ohio, C. H. Judson of Minneapolis, Hugh Dougherty of Bluffton, Ind., and E. B. Fisher of Grand Rapids, Mich., discussed the paper. E. B. Fisher then presented a paper on "Bell Methods," which appears elsewhere in this issue. John Roehrer, chairman of the Business Men's Central Council of Buffalo, sent a written request for information in relation to the establishment of an Independent exchange in Buffalo. A standing vote of thanks was extended to Judge Thomas, president of the association, for his work for the Independents. H. D. Critchfield made an address on "Legislation and Litigation." He asserted that the Berliner suit in Boston would have been lost were it not for the action of the Independent Telephone association. He said the Bell company was now credited with a willingness to combine with Independents where the latter have the better of the situation. The speaker counseled caution in this important matter. "Whip the Bell," he said, "and then let the Independents dictate the terms for all." C. S. Bash of Fort Wayne, Ind., followed Mr. Critchfield.

Election of Officers.

Officers were elected as follows: President, James M. Thomas, Cleveland, Ohio; first vice-president, H. C. Young, Columbia, Pa.; second vice-president, C. E. Stinson, Rochester, N. Y.; third vice-president, W. H. During, Cedar Rapids, Iowa; secretary and treasurer, S. P. Sheerin, Indianapolis, Ind.; first assistant secretary, J. B. Ware, Detroit, Mich.; second assistant secretary, C. E. Wilson, Philadelphia; third assistant secretary, T. B. Lee, Pittsburg, Pa.

The advisory board is composed of James M. Thomas, Cleveland, Ohio; S. P. Sheerin, Indianapolis, Ind.; Hugh Dougherty, Bluffton, Ind.; H. D. Critchfield, Mount Vernon, Ohio; E. B. Fisher, Grand Rapids, Mich.; Samuel E. Wayland, Scranton, Pa.; W. B. Seaton, Ashland, Ky., and George W. Beers, Fort Wayne, Ind.

The executive committee is made up as follows: Illinois, Geo. W. Fair, Chrisman; Indiana, L. A. Frazer, Connersville; Iowa, A. T. Presson, Iowa City; Kentucky, J. A. Armstrong, Louisville; Louisiana, L. H. Lancaster, Thibodaux; Michigan, J. B. Ware, Detroit; New Jersey, John J. Burleigh, Camden; Ohio, E. L. Barber, Wauseon; Massachusetts, Victor A. Sears, Boston; Pennsylvania, C. W. Kline, Hazleton; Texas, Mrs. A. McElroy Brett, El Paso; West Virginia, W. K. Cummings; Wisconsin, J. H. Moulton, La Crosse; Minnesota, C. H. Judson, Minneapolis.

The place and time of the next meeting of the association were left to the advisory board. After extending the usual votes of thanks, the convention adjourned.

Members and Visitors.

The following is a fairly complete list of the members and guests in attendance at the sessions of the convention:

Adely, W. F., Boston, Mass.
Allison, Price A., American Electric Fuse company, Chicago
Anderson, E. S., United States Telephone company, Dunkirk, Ohio
Atchison, H. F., G. F. Atchison company, Jersey City, N. J.
Babcock, W. F., Rochester Telephone company, Rochester, N. Y.
Babtiste, C. A., New York
Barber, Ed. L., Central Construction company, Wauseon, Ohio
Barkdull, W. R., Bowling Green Telephone company, Bowling Green, Ohio
Barker, A. E., Kellogg Switchboard and Supply company, Cleveland, Ohio
Barney, C. H., Monarch Fire Appliance company, New York, N. Y.
Barr, W. J., Cleveland, Ohio
Belanger, J. T., Galion Telephone company, Galion, Ohio
Bellering, J. S., Knoxville Electric company, Knoxville, Iowa
Bissell, W. S., F. Bissell company, Toledo, Ohio
Black, T. F., and wife, Mansfield, Ohio
Blaisdell, A. L., Elk Telephone and Telegraph company, St. Mary's, Ohio
Blount, R. F., Home Telephone company, Wabash, Ind.
Blyth, B. W., Galion Telephone company, Galion, Ohio
Boardman, A. F., Couch-Seeley company, Boston, Mass.
Bowman, W. T., John A. Roebling's Sons company, Cleveland, Ohio
Bowman, L. G., Western Telephone Construction company, Chicago
Brown, Eugene F., Stromberg-Carlson Telephone Manufacturing company, Beaver, Pa.
Burleigh, I., Eastern Telephone and Telegraph company, Camden, N. J.
Butler, W. H., Kent Home Telephone company, Kent, Ohio
Carson, B. L., Valley Telephone company, Bay City, Mich.
Cary, W. L., Jr., United States Telephone company, Cleveland, Ohio
Child, Charles T., Electrical Review, New York
Coen, Nellie, Federal Telephone company, Cleveland, Ohio
Coit, Henry A., St. Louis, Mo.
Collins, W. Forman, Western Electician, Chicago
Conde, S. B., Jr., S. B. Conde, Jr., company, Boston, Mass.
Conover, George W., North Electric company, Chicago
Cook, Frank B., Sterling Electric company, Lafayette, Ind.
Coontz, W. H., Cleveland, Ohio
Cravath, J. R., Electrical World and Engineer, Chicago
Crom, C. T., Galion Telephone company, Galion, Ohio
Cummings, W. K., Wellsburg Telephone company, Wellsburg, W. Va.
Curtis, Carl C., Sandusky Telephone company, Sandusky, Ohio
Davis, A. M., Stromberg-Carlson Telephone Manufacturing company, Chicago
Davis, Mark, Cuyahoga Telephone company, Cleveland, Ohio
De Land, Fred, Federal Telephone company, Pittsburg, Pa.
Dinsmore, S. A., Electric Appliance company, Chicago
Doolittle, W. E., Sterling Electric company, Lafayette, Ind.
Dommerque, F. J., Chicago, Ill.
Doyle, W. L., S. B. Conde, Jr., company, Trenton, N. J.
Doyle, H. J., Monarch Fire Appliance company, New York, N. Y.
Durin, W. H., Cedar Rapids, Iowa
Edwards, J. S. G., Johnstown, N. Y.
Enwright, R. C., Federal Telephone company, Cleveland, Ohio
Fair, George W., Fair Telephone company, Chrisman, Ill.
Firmin, John C., Findlay, Ohio
Fisher, C. L., Findlay, Ohio
Fitzgerald, James J., Cuyahoga Telephone company, Cleveland, Ohio
Fledderjohn, W. H., Inland Telephone company, New Knoxville, Ohio
Fledderjohn, Edwin, Inland Telephone company, De Graff, Ohio
Ford, J. B., Ontario Telephone company, Toronto, Ont.
Foss, W. A., American Toll Telephone company, Cleveland
Fox, H. W., Indianapolis, Ind.
Fralich, R. R., Federal Telephone company, Pittsburg, Pa.
French, O. F., Federal Telephone company, Cleveland, Ohio
Geiger, Amos A., Bluffton, Ohio
Gilmore, Tiffin, United States Telephone company, Cleveland, Ohio
Goddard, Stephen H., Electrical Review, New York City
Goss, John D., Johnson County Telephone company, Iowa City, Iowa
Gott, C. D., Black River Telephone company, Lorain, Ohio
Gowe, H. S., Portsmouth Telephone company, Portsmouth, Ohio
Gradolph, F. W., Ottawa County Telephone company, Oak Harbor, Ohio
Granel, C. M., Painesville, Ohio
Granger, Sherman M., Zanesville Telephone and Telegraph company, Zanesville, Ohio
Hagerman, A. V., Black River Telephone company, Lorain, Ohio
Hall, Newton, Electrical Age, New York
Hamilton, C. M., F. Bissell company, Toledo, Ohio
Hammond, E. H., American Electrical Works, Chicago
Harding, E. R., Holser Cabot Electric company, Chicago
Harris, C. O., Rochester Telephone company, Rochester, N. Y.
Hayden, Virgil, Cattaragus Telephone company, Franklinville, N. Y.
Helferstein, J. P., Juniata and Susquehanna Telephone company, Shamokin, Pa.
Hendrickson, R., Macedene, N. Y.
Hertz, P. J., Chicago, Ill.
Hibbard, C. L., Varley Duplex Magnet company, Chicago
Hipskind, John, Home Telephone company, Wabash, Ind.
Hoffman, George J., Tuscarawas County Telephone company, Cleveland, Ohio
Holland, Russel, Electrical Review, New York, N. Y.
Holland, W. H., Holser Cabot Electric company, Brookline, Mass.
Holloway, W. S., Massillon Telephone company, Massillon, Ohio
Honan, J. B., National Conduit and Cable company, New York, N. Y.

Hopkins, William A., Erner, Hopkins company.. ..Columbus, Ohio
House, E. L., Painesville Telephone company.... ..Painesville, Ohio
Howk, C. L., People's Telephone company..Shelby, Ohio
Hughes, T. E., Standard Underground Cable company ..Philadelphia
Hughes, William, York Telephone company....York, Pa.
Hyde, E. W., Jefferson and Warren Telephone company ..Orangeville, Ohio
Ihmsen, J. G., American Electric Telephone company ..Chicago, Ill.
Jaeger, H. J., American Miniature and Bec. Lamp company ..New York
Johnson, G. Hallett, International Specialty company ..Chicago
Johnston, W. J. ..New York City
Jones, Frank E., American Electric Telephone company ..Chicago
Jones, W. H., Cortland Home Telephone company ..Cortland, N. Y.
Judd, R. W., Federal Telephone company.. ..Cleveland, Ohio
Judson, C. H., Twin City Telephone company.... ..Minneapolis, Minn.
Juperon, George S. ..Cleveland, Ohio
Juvenall, C. D., Upper Sandusky Telephone company ..Upper Sandusky, Ohio
Kammeyer, C. E., American Electric Telephone company ..Chicago
Keily, W. E., Western Electrician..Chicago
Kenney, J. A., American Electric Fuse company ..Chicago
Kerlin, J. F., Laclede Battery company....Kokomo, Ind.
Knierim, T. M. ..Toledo, Ohio
Knoblock, Otto M., Miller-Knoblock Manufacturing company ..South Bend, Ind.
Koontz, Charles E., Breman Telephone company ..Breman, Ind.
Lancaster, L. H., Louisiana and Texas Long Distance Telephone company..Thibodaux, La.
Lee, Thomas B. ..Pittsburg, Pa.
Liggett, N. E., Marysville Telephone company ..Marysville, Ohio
Lunbridge, S. J., Utica Fire Alarm Telegraph company ..Utica, N. Y.
McConehay, C. D., Anderson Telephone company ..Anderson, Ind.
McDonald, C. M., Wagner Electric company.... ..Muncie, Ind.
McJarlan, Hyde, Hubbard City Telephone company ..Hubbard City, Texas
McVey, C. Y., Youngstown Telephone company... ..Youngstown, Ohio
Malery, A. B., Kent Home Telephone company.. ..Kent, Ohio
Manson, George T., Okonite company....New York, N. Y.
Martin, William, Cortland Home Telephone company ..Cortland, N. Y.
Martin, T. C., Electrical World and Engineer.... ..New York, N. Y.
Martin, K. G., Electrical World and Engineer.... ..New York, N. Y.
Mayberry, T. E., Mayberry Home Party Line System ..West Bedford Mass.
Mengab, L. C. and wife..Mansfield, Ohio
Meyers, Charles L., Kellogg Switchboard and Supply company ..Chicago
Millard, O. L., Electric Appliance company.....Chicago
Miller, Otto, Federal Telephone company.. ..Cleveland, Ohio
Miller, John J., Union Switchboard company..Erie, Pa.
Mitchell, Robert ..Bluffton, Ohio
Moore, H. P., Chase-Shawmut company....Boston, Mass.
Morrison, G., Morrison Telephone company.... ..Greenfield, Ind.
Morron, Will, Columbiana County Telephone company ..Lisbon, Ohio
Moulton, I. H. ..La Crosse, Wis.
Murch, Maynard H, Jr. ..Cleveland, Ohio
Murdock, William J., William Murdock & Co.... ..Chelsea, Mass.
Murry, Kennett V., United States Telephone company ..Cleveland, Ohio
Numan, Thomas W., Portsmouth Telephone company ..Portsmouth, Ohio
Osthoff, Otto E., Electric Storage Battery company ..Chicago
Painter, J. B., West Pennsylvania Telephone company ..Independence, Pa.
Patten, W. G., Louisville Home Telephone company ..Louisville, Ky.
Pear, Allen S., Central Electric company.....Chicago
Perry, Frank L., Western Electrician..Chicago
Pierce, F. W., Madison-Clark Telephone company ..London, Ohio
Pierce, John, Federal Telephone company.....Cleveland
Pratt, George B., Eureka Electric company.... ..Buffalo, N. Y.
Presson, A. T., Johnson County Telephone company ..Iowa City, Iowa
Price, H. A., Valley Telephone company..Bay City, Mich.
Putnam, J. L., Clark Automatic Telephone company ..Providence, R. I.
Pyke, Dr. A. D., Tippecanoe Telephone company.. ..Romney, Ind.
Quigley, W. G., John A. Roebling's Sons company ..Trenton, N. J.
Rhodes, J. B., Zanesville Telephone and Telegraph company ..Zanesville, Ohio
Risser, J. F., Putnam Telephone company..Ottawa, Ohio
Rolfe, Charles A., Rolfe Electric company.....Chicago
Ross, O. J., United States Telephone company.... ..Cleveland, Ohio
Rotchka, F. E., Western Electrician..Chicago
Roth, G. A., Roth Bros & Co..Chicago, Ill.
Rudy, G. W., York Telephone company.....York, Pa.
Sands L., Williams-Abbot Electric company..... ..Cleveland, Ohio
Sapp, F. F., and wife, Southern Telephone company ..Nashville, Tenn.
Sapp, Miss Bertha, Southern Telephone company ..Nashville, Tenn.
Sauerman, A. V., Standard Underground Cable company ..Boston, Mass.
Schapfer, John H., J. Edward Ogden company ..New York
Scofield, John H. ..New York, N. Y.
Scholl, A. G., Juniata and Susquehanna Telephone company ..Mifflintown, Pa.
Scott, D. P., Lesto, Ont., Phœnix Electric Telephone company ..New York, N. Y.
Sears, Vinton H., Eastern Automatic Telephone company ..Boston, Mass.
Seaton, W. B., Citizens' Telephone company..... ..Ashland, Ky.
Sleinkamp, J. G., Ottawa County Telephone company ..Elmore, Ohio
Slugluff, W. N., John A. Roebling's Sons company ..Chicago
Smith, H. L., Cortland Home Telephone company ..Cortland, N. Y.
Snyder, J. D. ..Findlay, Ohio
Speed, J. J., American Electric Telephone company ..Chicago
Stevens, Charles G. ..Chicago
Stiger, C. W., Stromberg-Carlson Telephone Manufacturing company ..Chicago
Stromberg, Alfred ..Chicago, Ill.
Strong, S. M., Akron People's Telephone company ..Akron, Ohio
Swan, G. W. ..New York City
Taylor, H. K., Federal Telephone company..... ..Cleveland, Ohio
Taylor, E. C ..Findlay, Ohio
Taylor, E ..Syracuse, N. Y.
Taylor, H. A., Lafayette Telephone company..... ..Lafayette, Ind.
Taylor, A. M. ..Cleveland, Ohio
Trier, George F., National Telephone and Telegraph company ..Fort Wayne, Ind.
Viggeles, Charles W., Automatic Telephone Meter company ..Boston, Mass.
Walker, Edward T., Electrical World and Engineer ..Boston
Walker, M. S., F. Bissell company.....Toledo, Ohio
Warner, T. W., and wife, Electrical World and Engineer ..Muncie, Ind.
Watson, W. J., New York agent, American Electrical Works ..Providence, R. I.
Weil, Samuel, Youngstown Telephone company.... ..Youngstown, Ohio
Whitney, A. A., Morrow County Telephone company ..Mount Gilead, Ohio
Wiley, J. R., Standard Underground Cable company ..Chicago
Wiley, G. L., Standard Underground Cable company ..New York
Willcox, F. W., General Electric company..... ..Harrison, N. Y.
Williams, J. A., Williams Electric company..... ..Cleveland, Ohio
Woodbury, W. B., Federal Telephone company.. ..Cleveland, Ohio
Woodman, H. E., Burlington County Telephone company ..Mount Holly, N. J.
Worstall, A. M., Interstate Telephone company.. ..Philadelphia
Young, H. C., Columbia Telephone company.... ..Columbia, Pa
Zuvern, George T., Marysville Telephone company ..Marysville, Ohio
Zuver, Minnie E., Federal Telephone company.... ..Cleveland, Ohio

Convention Notes.

Harry P. Moore, representing the Chase-Shawmut company, came all the way from Boston.

P. H. Hover, as is his regular custom, represented the New York Insulated Wire company.

Bleecker S. Barnard was on hand; he passed around the cards of the American Vitrified Conduit company.

Sears B. Conduit, Jr., Boston's cultured representative, came nobly to the front, as has been his custom for years past.

Adrian, Mich., was among the manufacturing towns represented, through Frank B. Jones of the Gilliland Electric company.

The National Conduit and Cable company of New York city sent a most creditable representative, in the person of J. B. Honan.

Raymond Hendrickson of the North Electric company of Cleveland used that little "good-luck" souvenir to good advantage.

Of course, the American Electric Fuse company sent representatives, and this time they were Frank G. Jones and James A. Kenny.

The American Electrical Works' Chicago office, as has been its custom on such occasions, sent a representative in the person of E. H. Hammond.

Mr. G. Hallett Johnson was on hand, distributing a booklet of his apparatus, manufactured by the International Supply company of Chicago, exploiting Schwarz telephones.

President George A. Briggs, Chicago Telephone Supply company, Chicago, made his maiden trip to a telephone convention. He appeared at the Iroquois on Tuesday morning.

Electrical Engineer F. R. Marsh of the Fall River Automatic company was constantly about the rotunda of the Iroquois, in company with the Standard Underground Cable contingent.

W. S. Paca, electrical engineer of the Union Switchboard company, Erie, Pa., accompanied by Mrs. Paca, and John Z. Miller of the same company, were in attendance at the convention.

One of the prominent convention visitors was Mr. A. V. Abbott, until recently chief engineer of the Chicago Telephone company. Mr. Abbott was an interested spectator of the proceedings.

The Ericsson telephone apparatus, which is handled by the Smith & Hemingway company, was exploited by Mr. Smith of the latter concern, who was on hand shaking hands with everybody.

Albert Lynn Lawrence, a Cleveland patent lawyer, formerly of Chicago, attended the convention. Mr. Lawrence was formerly with George P. Barton of Chicago, and is interested in telephone matters.

Western Manager of Sales J. R. Wiley and Northeastern Manager of Sales A. V. Sauerman and G. L. Wiley did the honors in their usual inimitable manner for the Standard Underground Cable company, Pittsburg, Pa.

"Joe" Williams of the Williams Electric company was, of course, on hand. Mr. Williams is one of those "good fellows" with a well-deserved popularity. Mr. Williams reports the company is doing a most excellent business at the present time.

Kent, Ohio, sent a popular representative in the person of Manager W. H. Butler, of the Kent Home Telephone company. Under Mr. Butler's management this company has become a valuable property, and its lines are now being widely extended.

"Railway and Telephone Securities" were synonymous of the Crittenden & Ely company, 35 Broad street, New York. This institution is giving special attention to the construction of new telephone exchanges and the placing of telephone bonds.

Where were C. W. Farr and Secretary Hearst of the Farr Telephone Manufacturing company, Chicago? Last year Messrs. Farr and Hearst appeared, accompanied by Mrs. Farr, and in consequence this years there were many inquiries for them.

The Electric Storage Battery company of Philadelphia sent Electrical Engineer Otto E. Osthoff from its Chicago office to do the honors. The Electric Storage Battery company is now pushing energetically for telephone storage-battery trade.

Although Mr. Hammond was doing the best he could in representing the American Electrical works, Representative F. B. Baker evidently was under the impression that the job was too big for one man, and came on from Providence to help him out.

Charles A. Brown of Chicago, chief counsel for the Stromberg-Carlson Telephone Manufacturing company, was called to Buffalo by legal business and was seen among the telephone men at the Iroquois on Wednesday. Mr. Brown was warmly welcomed.

Okonite was represented, of course. This time Mr. Manson brought the news that Captain Candee was prevented from accompanying him by his being about to start on a trip abroad, to be gone at least a month, with a possibility of an absence of several months.

President Bowman of the Western Telephone Construction company was, of course, in attendance. The Western company has recently moved its factory to Winthrop Harbor, a suburb of Chicago, and the latest reports are that this institution is prospering in a most gratifying manner.

General Manager Hipwell of the Hipwell Manufacturing company of Allegheny, Pa., was warmly welcomed. Mr. Hipwell made a host of friends at the last telephone convention, who were glad to again shake his hand and renew the pleasant acquaintance formed a year ago.

The Holtzer-Cabot company of Brookline, Mass., rarely misses a telephone convention, and this time was no exception, for Western Manager E. R. Harding came down with the Chicago party and contributed much to the sociability that marked the party on board the Convention Special.

Again came General C. Henry Barney, the popular and ubiquitous assistant general manager of the Monarch Fire Appliance company. General Barney, as usual, came to the front with some little novelty telling the merits of Kilfyre; this time it was an interesting little pamphlet.

Messrs. Holtzer and Ness of the Holtzer-Cabot Electric company of Brookline, Mass., arrived on Wednesday, and joined Mr. Harding in looking after the company's friends. It is not often that Mr. Holtzer leaves the Brookline factory interests, so his appearance this time was doubly welcomed.

The Automatic Telephone Meter company, 620 Atlantic avenue, Boston, exhibited for the first time an automatic telephone meter which, it is claimed, furnishes a solution of the measured-service problem. This device was explained in detail by the company's courteous representative, Charles H. Viggars.

For fear he might overlook some of the good times of the convention, E. L. Brown, eastern manager of the Stromberg-Carlson Telephone Manufacturing company, drifted in from Beaver, Pa., and arrived in time to prove some of the things that the other members of the company had been telling delegates.

Of course, the Electric Appliance company put in an appearance, and instead of President Low, this time it was S. A. Dinsmore and A. L. Millard who reminded the delegates that the Electric Appliance company still kept up that big stock of telephone material that can always be tapped at an hour's notice by telegraphic order.

Dr. Habirshaw was in Buffalo at the time of the telephone convention, and not having kept track of the date of the meeting of the telephone people, was somewhat surprised on Tuesday morning to find himself in the center of a host of old friends among his multitudinous acquaintances among the electrical people of the United States.

President L. Sands of the Williams-Abbott company of Cleveland, as usual, mixed with the "boys." Many inquiries were made for General Manager H. C. Dodge. It is said, however, that the company's Cleveland factory is almost overworked at the present time, and for this reason Mr. Dodge was compelled to deny himself convention pleasures.

South Carolina sent a clever representative, in the person of F. C. Manning, secretary of the Sumter Telephone Manufacturing company of Sumter, S. C. Mr. Manning presented a full line of his specialties, and by a very neat little picture of the company's large works reminded the convention that the South was doing its share of the telephone business.

Advertising Manager Sapp did the honors, and did them royally, for the North Electric company of Cleveland. It was a matter of regret that neither President North nor Secretary and Treasurer Steele could spare the time to be on hand at

[*Continued on page 377.*]

Bell Methods.[1]

By E. B. Fisher.

I do not expect or hope to say anything startling or novel. Most of you already know all that I shall mention this morning, have had experiences and observations similar to those mentioned, but to recall them may induce the presentation of other and really new experiences, and may prove an encouragement or a suggestion to those just entering, or about to enter, the Independent telephone field.

The man or corporation that should ignore competitors, that fails to study their mutual conditions and profit from them, could not expect to succeed in competitive enterprises and efforts. The man or corporation that maliciously or falsely discusses a competitor and its business in the hope that thereby its own business may be benefited makes a grievous mistake, and in the end loses more than is expected to be gained. With these two thoughts as premises, I enter upon a discussion of Bell methods. I could not, under any circumstances, consider such a topic in the spirit of criticism only, and were I expected to do so, should certainly decline the assignment. The gentlemen who have been conducting the business in the various constituents of what we know as the Bell company are our neighbors and friends. Many of them have been in the telephone business for years; some for quite 20 years. They have extended experience, they are competent, successful business men, and we can learn much by observing their methods, and undoubtedly can find many examples in their conduct of business from which to profit.

One of the most serious criticisms I have had occasion to suggest as to Independent telephone companies is their lack of system, their lack of carefully analyzing conditions and experiences and their making systematic deductions therefrom. They have engaged in the telephone business, in too many cases, much as the original Bell corporation did, and have been learning from sad personal experiences, rather than from profitable observation, of what had already been "threshed out" in the evolution of the Bell system. It is highly essential, now that the Independent systems are becoming larger, more complex, and intimately related with each other, that thorough system shall obtain; that first-class construction shall be the rule rather than the exception; that uniformity of practice in the manner of toll service, in the division of revenue arising therefrom, shall obtain; that those conducting the business shall exchange experiences, thus enabling all to learn of mistakes and avoid them, and to secure the advantages of improvements that may be devised. The exchanges of the Bell company throughout the country have for years enjoyed this interchange of opinion and experience, and through the manifest advantages of such interchange have avoided many difficulties and secured many betterments. We can and should copy this feature. We should meet each other frequently, individually and collectively, should keep in touch with each other by correspondence, as well as over the wires; when we hear of a good thing, let our neighbors know of it; when we discover perils or uncomfortable conditions, warn our friends.

The Bell, in a sense, although composed of many subordinate companies, has been one family. We can retain our individuality, maintain our ambitions to be the first in our chosen sphere of action, and still remember that we are a part of a family. Some have been inclined to suggest that our friends of the Bell company had too much system. As the business develops, it begins to appear that too much system is less expensive and less foolish than too little. If the managers and operators of Independent plants shall more carefully and fully analyze the cost of conducting their business in the different departments and the results therefrom, many errors will be avoided and the ledger balance on the right side will unquestionably grow. In systematizing business, we have much to learn from Bell methods. We should gain on this knowledge and improve on it.

There are directions, as we believe, in which our neighbors are still in error. What shall be said this morning, the statements or conclusions derived therefrom, should be received as they are intended, wholly in the nature of suggestion and warning for ourselves rather than of criticism of, or of faultfinding with, the aforesaid neighbors. It is undoubtedly true that the conduct of a monopoly often results in somewhat of arrogance on the part of those who are at the head of such monopoly or who hold responsible positions in the management of its business. Such people naturally come to feel that they can do about as they please, and if patrons or the public are not delighted therewith, what odds? I have heard gentlemen, who are listeners to this paper, more than once offer the suggestion that they would not care for the service of certain Bell employes who had applied for positions, because they were too "cranky." We can see for ourselves how natural it was that crankiness grew upon many officials and managers of Bell plants. They were not obliged to consult the wishes or desires of the public to secure their business and profits. One could take telephone service on their terms or let it alone. That was all there was of it.

This spirit of crankiness, so natural under the circumstances which engendered it, is the exponent of general conditions which produced other peculiar manifestations often noted the last few years. We should carefully consider these manifestations which are intended or expected to affect our own business, and, by interchange of observations or experiences, help each other, and counsel or warn those who are about to engage in the Independent telephone business. I well remember, when, a little more than six years ago, we began canvassing in Grand Rapids, Mich., to secure the money with which to build the plant of the Citizens' company and for patrons of the same, the many stories which were afloat among our people as to our business. It was confidently asserted by representatives of the Bell company in our city and state that we never would build a telephone plant—indeed, that we had no intention of so doing and were only trying to make money by being bought out. We were in effect, it was intimated, intending blackmail. It was said that we could not build, could not get material, could not properly combine the material when we got it, could not find apparatus that was not infringing, could not get a switchboard that would work; would not know enough to set poles, string wire thereon and make them stand up. Even after we had actually begun to install telephones, those who had given us contracts were prompted to bet that we never would give service. There were infringement suits which may have been really expected to put a quietus on our enterprise, but there did not any of them succeed—it scarcely seems possible that some of them could have been expected to.

We have been giving service for more than five years, and the company which was then organized with but $100,000 authorized capital has grown until it has to-day in service more than one-half as many telephones as the Bell had in the entire state of Michigan but five years ago, and has an authorized capital well toward one-half what the Michigan Telephone company then had. And yet to-day similar predictions and commentaries upon like enterprises, even in Michigan as well as other states, are indulged in by our neighbors. Officials of the Erie company have informed the public through the press within a few weeks that the new Independent plant will never be built in Detroit; that the People's company in that city never will give service. When, in your respective localities, the Bell resorts to such methods to dissuade the public from patronizing them, to persuade them that you are not intending genuine business, you can comfort yourself with the fact that you are not singular in this experience, and you can point to results in other localities, and say to your friends, "It is an old story, and no truer here than it has been elsewhere."

If you get started with service and you find that your patrons receive circular letters suggesting that the Bell is owner of letters patent "steen hundred thousand and steen," and that all who use the Independent apparatus infringe such letters patents and are liable to prosecution for using the same, do not flatter yourself that in this method the Bell company is distinguishing you beyond other Independent companies. Such things have been done repeatedly. You have yet to hear of a subscriber who has been so prosecuted, and you can very safely guarantee your patrons against any damage that may be awarded by any court under such suits, and that you will pay all costs for defense.

If you should find that the Bell company, which has frequently informed the people in your community that their former rates were the lowest they could afford to make for their service in your locality, has, upon the development of your competition, resorted to free service, or much less than cost rates, in an effort to destroy you, do not be fearful that such practice can really damage your company; do not imagine that you are enduring an experience novel in the telephone business. Do not, for a minute, when the Bell resorts to this method, attempt to meet competition by establishing like rates, or lower rates, for your own service. Begin the education of your people; take them into your confidence; tell them the truth about your business and its results; insist upon a fair profit, upon reasonable returns on the actual investment, after giving good service, and you will find the people ready to pay your price rather than to get absolutely free service from the competitor. Do not resort to other tactics, because there can be but one result from such procedure. This Bell method is a "war measure," pure and simple, and if it could succeed, would be followed by such advance in rates as would fully compensate that company for the temporary concession of free service or less-than-cost rates. This fact has but to be stated to intelligent business men to be apparent to them and to influence their action. This method, which has been practiced by the Bell subordinate companies in considerable regions of the country, so far as I know, never yet has succeeded in taking away the patronage of an Independent company honestly striving to give good service at a reasonable rate. The company which shall reduce its rates below a reasonable point in a struggle with the Bell company is doomed the moment it shall do so.

What do you think of party-line service? One of the methods of the Bell company in its efforts to meet the lower rates of Independent telephone companies has been to introduce, quite largely, party-line service with important reductions in rates for such service. Has it been successful where you have observed it? Is it a serious menace as a competitor? Of course we know that the new president of the Central Union and the Chicago Telephone companies, who still retains his position at the head of the Pacific Coast company—all Bell—is a stanch advocate of this sort of service. He is a gentleman of extended experience and wide observation in telephony, and for that reason his opinion is not to be lightly dismissed or treated with indifference. We are this morning discussing Bell methods in the hope that we may learn from them and profit from either accepting or avoiding their example. My own observation has been that party-line service is largely "a snare and a delusion" where given in city exchanges, and is not a competition that we need fear. It is evident that no devices have yet been invented which will permit more than two parties to use the same line at the same time, so when any pair on a party line holds the line, others must wait. Should this sort of service be generally used, the difficulty of securing your own line and of getting connections with other parties on similar lines is manifestly very greatly increased. We all know how impatient the average telephone user is to get service the moment it is wished; you have known subscribers ready to swear that the girl kept them waiting two minutes for a connection when it was not to exceed 20 seconds. I do not believe that you will be compelled to resort to party-line service to meet this method of the Bell competition. The B. W. C. service which was expected to work wonders three or four years ago is not very generally popular.

No discussion of recent Bell methods would be useful if we did not consider minute rates for toll service. What is your observation on this topic? The high authority from the Pacific coast, who is trying to stifle competition in the Central Union territory and to prevent it in Chicago, who is indeed regarded as a possible head of the American Telephone and Telegraph company, is the father of the minute-rate service. He sets great store by his scheme, and has secured its adoption in considerable territory outside of that which he controls. We, in the Michigan territory, find it one of our competitions, and have not quite made up our minds as to its present and probable effects. However, on general terms, it is fair to state that it is causing considerable friction and dissatisfaction. The average telephone user is ready to affirm that he has not used the service so long as he has been charged for. He considers himself a victim of overcharge, and believes that the minute rate is intended thus to increase the fees of the telephone company, which he was inclined to believe were already quite large enough. If the average business man, on a long-distance connection, can actually accomplish his conversation in a single minute, it strikes me that at the price for one minute's connection, the line cannot earn enough; for we all know that quite as much time heretofore has been spent in getting two parties to talking as is occupied with their conversation. Now, if the time for securing connections cannot be reduced and the time of using is reduced, with theoretical reduction of pay, service would be less profitable to the companies than on the three or the five-minute basis. If the average subscriber is expected to use the line on a three or five-minute basis, why not make rates upon that theory? That would be fair to both company and patron, and secure the desired revenue, even if but one minute should actually be used. The purpose of this paper, as before intimated, is to set you to talking about your mutual experiences and to induce discussion rather than to state conclusions.

In Michigan, our neighbors have taken a new departure within the last few weeks. Formerly, they refused to admit that any other apparatus than the Bell could be successfully used in telephone service. The sub-companies of the parent company were supposed to have a hard and fast contract forbidding the use of any other apparatus and forbidding connections with any other apparatus. Latterly, the Michigan Telephone company has been attempting to secure, in a few instances, toll-line alliances with companies formerly built and still continued, as far as exchanges are concerned, as Independent companies. The Michigan company has said in effect to such companies: "Keep your local exchanges, even your own toll lines; take control of the exchange business in your locality, but enter into a contract for toll connection outside your territory through the Bell system; it will give you equal percentages on originating business to those you have heretofore enjoyed and provide you with more extended and superior toll-line facilities." This late Bell method is insidious, and it is not strange that in some cases it is successful. Where such a contract is made exclusive—and of course they try to make it exclusive, if possible—it subtracts by so much from the efficiency of adjoining or neighboring Independent service. So anxious has the Michigan Telephone company become in this matter, I believe it is true that it has been willing to make arrangements in some cases for a divided toll service, where it was impossible to secure an exclusive contract. This Bell method is one of the most threatening efforts yet made, and yet has its silver lining. The strong Independent companies, with considerable toll-line facilities, which have been growing, have not been influenced by such propositions. Only the smaller and weaker companies have made such contracts with the Bell company. Of course, no other Independent company has been willing to parallel the lines of a neighboring Independent company, no matter how inferior might be such neighboring plant, or how imperfect its service. Now, that sort of terri-

1. Read before the Independent Telephone association of the United States at Buffalo, N. Y., on June 13, 1901. Mr. Fisher is secretary of the Citizens' Telephone company of Grand Rapids, Mich.

tory will be provided with up-to-date Independent plants. This recent manifestation would seem to indicate that the parent company must have consented to an abandonment of the exclusive feature of its contract with subordinate companies.

I believe that the Bell habit of ignoring the farmers, the small villages and the country has been an error. I think that in this department of telephone service a proper development of party lines may be made with great advantage to the communities served, and at fair profits to the investor. There are regions in Michigan—and probably each of you could repeat the same tale—where the Bell is beginning to compete with Independents in their own field in this regard. I say their own field, because the Independents were the first deliberately to provide this sort of service. This Bell method of following a good example may prove a formidable competition and may materially strengthen their smaller exchanges and their situation, if they shall first enter new territory with this sort of service.

There was a time when I think it was actually believed by the average general manager or prominent official connected with the Bell Telephone companies that an Independent company could not possibly secure intelligent, experienced employes. They thought that we would be compelled to go through the process of evolution which was so tedious and so costly in the earlier days of the Bell company; that their employes would remain with them. They even thought in some localities that an Independent company could not get exchange operators, and in some instances employed superfluous help simply to keep them from entering the service of Independent competitors. Some know more to-day on this topic than they did a few years ago. A large number of the brightest men in telephony have found employment in the Independent field, and there is scarcely one in this convention hall who has not had frequent opportunity to secure many more of the most important employes of the Bell company than he has had places for.

We have been surprised at times at the seeming lack of loyalty to their employers by those who have been so long on Bell payrolls. Perhaps a little analysis of Bell methods may explain this situation and furnish a warning for ourselves. The rewards among the employes of the Bell heretofore have not been great, either in salary or opportunities. They have been made to feel more like machines than human beings. In many cases, they have not had their inventive tendencies encouraged by proper compensation for what they produced—indeed, they have been compelled to part with their inventions on the theory that their brains, as well as their labor, belonged to their employer, or, because there was but one market for their invention and devices and that market could set its own price upon what it bought. Such conditions are not conducive to loyalty, or to inducing energetic service. The Independents, if they shall copy Bell methods in this respect, will make a grievous mistake.

If you should wake up some fine morning and hear that you have sold, or are about to sell, your telephone plant to the Bell company, do not consider that the transaction is necessarily closed. If you hear similar reports as to actual or impending sales of other Independent companies in your own or other states, be not disturbed thereat, nor convinced that the news is reliable. There have been some such sales, but vastly more rumors of those which never have occurred and do not seem likely to. There have been methods in these rumors; for some reason, some interest, evidently not Independent, has believed it desirable to circulate such reports, probably in the hope that other Independent interests might be disquieted or discouraged, and yield more readily to apparently advantageous offers. These methods have been relied upon to produce serious effects. Keep yourself and your neighbors advised of the strength and growth of the Independent movement, of the strength of their own situation in competition, and fewer such rumors will be verified hereafter.

In nothing that I have said thus far have I given many of you real news. As I said to one of my friends, I felt that it was impossible to do so, and was almost ashamed for having tried to prepare and read such a paper; but if it shall refresh your memory, if it shall induce you to give other experiences and observations of your own, if it shall attract, through publication in our annual reports or otherwise, the attention of any who are about to engage in the telephone business, and shall hearten and strengthen them in their enterprise and efforts, it may accomplish some of the good earnestly desired and intended in the preparation of the paper. As stated at the outset, it is not in criticism or derogation of the Bell company that it is offered. That corporation has the right to resort to any efforts, within the bounds of fact, it may choose to make, and we have equal right to discuss its methods, and by considering them, minimize their effect, if not entirely to overcome them. It is in this spirit of consideration only that this paper is offered.

The Washington and Annapolis Electric Railway company of Baltimore has completed its permanent organization by the election of the following-named officers: President, W. H. Lamprecht, Cleveland; vice-president, James Christy, Cleveland; secretary and treasurer, Otto Maller. E. W. Moore and several other Cleveland men are interested in the company.

Ohio Telephone Statistics.

Judging by statistics compiled by E. C. Bickel for the Federal Telephone company of Cleveland, the Independent telephone situation in Ohio is very promising. The movement in Ohio appears to be more decisive and widespreading than in any other state in the Union. The growth since 1895 has been very rapid and the field which, in that year, was almost entirely controlled by the American Bell Telephone company, is now about equally divided between it and Independent companies. The Bell company has been forced by competition to drop its former exorbitant rates to a more reasonable basis, and in some towns it is giving free telephone service in order to be able to compete with the Independent people. The villager and farmer are almost exclusively in favor of the home companies and believe that the citizens of each county can supply their own wants much better than can a company, with remote headquarters, which attempts to supply the whole country. Opposition to the Bell company has sprung up in almost every city, town and village in the state, until now, according to Mr. Bickel's statistics, there are more subscribers for Independent telephones than there are for the Bell.

The following tables, compiled by Mr. Bickel, show a comparison of the number of Independent and Bell telephone subscribers. The first table is a list of the towns having over 500 subscribers, either Independent or Bell, and gives the business rates of the companies. The second table is a comparative list of the telephone users in the different counties of Ohio.

Name of City or Village.	Population, 1900.	Number of Bell Subscribers Mar. 1, 1901.	Bell Business Rate.	Number of Independent Subscribers Mar. 1, 1901.	Independent Business Rate.
Akron	42,728	1,100	$ 38	1,505	$32
Ashtabula	14,000	180	24	800	24
Bucyrus	6,550	350	24	570	24
Canton	30,667	1,300	36	1,000	30
Chillicothe	12,976	400	18	728	24
Cincinnati	325,902	14,000	125	.....	.....
Cleveland	381,768	11,000	84	7,000	48
Columbus	125,560	3,300	72	4,642	40
Conneaut	7,133	200	24	525	24
Coshocton	6,473	91	Free.	535	24
Dayton	85,333	2,000	60	.....	.....
Defiance	7,579	260	15	527	24
Delaware	7,940	230	24	545	24
East Liverpool	16,485	315	21 24	522	24
Elyria	.....	180	24	730	24
Findlay	17,613	800	30	800	30
Galion	7,288	500	24	324	24
Hamilton	23,914	1,200	64	.....	.....
Lima	21,723	800	24	700	30
London	3,511	137	24	582	24
Lorain	16,028	6	.....	600	30
Mansfield	17,640	1,200	36	700	30
Marietta	14,000	700	28	750	24
Massillon	11,944	350	24	600	30
Mount Vernon	6,633	335	15	506	30
Newark	18,157	600	30	600	24
Norwalk	8,000	500	18	327	24
Ottawa and all of Putnam County	.....	.....	.....	600	18
Painesville	5,024	300	18	508	24
Piqua	12,172	650	24	690	24
Portsmouth	17,870	197	24	680	24
Sandusky	19,664	450	30	900	30
Springfield	38,235	890	48	.....	.....
Tiffin	10,999	580	24	815	24
Toledo	131,822	4,000	120	525	....
Urbana	6,806	112	24	823	24
Van Wert	6,500	.....	.....	519	24
Warren	8,529	450	18	750	24
Washington C. H.	5,751	175	24	622	24
Youngstown	44,845	950	42 36 30	1,300	25
Zanesville	23,538	750	48	600	33

Counties.	Ohio Telephone Users in 1901. Bell.	Ind.	Counties.	Ohio Telephone Users in 1901. Bell.	Ind.
Adams	3	3	Logan	14	602
Allen	850	1,194	Lorain	386	1,845
Ashland	6	442	Lucas	4,000	525
Ashtabula	405	1,612	Madison	154	1,236
Athens	246	610	Mahoning	962	1,351
Auglaize	69	576	Marion	306	5
Belmont	267	290	Medina	215	555
Brown	156	2	Meigs	164	.....
Butler	1,508	110	Mercer	77	316
Carroll	75	5	Miami	1,102	1,260
Champaign	120	1,218	Monroe	8	296
Clark	900	149	Montgomery	2,020	29
Clermont	12	191	Morgan	6	7
Clinton	180	560	Morrow	9	410
Columbiana	780	1,909	Muskingum	790	670
Coshocton	100	621	Noble	3	60
Crawford	855	1,247	Ottawa	196	425
Cuyahoga	11,500	7,370	Paulding	3	560
Darke	86	163	Perry	12	260
Defiance	267	665	Pickaway	160	6
Delaware	235	615	Pike	29	207
Erie	550	1,025	Portage	250	882
Fairfield	258	470	Preble	8	374
Fayette	183	838	Putnam	6	615
Franklin	3,315	4,792	Richland	1,556	1,280
Fulton	92	764	Ross	413	846
Gallia	128	365	Sandusky	304	886
Geagua	6	668	Sciota	203	650
Greene	350	300	Seneca	892	1,825
Guernsey	315	433	Shelby	199	561
Hamilton	14,000	10	Stark	2,040	1,900
Hancock	800	880	Summitt	2,298	2,390
Hardin	332	490	Trumbull	655	1,642
Harrison	156	132	Tuscarawas	235	1,376
Henry	6	311	Union	6	312
Highland	252	346	Van Wert	12	553
Hocking	3	153	Vinton	44	89
Holmes	5	538	Warren	281	477
Huron	650	1,250	Washington	744	784
Jackson	553	540	Wayne	8	636
Jefferson	527	616	Williams	125	1,000
Knox	353	665	Wood	765	494
Lake	311	838	Wyandot	360	360
Lawrence	321	505			
Licking	610	756	Total	64,716	67,597

Telephone News from the Northwest.

The Twin City Telephone company in St. Paul is charged with placing its conduits over the water mains, in defiance to the rule which requires that these conduits, with the pipes of the gas company, are to be placed on the side of the street opposite to the water mains. The water board is thus placed to considerable extra expense when it becomes necessary to repair its mains.

C. R. Meredith has installed an exchange of 100 connections at Casselton, N. D.

H. P. Proctor & Sons of Phillips, Wis., have a telephone line covering about 80 miles. It reaches from Medford, Wis., on the south to Glidden on the north. The latter line will be continued on to Ashland, which is but 20 miles.

O. J. Jensen is building a telephone line between Cadott and Stanley, Wis.

The Wisconsin Telephone company will install a local exchange in Stanley, Wis.

The Zenith Telephone company will erect a building for a central office for its new exchange for Cloquet, Minn.

The wires of the Northwestern Telephone Exchange company into the courthouse at Minneapolis have been cut by order of the board of county commissioners. The Twin City Telephone company has just instituted a complete exchange covering the building, and the board does not care to pay rent for two systems. County officials who want the Northwestern connection will have to pay their own rent.

The Goodhue County Telephone company has been formed in Goodhue, Minn., and has begun work on a local exchange.

The Mountain Lake (Minn.) Telephone company will build a toll line to Comfrey.

The Wisconsin Telephone company proposes to build a toll line from Tomahawk to Rhinelander, Wis., as soon as permission to string wires along the right-of-way of the Soo line can be secured. The company claims that to string wires in the northern part of Wisconsin, on the country roads, is unsatisfactory, as the wires are being interrupted by trees being blown down and breaking them.

The rural line, between Elcho, Wis., and Enterprise Lake, has been a great success, and will probably be extended considerably.

The Price County Telephone company has set poles between Prentice and Phillips, Wis., for an extension. It will build south to Ogema and north to Butternut this season.

The Osseo Telephone company has about 50 subscribers secured for the proposed local exchange at Mondovi, Wis.

The Twin City Telephone company has bought a site at Eighth and Cedar streets in St. Paul for the erection of a central-exchange building. The exchange will be built to accommodate 6,400 connections, and will represent an outlay of $75,000. With the Dale exchange, the company can handle 10,000 connections in St. Paul.

A local exchange has been installed at Henning, Minn., by the Fergus Telephone company.

A meeting of the leading telephone companies of the Wisconsin River Valley was recently held at Wausau, Wis., to formulate plans for the consolidation of all toll-line interests in the valley. The company will be known as the Wisconsin Valley Telephone association, and it will be capitalized at $75,000. Six Independent companies are represented.

At the Wisconsin Independent Telephone convention at La Crosse, Wis., on June 26th and 27th, the construction of a through line from La Crosse to Milwaukee will be considered.

A toll line is projected by Allan Tompkins of Devil's Lake, N. D. It is to extend from that place to Lunde.

H. C. Parker is arranging to establish a local exchange for Inkster, N. D.

The Union Telephone company of Cedar, Iowa, plans to extend its lines to connect with Ottumwa, Iowa.

The Maple Grove Telephone company has been formed in Lee township near Iowa Falls, Iowa, to build a rural telephone line.

The German-American Telephone company has been formed at Mount Hamill, Iowa, and will build a line connecting Donnellson, West Point, Salem, Cottonwood and other places.

A farmers' mutual telephone line is being built near Reinbeck, Iowa.

The Star Telephone company of Lincoln township has connected with Clear Lake, Iowa.

The council of Tacoma, Wash., has made a number of changes to the franchise as offered by E. A. Seeley for a telephone system. Robert Wingate is an applicant for a franchise also.

The Hopkinton Telephone company has been incorporated at Hopkinton, Iowa, with $3,000 capital stock.

The Farmers' Mutual Telephone company will build a line between Panora and Guthrie Center, Iowa.

It is reported that the Automatic Telephone company has bought the franchise of the Independent telephone company in Seattle, Wash. The people interested in the Automatic company are applying for a franchise at Tacoma.

The Yorkton and Clarinda Telephone company has been formed at Yorkton, Iowa, to build a line to Clarinda. R.

Century New Central-battery System.

To meet the demands of its customers, the Century Telephone Construction company of Cleveland, Ohio, recently determined to manufacture its own switchboards. After a considerable study of the situation it was determined to design a central-battery system as being best calculated to meet the conditions surrounding the contracts the company had on hand. The reasons for finally deciding upon this type of board were the advantages of automatic signaling, secrecy of communication, visual lamp signals, reduction in size and cost of instruments, etc.

The first board made by the Century company has just been installed in Hornellsville, N. Y., which after the correction of a few minor details, has proved so successful that the company intends to fill all its present contracts in exchanges of 200 or more lines with this system. While the subscribers are engaged in conversation, the lamps in the cord circuit are left open, instead of shunted, so that there is no waste of current from that source. The instrument at the subscriber's station is not grounded, so that there is no trouble from earth currents.

In the subscriber's instrument local batteries are used to furnish current to the transmitter, as this has been found to give the best results in practice. In this way the instruments combine all the advantages of the local battery in long-distance work with the advantages of automatic signaling. As the two cells of dry battery used do not require attention for at least a year, they are said to be cheaper than a storage-battery source of supply.

The Hornellsville board has a frame capacity for 1,500 subscribers, although only about 600 are installed at the present time. The board being of the open-multiple type, not series-multiple, there are few chances for trouble in the jacks, while additions can be made at any time without the necessity of all the cables being pulled in as at present.

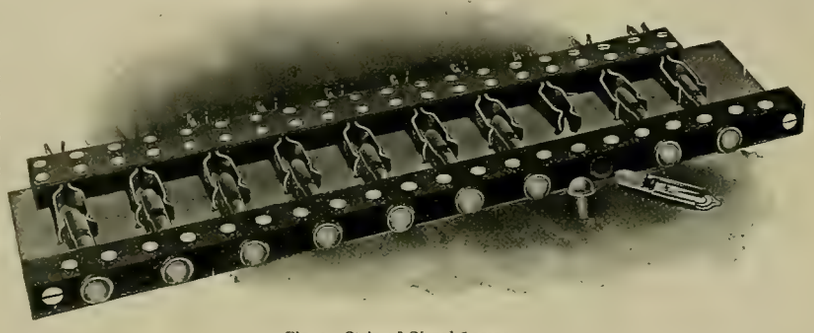


Fig. 1. Strip of Signal Lamps.

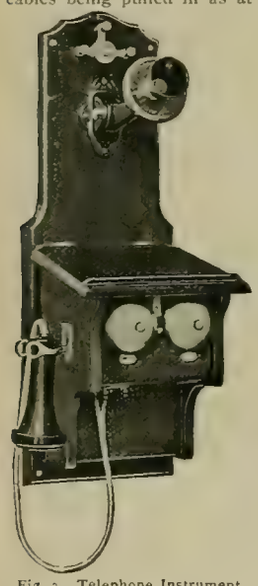


Fig. 3. Telephone Instrument.

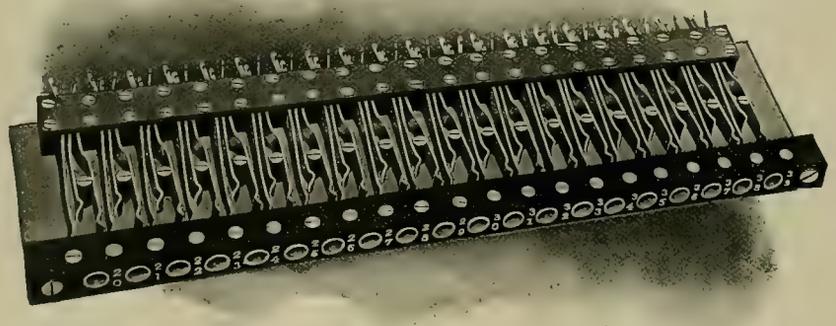


Fig. 2. Strip of 20 Multiple Jacks.

CENTURY NEW CENTRAL-BATTERY SYSTEM.

In the accompanying illustrations, Fig. 1 shows a strip of lamps used in signaling, which are mounted on hard rubber supported upon a brass plate in a substantial manner. Fig. 2 is a strip of 20 multiple jacks, which have closed contacts, except when the plug is inserted, and which, unlike a series-multiple system, leave no chance for trouble in loose or dusty contacts. Fig. 3 shows one of the subscriber's telephones with an apartment for holding two cells of dry battery.

Moon Terminal Head and Casing.

One of the essential points to consider after securing a good terminal in a telephone system is to provide a good protection for the apparatus. This point is often overlooked by putting up a wooden box or case, which may easily warp or leak, with hinged doors that are liable to rust and break off in a short time. The Moon terminal head is provided with an outer casing, as shown in the illustration. This casing is made of the best galvanized iron with a heavy coating of mineral paint, thus making it rustproof, while a sliding door makes it dustproof also. When the sliding door is opened the sides of the terminal head are exposed without obstruction. This feature makes the lineman's work easy and saves his time. The Moon Manufacturing company of 49 South Canal street, Chicago, makes this terminal and casing.

MOON TERMINAL HEAD AND CASING.

The Syracuse Lighting company of Syracuse, N. Y., has been incorporated, with a capital stock of $2,500,000. The directors are Charles V. Nellany, Harry F. Cues and Richard F. McKiniry.

The White Telephone Lightning-arrester Case Decided.

The suit brought by the Western Electric company against the Kinloch Telephone company and Samuel M. Kennard for the infringement of a patent for a potential discharger or lightning arrester was argued in the Circuit Court at St. Louis, Mo., on April 24th and 25th, before Judge Marshall of Salt Lake City, Utah. George P. Barton, DeWitt C. Tanner and George C. Hitchcock represented the complainant, and Charles C. Bulkley and Boyle, Priest & Lehman represented the defendants.

Opinion in favor of the complainant was rendered by the court on June 7th. The suit was for an injunction and damages for the infringement of letters patent No. 438,788, dated October 21, 1890, issued to Anthony C. White of Boston, Mass., for a potential discharger or lightning arrester. The defendant's apparatus that was held to infringe was of the Sterling type.

The White arrester is described as follows: "The patented device consists of two carbon plates mounted parallel to each other and only separated by a thin dielectric. The solid portion of this dielectric, which is preferably of mica, is slotted so as to permit of disruptive electric discharges through the air space separating the plates. The upper plate has a plug of easily fusible metal or alloy fixed in a hole in its surface. In use, one of these plates is connected electrically with a telegraphic or a telephonic circuit, and the other with the earth. The purpose of the patented device is to protect telegraphic or telephonic apparatus from injury due to lightning or to the accidental crossing of the circuit by electric circuits conducting powerful currents under high potential. The trespassing current of high potential seeks a short path to the earth. It breaks down the air dielectric between the carbon plates, and a spark or disruptive discharge from plate to plate results. If the current is of small volume, an arc forms and heat ensues. The fusible plug melts, and, running down, forms a conducting union between the carbon plates. The resistance to the current at once ceases, the metal cools and a permanent earth connection is made."

The first and fourth claims were alleged to have been infringed by the defendants. The court decided that the first claim had been infringed and that the fourth claim was not infringed.

A portion of the opinion of the court is as follows:

"At the time of White's invention it involved no inventive skill to substitute carbon plates for the metal plates before used. The carbon plates are highly refractory and the threads of the metal plates are obviated. But when persisting currents of high intensity get on the line an arc is formed between the carbon plates, great heat is generated and danger from fire ensues if means are not used to connect the plates conductively so as to lessen the resistance. The carbon plates, in remedying one evil, brought another in its place. The latter defect was remedied by the insertion in one of the plates of the plug of easily fusible conducting material. White's invention, then, consisted in an arrester which would divert currents of high potential and small volume without impairing the working of the line or its own efficiency, and which would also divert a persisting current of high potential by the forming of a conducting union between the plates. While not a pioneer invention, it marked a decided advance in the art.

"In the first claim of the patent in suit one of the elements is a 'plug or mass of easily fusible conducting material,' and the defendants claim that the lead shot of their device are not easily fusible within the meaning of this claim. In practice the shot used in the defendants' arrester sometimes, but rarely, melt. When a current of high potential persists the wax melts, releases the shot, and they, falling together, form the permanent conducting union between the plates, provided the silk dielectric is then burned away at its approximate center. If the silk be not burned away it holds the shot apart and the union is not formed until it is so burned. The melting of the shot is at no time essential to the operation of the defendants' device, while in the White arrester the fusible plug is only released by its own fusion. The permanent conducting connection formed by the complainant's device, under a persistent current of high voltage, does not, however, depend on the melting of the entire plug. It is sufficient if it melts superficially, so as to be released from the hole in which it is held. So that the essential difference is that the defendants used a cement of wax, which is not a conductor and melts at a slightly lower degree of heat than the alloy used in White's arrester, and a lead shot, which is a conductor and fuses at a slightly higher degree of heat than the alloy, instead of the homogeneous fusible plug of the White patent.

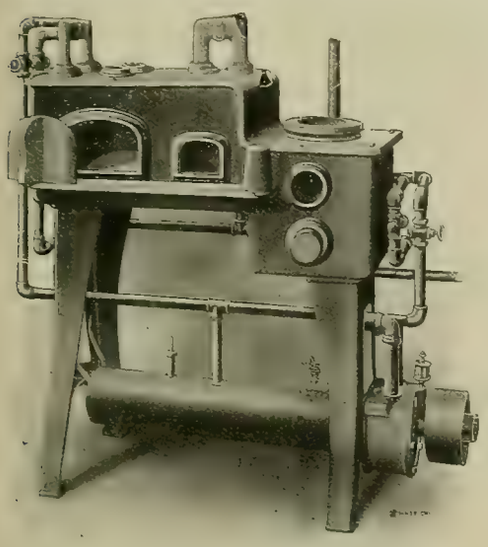
"The two devices operate in substantially the same way. In each the spark discharges do not develop sufficient heat to release the metallic conducting mass. But when an arc is formed heat is generated sufficient to release the plug or shot by the fusing of an easily fusible material. It does not matter that in the one case the material fused is itself a conductor and in the other is not. In both cases a conductor is released and the same result is produced in substantially the same way. But the defendants assert that the wax used in their device is but a workshop expedient for convenience in the assembling of the parts; that it is to hold the shot until the parts are assembled. After that the silk dielectric is said to prevent the coming together of the shot and the short-circuiting of the line. But it appears that in practice the silk dielectric is sometimes burned away at a point which would permit the loose shot to come together, although the heat is not sufficient to melt the wax. In such case the wax plays an important part in the operation of the device. Without it the line would be short-circuited, and with it the operation of the line is not interfered with, and the arrester remains in a working condition. So that, however useful the wax may be as a workshop expedient, it is also a useful feature of the completed device."

The court holds that the complainant is entitled to a decree against the defendants for an infringement of the first claim of the patent, and for the usual injunction and accounting.

J. R. Cravens, J. H. Shelley and T. S. Miller have incorporated the Mexia Light and Power company at Mexia, Texas, with $16,000 capital stock.

Stewart Combination Gas Furnace.

In the accompanying illustration is shown the Stewart combination gas furnace, which combines on one base three very useful furnaces for the general machine shop, tool work, and the heating of magnets. The muffle furnace, which is shown on the left, was especially designed for the heating of fine tools, dies, taps, punches, etc. Its size is six by eight by 12 inches. The flame is projected from the double burners downward into the chamber encircling the muffle. The lining is of such shape that a rotary motion is imparted to the flame, causing it to distribute itself evenly all over the enclosed space. The products of combustion are drawn off by the two small openings at the top of



STEWART COMBINATION GAS FURNACE.

the chamber. The muffle is heated rapidly and evenly throughout.

The forge section of the furnace is shown in the center of the cut. The combustion chamber is circular in form and is heated by two burners, which project the flame downward, the heat being under perfect control. The forge will heat a one-inch round piece to a good hardening heat in one minute.

On the right-hand side of the furnace is shown the crucible section. It is especially useful for lead hardening and for oil tempering; springs and thin pieces of all kinds can be hardened in this section of the furnace economically. It is also useful for babbit melting.

As will be noticed in the illustration, the blower and air reservoir are both attached to the furnace, which does away with all unnecessary piping, etc. The furnace occupies very little floor space and does not require to be connected to a chimney. It can be placed right in the tool room or any place where it is most convenient. It can be started instantly and covers a range of uses that make it practically indispensable to every up-to-date electrical concern or machine shop. The manufacturer of this combination furnace is the Chicago Flexible Shaft company, La Salle avenue and Ontario street, Chicago.

Ohio Telephone Notes.

The council of North Lewisburg has granted a franchise to an Independent telephone company made up of business men of the place. It is the intention to put in a first-class exchange.

A telephone line is being constructed from Rutland to Pomeroy, Middleport, Cheshire, Addison and Bulaville, in the southern part of the state. It is being built primarily for farmers' service, and it is said the system will be very much enlarged later on.

Fairport has a woman who is something of a genius in a business way. She is Mrs. J. A. Harris. Her husband was collector of the port at that point, but, becoming ill, he was compelled to give up the position. His wife had aided him in the work and was perfectly conversant with it, so she was appointed in his place. In addition to these duties, she is manager of the Postal Telegraph company's office, the local telephone exchange and freight agent of one of the railroads. She is also a writer and frequently contributes to the papers. It is said her work is always promptly and perfectly done in all the branches she looks after.

The Central Union Telephone company is preparing to rebuild its plant at Fostoria. About $20,000 will be spent in the improvements.

The Morrow County Telephone company of Cardington has increased its capital stock from $12,000 to $30,000. O. A. Whitney is the president, and Harry B. McMillin, secretary.

The Collinwood Home Telephone company of Collinwood has filed notice with the secretary of state of an increase of capital stock from $25,000 to $50,000. J. M. Hart is the president of the company, and W. L. Griswold, secretary.

The Central Union subscribers at Poland, Ohio, are being connected with the exchange at Youngstown, with all the privileges granted the Youngstown patrons.

The Sidney Telephone company of Sidney has given notice to the secretary of state that the capital stock has been increased from $40,000 to $60,000. The president of the company is W. H. Wagner and the secretary is H. T. Mathers.

The Cincinnati and Suburban Telephone and Telegraph company has asked for a franchise in Elmwood place, near Cincinnati. It will likely be granted.

C. A. Snyder, E. E. Hoge and D. H. Campbell are at the head of a new company to build a telephone system in Harmony township, Clark County. They can likely be reached through the postoffice at Springfield.

It is said that the Independent Telephone lines between Youngstown and Pittsburg will begin operation this week. It seems that all the troubles have been settled. This will connect all territory west of Pittsburg with the Independent lines east of that city. O. M. C.

Indiana Telephone Items.

Articles of incorporation were filed with the secretary of state on June 7th by the Citizens' Telephone company of Brazil. The capital stock is placed at $10,000. On the same day the Home Telephone company of Columbia City filed addition papers increasing its capital stock from $10,000 to $25,000. On the following day the Farmers' Mutual Telephone company of Elkhart filed articles of incorporation, with a capital stock of $5,000.

The telephone systems of Putnam and adjacent counties suffered to considerable extent during the last week on account of wind and electric storms.

The Central Union Telephone company has taken possession of a large warehouse on Madison avenue, Indianapolis, and established a shop and distributing plant for this city and the state. Seventy men are employed and all the electrical appliances used in the state will be handled from this plant, and many of the appliances the company uses will be made here.

The American Telephone and Telegraph company is asking for franchises in a number of the counties in the northern and northeastern parts of Indiana. Charles D. Cole of New York, who is looking after the company's business in Indiana, held a conference with other employes of the company in Indianapolis last week, but they carefully guarded the result of their conference. Mr. Cole said the company was an Indiana incorporation, but feigned knowledge of its plans, though he acknowledged work of constructing a line across the state would begin soon. The intention, it is believed, is to build a line from Chicago to New York, and the company asks only the right to construct a line and one toll station in each county.

The Troy Telephone company, Troy, has increased its capital stock from $40,000 to $75,000. A. G. Stouder is president, and E. E. Pearson, secretary, of the company.

The Piqua Home Telephone company, Piqua, has filed notice of an increase of capital stock from $75,000 to $100,000. M. G. Smith is president of the company, and L. M. Flesh, secretary.

All of the linemen employed by the Central Union Telephone company at Terre Haute went on a strike last Saturday. The company conceded the advance demanded, but declined to sign a contract with the Electrical Workers' union, hence the strike. F.

Canadian Electrical Association.

The eleventh convention of the Canadian Electrical association, to be held at Ottawa, Ont., on June 19th, 20th and 21st, promises to be a profitable and enjoyable meeting. The papers to be read include the following: "Transformation from Constant-potential Alternating to Constant-current Alternating," by Professor Owens of McGill University, Montreal; "Notes on Construction and Protection of Aerial Transmission Lines," by K. B. Thornton, Montreal; "Dominion Electrical Standards," by O. Higman, Ottawa; "The Influence of the Load Factor on the Design and Operation of a Lighting and Power System," by J. R. Robertson, Montreal. Papers will also be read by H. L. Doherty of New York city and L. Denis of Quebec city, the former dealing with rates for electric lighting. The following topical discussions will be presented: "The Best Practice in Cleaning, Trimming and Inspection of Enclosed-arc Lamps" and "The Different Systems of Charging for and Measuring Power Consumed by Induction Motors with Varying Power Factors."

The convention headquarters will be at the Russell House and the sessions of the meeting will also be held there. Among the social features arranged by the local committee are a carriage drive about the city, band concert at Brittania-on-the-Bay and the annual association banquet at the Russell House. On Friday afternoon a visit will be made to power houses and other points of interest in the vicinity. The government electrical standards will also be visited.

The following-named gentlemen are officers of the association: President, A. A. Dion of Ottawa; first vice-president, E. E. Cary of St. Catharines; second vice-president, P. G. Gossler of Montreal; secretary-treasurer, C. H. Mortimer of Toronto. John Murphy is president and William Ahearn, Jr., secretary of the local committee.

Columbia Telephone Apparatus.

In the accompanying illustration is shown one of the new telephone appliances which are being placed on the market by the Columbia Telephone company of Chicago, and which are said to possess points of merit far in advance of most of the present purchasable apparatus. Among the features claimed is almost total absence of side tone to the transmitter, the construction of which is such that while transmitting as clearly as possible, the disturbing condition above mentioned has been entirely, or nearly so, eliminated.

The receiver, as will be seen by the accompanying cut, possesses a feature of novelty, in that the diaphragm receives the direct impulse of both poles of the magnet, which are so arranged that the greatest efficiency is at the center of the diaphragm, where it should be. Another feature is the perforated earpiece, in place of the old style, with only one aperture in the center. This does away with all possibility of a cushioning effect, and makes the receiving efficiency of this device more perfect.

In the matter of a switchboard, this company has produced what is certainly a novelty, and one that must be seen or described in detail to be appreciated. Among the points claimed for it is the impossibility of a line or subscriber being hung up through any fault or defect of spring jacks. Another feature claimed is the very novel circuit changer or operator's ringing and listening key.

The above-mentioned apparatus has all been designed by James G. Nolan, who is the company's engineer. Mr. Nolan is well-known to the telephone field through his long connection with it. He started in the electrical business in 1882. In 1894 he associated himself with the Western Telephone Construction company of Chicago, with which

COLUMBIA TELEPHONE APPARATUS.—RECEIVER.

he remained for a number of years. He has invented many useful and improved electrical appliances, among which may be mentioned the carbon brushes now so universally in use on dynamos and motors.

Telephones for Railroad Without Agents.

It is the intention of the Missouri Pacific Railway company to establish a telephone system along its lines for the convenience of its patrons and also for the furtherance of its own business. The company proposes to establish a telephone at each station that does not justify the employment of an agent. This telephone will be connected to the nearest station that does employ an agent. The key to the telephone booth will be left with the nearest family. Then, if a farmer wants a car left at the siding, all that is necessary is for him to go to the telephone, call the agent at the next town, and transact his business with him, instead of being compelled to drive to the town for that purpose.

Convention Notes.

[*Continued from page 411.*]

the opening of the convention. Mr. Sapp was an able representative, however, and distributed a "good-luck" souvenir in the way of a new penny framed in aluminum.

That energetic, ubiquitous and always welcome "Clark" of the Valentine-Clark company arrived at the Iroquois early Wednesday morning. Mr. Clark came, as he put it, "on his own special train." These two young men, Messrs. Valentine and Clark, have built up a reputation that it is needless to say makes them always welcome in the best telephone circles.

Watson M. Holmes came on from West Medford, Mass., to exhibit for the first time the Mayberry-Holmes party-line system. This device is for selective signaling, and is a lock-out system for party lines. It is well worth an investigation, and Mr. Holmes met with every encouragement from the exchange manufacturers at this, his first exhibition.

H. J. Kusel, general superintendent of the Eureka Electric company of Chicago, was on hand and did not seem to be afraid of meeting the delegates. The same could hardly be said of Secretary Stein of the same company, however, who, although in Buffalo, was not visible at any of the convention proceedings. When the "gang" learned, however, that Arthur had just been married, they forgave him his evident shyness.

Of course, Western Manager E. F. Kirkpatrick of the McRoy Clay Works put in an early appearance, and in his usual inimitable manner, did himself proud. Kirkpatrick, as usual, made himself, as the Spaniard says, "personaga grata," but it was felt that he made a mistake in not insisting that Mr. McRoy came on from New York. Mr. McRoy was certainly among the missed, as he is always accounted a strictly "good fellow."

Frank B. Cook, H. A. Taylor, and last, but not least, Secretary and General Manager W. E. Doolittle, of the Sterling Electric company, Lafayette, Ind., came nobly to the front early Tuesday morning. Mr. Cook was this time accompanied by Mrs. Cook, who seized a most excellent opportunity to take in the Pan-American Exposition. The Sterling company made no attempt at an exhibit beyond the handsome countenances of the three above-named gentlemen.

A specialty that attracted no little attention, although not in the telephone line, was a new gasket that was shown to a number of the machinations at the convention. This new specialty is manufactured by the Standard Gasket company, 256 Delaware avenue, Buffalo, N. Y. It is made of a peculiarly hardened copper, formed into concentric corrugations. This gasket is worthy of the inspection of anyone having trouble with leaking steam-pipe or other joints.

Mr. MacMeal won for himself the good will of all who came down on the Lake Shore Chicago Special by his courteous efforts in looking after the comforts of everyone. The Lake Shore railroad, as usual, did everything in its power to make good its already excellent reputation. The train consisted of four sleepers, an observation car, buffet car and diner; the observation car was devoted exclusively to the ladies; in fact, it was the "reception room" of the train.

Western Manager Hibbard, for the Varley Duplex Magnet company, arrived early Tuesday morning. "Where was President Varley of this company?" was asked on all sides. Mr. Varley made many friends at the last telephone convention, at Cleveland, but it was whispered this time that the company's works at Phillipsdale, R. I., were running overtime, and for that reason Mr. Varley could not be spared, and had to on this account leave the social obligation to Mr. Hibbard.

As was the case at the last telephone convention at Cleveland, E. B. Seeley of the Couch & Seeley company, Boston, came nobly to the front; this time, however, being accompanied by A. F. Boardman. The Couch & Seeley company exhibited a line of general telephone apparatus in its parlor and made a particular point of a common-battery system, in which a one-line relay controls the line signal and cord supervisories. With this system, there is no repeating or choke coils in the cord circuit.

President C. E. Wilson and General Agent F. A. Wonder of the Keystone State Telephone and Telegraph company of Philadelphia accompanied by Dr. L. Duncan, chief engineer of the company, appeared in the rotunda of the Iroquois Wednesday morning. Electrical people at large will recognize in these three above-named gentlemen brilliant "lights" that have shown at electric-light conventions for years. This occasion, however, was their first appearance among those interested strictly in telephony.

The Wabash railroad carried a number of the western delegates, who left Chicago on the 3:15 p. m. train on Monday. At the present time the Wabash road is making a reputation for itself through its popular "a la carte" dining-car service. One of the pleasant features of the entire journey was the dinner, delicately served, from 5:30 to 8 p. m., as the Wabash flyer passed through the beautiful country between Chicago and Detroit. Returning from Buffalo, passengers by the Wabash evening train get a fine view of that superb electrical illumination for which the Pan-American Exposition is getting a world-wide reputation.

Among the prominent manufacturers' representatives present were C. H. North, president, and G. C. Steele, secretary-treasurer, of the North Electric company of Cleveland; Burt C. Hubbell of the Century Telephone Construction company, Cleveland; Wylie Brown of the Bridgeport Brass company, New York; H. C. Dodge, general manager of the Williams-Abbott Electric company; Charles A. Rolfe of the Rolfe Electric company, and wife, Chicago; Charles S. Kaufmann of the American Battery company.

St. Louis came to the front on Wednesday in the person of "Cuming" of the Central Telephone Manufacturing company. Mr. Cuming made himself so agreeable to the ladies at the last convention at Cleveland that he would have made the mistake of his life had he not turned up in Buffalo. The Central company is doing at the present time the largest business in its history, and the success of the institution is due entirely to the businesslike methods employed by Mr. Cuming, who has managed the company from the start.

The fact that the Stromberg-Carlson Telephone Manufacturing company has recently made a $212,000 purchase of one of the largest manufacturing buildings in the city of Chicago did not prevent President A. G. Stromberg and General Manager Henry Shafer from putting in an appearance at the Iroquois. The Stromberg-Carlson company, during the last two years, has steadily grown in popularity among the Independent telephone people, and the company's recent expansion is merely an impressive indication of the fact that sterling worth and merit in the matter of manufacture and careful attention to scientific details, almost invariably lead to success.

The Kellogg Switchboard and Supply company of Chicago sent a sturdy company of representatives headed by President Milo G. Kellogg himself. This time the company's exhibit, however, was at the Pan-American Exposition grounds. The following-named gentlemen connected with the company accompanied Mr. Kellogg: Frank J. Dommerque, Stanley A. Duvall, P. W. Bossart, A. E. Barker, S. C. Platt, A. J. Rousseau, George Burlingame, R. H. Manson, H. J. Webster, C. L. Meyers and Mr. Wheeler. A number of these gentlemen were thoughtful enough to bring their wives with them that they might enjoy some of the pleasures incidental to the convention and exposition period.

The Swedish-American Telephone company came to the front in the persons of A. V. Overshiner and Secretary and General Manager C. H. Macklin. It was a matter of regret that large pressure of business at the company's Chicago factory prevented the appearance of President E. P. Overshiner. Mr. E. P. Overshiner was at the last telephone convention in Cleveland, and made a host of friends by his hospitable manner of entertaining, and especially through his ingenious and novel menu, which was pronounced one of the cleverest pieces of advertising that has ever been "sprung" in the electrical business. This time Messrs. Overshiner and Macklin carried out the company's methods of unique advertising by the distribution of the "Time Table of the Pirate's Train."

President Seymour Swartz's face was all over the convention hall, for by some mystery his clever bit of advertising his presence at the telephone convention as the buyer of scrap copper was posted not only on the walls of the convention hall, but at several conspicuous spots on the stairway leading to the president's platform. The Swartz Metal and Refining company of Chicago has, during the last several years, made a specialty of catering to the wants of the Independent telephone exchanges in the matter of relieving them of waste copper scrap. Its advertisement offering to pay "the best market prices" has brought a business that has been subject to a steady increase, until at the present time the company finds itself the possessor of an enviable reputation in this line.

President P. C. Burns of the American Electric Telephone company, who, at the last convention, through his splendid exposition of telephone apparatus, earned for himself the title of "Napoleon P. C.," was on hand, as usual. But, owing to the American company's very complete exhibit of telephone apparatus at the Pan-American Exposition, no special effort this time was made for an extra display of its product. Mr. Burns was accompanied by General Manager Ihmsen, Advertising Manager Carl C. Kammeyer and Representative Speed. Mr. Speed did not make any particular attempt at what might be called a convention exhibit; nevertheless, he brought with him an amount of baggage in the way of more recent samples of the company's product that did the American company a world of good at the convention.

The Lambert Schmidt Telephone Manufacturing company of New York made a big showing in parlor 80. President Lambert Schmidt was constantly on hand, assisted by W. W. Bostrick and Paul Schwarz. Through his careful and painstaking work, Mr. Schmidt has earned for his company a high reputation among telephone buyers. He is now fulfilling a large army contract. Mr. Schmidt exhibited the United States Army cordless, portable switchboard for 100 drops. He also presented a 40-drop, United States Army switchboard, built for service in the Philippine Islands. Another specialty of this company that attracted a large amount of attention was its full line of automatic interconnecting apparatus. Much amusement was caused by the operation of Mr. Schmidt's ingenious subscribers' instrument that offered a person a cigar in a most polite manner when he attempted to ring up central.

Among the novel and attractive souvenirs distributed by some of the manufacturers and material men may be mentioned the handsome leather card-case bearing the imprint of the American Electrical Telephone company; the celluloid silver-trimmed match box, presented by the Western Telephone Construction company; the miniature transmitter, by the Eureka Electric company; the practical telephone manual, distributed by Mr. Dinsmore, of the Electric Appliance company; electrical engineer's button, presented by President Rolfe of the Rolfe Electric company; the convention button and receiver, presented by W. J. Murdock & Co., and the many-hued butterfly with real stickers, which were persistently and everlastingly distributed by E. R. Harding of the Holtzer-Cabot company. The Kellogg Switchboard and Supply company also distributed a neat morocco cardcase and memorandum book.

Annual Meeting of Chicago Edison Company.

The annual meeting of the stockholders of the Chicago Edison company was held in Chicago on June 10th. The proposition to increase the authorized amount of capital stock from $6,000,000 to $10,000,000 was acted upon favorably. The new stock is to be issued in the discretion of the directors from time to time, as it seems necessary for extensions and improvements to the business. It is announced that $900,000, or 15 per cent., of the amount now outstanding, will be issued August 1st. In his annual statement to the stockholders, President Insull said:

"In the last annual report attention was drawn to a proposed installation of additional capacity (amounting to 5,000 horsepower in steam and electrical machinery) in the principal generating station of the company, located at Harrison street and the river. The increase in the company's business during the last fiscal year has rendered it necessary for your board of directors to make a still further enlargement of the Harrison street plant, and an installation of 5,000 horsepower additional to that contemplated at the time of the last report is now in course of construction. In addition, large extensions to the underground system of the company and the equipment of four sub-stations have been ordered by the board to take care of the increased business obtained in the territory already covered by the company's mains, and also for the purpose of extending the same into streets not yet supplied with electric light and power service. For the purpose of providing the funds necessary to cover the expenditures mentioned, and to take care of further capital requirements from time to time, the board of directors recommends that an increase in the capital stock amounting to $4,000,000 be authorized by the stockholders, said additional stock to be issued at such times and in such amounts as the board may think desirable. If the authority asked for is granted, your board is expecting to issue $900,000 of stock at par to the stockholders on August 1st next."

The annual report showed an equivalent of 732,235 16-candlepower lamps connected on March 31, 1901, as compared with 594,202 connected on March 31, 1900.

The old board of directors was re-elected as follows: A. F. Seeberger, Robert T. Lincoln, John J. Mitchell, F. S. Gorton, A. A. Sprague, E. M. Phelps, Jesse Spaulding, Lambert Tree, E. L. Brewster, Joseph Leiter and Samuel Insull. The directors met the following day and re-elected the former officers as follows: President, Samuel Insull; vice-president, Robert T. Lincoln; secretary and treasurer, F. S. Gorton; assistant secretary, W. A. Fox; comptroller, W. M. Anthony. Louis A. Ferguson was retained as general superintendent of the company.

The Machinists' Strike.

At the convention of the International Association of Machinists in Toronto, Ont., on June 8th, a resolution was adopted, accepting the challenge of the National Metal Trades association to continue the fight on the machinists' strike. The association has asked for financial assistance from the American Federation of Labor, with which to carry on the contest. There are at present about 50,000 machinists out on strike throughout the country, nearly 2,000 being in Chicago. The situation has not changed materially during the week, and probably will not until the result is known of the meeting of the National Metal Trades association, which is being held in New York city this week.

The French Thomson-Houston Electric company is about to become the controlling force in a large transportation consolidation in Paris. This will include all the Paris omnibus lines and electric railways and the Metropolitan underground railway. It is said that the Thomson-Houston company has recently purchased 3,000 shares of the General Omnibus company and has also made a deal for a large interest in the Metropolitan.

Committee on Street-railway Standards.

The committee on standards of the American Street Railway association held a meeting at Niagara Falls on June 3d. The object of the meeting was to map out the preliminary work of the committee. An abundance of material, which had been gathered by the secretary, was placed before the committee for consideration. It was apparent, from the data in the hands of the committee, that both street-railway operators and manufacturers of street-railway appliances are much interested in the work of standardizing street-railway equipment. It was decided that the best results could be obtained by apportioning the work among the members of the committee, each member to act as a sub-committee on certain parts of the work assigned to him, with power to incur reasonable expense in the preparation of plans and specifications, and to report at the next meeting of the committee. The following assignments were made:

To consider two forms of rail, the "T" rail and a grooved girder rail, each with a modified form of head; to consider two forms of wheels, one a cast chilled wheel, with either spokes or plate center, the other a steel-tired wheel, with either spokes or plate center, tread and flange of wheel to conform to the rail to be recommended; to consider the wearing parts of trucks, the center-bearing, swing-bolster for double trucks to be recommended; to consider a standard for axles, journals, journal brasses, oil boxes and brake-heads, such as will fit the trucks of different makers, N. H. Heft of Meriden, Conn.

To consider electric motors with a view to standardizing all parts of the motor, including suspension, lead wires with connector boxes and ventilation, W. J. Hield of Minneapolis, Minn.

To consider single-truck and double-truck car bodies, including open cars, in order to determine wherein such cars can be standardized to meet the requirements of various conditions of operation, with due regard to proper ventilation, John R. Graham of Boston, Mass.

To consider the standardizing of overhead material as far as practicable along the following lines: Trolley wire, trolley wheels, trolley ears, trolley hangers, span wires, pull-off wires, section insulators, cut-outs, overhead frogs and switches, lightning arresters and all parts that go to make up the overhead system, C. F. Holmes of Kansas City, Mo.

T. E. Crossman, 1829 Park Row building, New York, is secretary of the committee, and he will be glad, on behalf of the committee, to receive any communications bearing on the above-named subjects from any interested persons.

C. T. Yerkes Secures London Metropolitan District Railway.

At a special meeting of the Metropolitan District Underground Railway company of London, England, on June 6th, Charles T. Yerkes' plan for the introduction of electricity as the motive power of the road was adopted. The agreement with Mr. Yerkes provides for the formation of an electric-traction company to electrify the road. Mr. Yerkes, who represented 16 of the most influential firms, bankers and capitalists, was ready to stake £1,000,000 to help the road relieve its position. The syndicate has already bought shares to the value of £1,250,000, and is ready to buy as many more. It will have to construct a generating station at Chelsea, make the necessary alterations in the permanent way and construct new rolling stock. The traction company undertakes to convert the line without interfering with a single train. It is expected that the work will occupy two years.

D. H. Louderbach, who recently returned to Chicago from London, where he was connected with the Yerkes interests, is quoted as saying: "The acquisition of the Metropolitan District Underground Railway company, in my opinion, practically gives Mr. Yerkes entire control of the urban system in London. This system is to London what the Union Loop is to Chicago. It encircles the business portion of the city, and is the terminus of nearly all other systems. It is therefore absolutely indispensable to outside companies, and when Mr. Yerkes has control of it he is practically in control of the street-railway situation there."

National Association of Manufacturers.

The sixth annual convention of the National Association of Manufacturers of the United States was held in Detroit on June 4th, 5th and 6th. About 250 members and guests were in attendance. Mayor William C. Maybury welcomed the visitors to Detroit at the opening session, and President Theodore C. Search responded. In his annual report the president gave a comprehensive view of the industries, trade and general economic movement of the United States in their relations to the world at large. On Tuesday afternoon committee reports were read on patents, international freight bureau, parcels post, etc., and the president's address was discussed. Most of Wednesday was given up to a discussion of commercial reciprocity, the delegates being agreed that reciprocity is the only means by which the foreign trade of the American manufacturer can be safeguarded. A banquet to the delegates was given on Wednesday evening at the Country Club. The association selected Indianapolis as the meeting place for next year.

Fall River Automatic Telephone Exchange.

The annual meeting of the Fall River Automatic Telephone company was held on May 27th in the company's new exchange building on Bank street, Fall River, Mass. The various reports were read and were approved by the stockholders. The following board of directors was then elected: B. D. Davol, E. B. Jennings, R. P. Borden, C. S. Greene, R. J. Thompson, V. A. Sears, R. F. Haffenreffer, J. W. Coughlin and M. Sweeney. B. D. Davoll was appointed treasurer, and R. P. Borden, clerk, of the board. The plant which the company is erecting is almost completed. The underground system is to be used and the exchange will have a capacity of 3,000 subscribers, on private lines exclusively. Automatic switchboards, manufactured by the Strowger telephone exchange of Chicago, are being connected up. The exchange will be opened for business in July and will be, it is believed, the largest automatic telephone exchange at that date in the world. This same system has been in successful operation in the adjoining city of New Bedford, Mass., for six months. The two cities, which are 14 miles apart, will be connected with toll lines.

COMMUNICATION.

The Late J. W. Dickerson.

To the Editor of the Western Electrician:

Pardon my intrusion, but I see from your columns that J. W. Dickerson has passed away. Your last paragraph does him justice. He was, indeed, a lovable, noble young man. He and I were schoolmates and "frat" men at the old Chicago University. It appears that God did not give him the strength to do his life's work to an end. May his soul rest in peace. CHARLES W. NAYLOR.

Chicago, June 8, 1901.

CORRESPONDENCE.

New York Notes.

New York, June 8.—The annual meeting of the New York Electrical society was held on June 6th and the following-named officers were elected: President, Arthur Williams; vice-presidents, C. E. Knox, C. O. Baker, Jr., S. L. Nicholson, H. A. Lardner, George Herbert Condict, H. V. Parsell; secretary, George H. Guy; treasurer, Henry A. Sinclair.

Contractor John B. McDonald planned to reduce the cost of equipment of the rapid-transit railroad by about $1,000,000. He requested the Rapid Transit commissioners to allow him to build sub-stations underground in City Hall Park, Union Square and Long Acre Square. These stations were each to occupy a space 50 by 180 feet and have a depth of 30 feet for machinery. After considering the plan for several months, Edward M. Shepard, counsel to the commission, and Engineer Parsons reported against locating the sub-stations in public parks.

The Fourth Avenue railway is having temporary tracks laid on the east side of Fourth avenue, from Fourteenth to Seventeenth streets. This is being done to avoid the delays that are sure to result to surface traffic, because of the difficult nature of the rapid-transit work at that place. The street-car rails rest upon a strong wooden structure about three feet high, and the conductor for the electric current is above the level of the roadway. It is expected that the temporary tracks will continue in use until the section of the subway which they parallel is completed.

Arrangements have been completed by which the New York Electric Vehicle Transportation company obtains control of the recently organized Metropolitan Express company. The latter company has a contract with the Metropolitan Street Railway company to operate express cars over the Metropolitan lines under conditions which should not interfere with the regular passenger traffic of the Metropolitan company. Express cars are not to be used on the Broadway line and are to be used on the lower avenues only at night. The cars will be equipped to operate by the underground-conduit system. This is the beginning of a scheme for delivering baggage, express and parcels in The Bronx and Westchester. Henry Sanderson, president of the Vehicle company, says that it is the purpose of the company to handle anything from a 10-cent package to a carload of baggage.

The tunnel strike was thought to have been settled on June 4th, and the strikers returned to work under an agreement for two years. Under the terms of the agreement none of the non-union men were discharged, but all the strikers were to be reinstated at their former wages, though they might not be put to work at their old jobs. Wednesday the engineers protested against being required to take the places of iron workers in the tunnel, who are on strike, and it was agreed that the committees of the Central Federated Union and the Rapid Transit contractors should meet again at the Grand Union Hotel to consider the new trouble.

The Subway Realty company of New York city, which was incorporated a short time ago with a capital stock of $500,000, has filed a certificate of increase of capital to $2,000,000. The certificate is signed by August Belmont, chairman, and George G. Thomson, secretary, of the meeting, at which the increase was authorized. The Subway Realty company is the corporation formed as an auxiliary of the Rapid Transit Subway Construction company, to acquire title to land when the underground road traverses private property. It has already made large purchases at Broadway and Forty-third street and at Broadway and One-hundred-and-fourth street. M. L. G.

Information from Indiana.

Indianapolis, June 10.—One of the recent moves of the representatives of the various local interurban electric lines was to urge the Board of Public Works to take action in the matter of an interurban franchise. The board has done nothing since the council refused to ratify the franchise formerly prepared. The roads are now entering the city by courtesy, and without any payment to the city. The board has promised to take immediate action. It says it has simply delayed the matter until public sentiment would crystallize something near what the people want.

Judge Paulus of the Wabash Circuit Court has held that a franchise covers the right to lay track wherever wanted, and has dissolved the restraining order of Mrs. Eagle and others who sought to prevent the Wabash River Traction company, which is building an interurban line, from laying its track in Wabash street. The court holds that the question of the organization of the company as a street railway, or under the general-railway act of the state, would have to be determined by a suit brought by the attorney-general.

The Central Traction company of Indianapolis, which was incorporated recently to build a line from this city to Richmond, has discovered that a company previously organized in the northern part of the state has the same name. Thereupon the company gave notice to the secretary of state that it would change the name to Indianapolis and Eastern Traction company.

The ordinance prohibiting the use of electric arc lights on street cars in Indianapolis was passed.

Joseph I. Irwin of Columbus, president and one of the heaviest stockholders of the Indianapolis and Greenwood electric line, has announced that the line will be extended to Shelbyville, and that the work is to commence soon. This is an entirely new project, and if carried out may throw a damper on the company proposing to build a line to Shelbyville, by way of Acton.

The Philadelphia capitalists who have promised to furnish the money to build the Indianapolis and Logansport line have had an expert going over the line for the last two weeks. The promoters say his report will be made soon. If this report is favorable, the condemnation proceedings will be pushed all along the line.

Charles F. Smith of the Indianapolis and Martinsville Rapid Transit company has completed the grading of his line as far as Mooresville. The work is being pushed rapidly.

Hugh J. McGowan, president of the Indianapolis Street Railway company, says he is proud of the system, and asserts that there is none better anywhere. He says the street cars of Indianapolis cover a mileage of 17,000 miles every day. "That is entirely exclusive of the interurban cars that are now entering the city on our tracks; if you include these the aggregate will be increased to 20,000," he said.

It is reported that the Union Traction company will meet the competition of the Big Four interurban trains by reducing the fares upon its lines. The fight promises to bring about exceedingly low rates between competitive points.

J. K. Fatout and Q. A. Wright have secured a franchise for an electric-light plant at Fortville. The plant is to be constructed within the next 90 days. F.

From the Buckeye State.

Columbus, Ohio, June 8.—It is again reported that the Everett-Moore people have closed a deal for the property of the Toledo Traction company at $9,000,000. The property consists of the 65 miles of road of the Consolidated street railway, 33 miles of Toledo Traction company and 33 miles Toledo Electric Street Railway company, besides holdings of other companies. The earnings of this property show that it is very valuable. The yearly net earnings for the last few years are thought to be something over half a million.

The Dayton and Western Traction company has filed a request for a franchise along the pike from Eaton, Ohio, to the Indiana line on the route to Richmond.

The promoters of the Findlay, Columbus Grove and Fort Wayne road have secured a good portion of the right-of-way. There have been some slight changes in the route. Connection will be made with other roads for Columbus and other places.

The Everett-Moore people are rapidly closing up the gap between Oberlin and Norwalk, while the Pomeroy people are also building a line between the two places. This will give through connection from Norwalk to Cleveland over two lines.

The Xenia and Wilmington Traction company of Cleveland, with a capital stock of $5,000, has been incorporated, to build a line between the two towns indicated in the name. Charles Orr, Eckstein Case, C. D. Dockstader, H. M. Yost, William E. Sage and John P. Martin are the incorporators.

Contractor W. H. Luchtenberg has begun work on the Urbana, Mechanicsburg and Columbus Elec-

tric Railway company's line, and from now on it will be pushed along as rapidly as possible. President H. A. Axline estimates that it will be completed by Thanksgiving Day.

It is reported that an electric line will be built from Oakley to Hyde Park, Cincinnati, where it will connect with the lines of the Cincinnati Traction company. The names of the interested parties have not been made public.

The Canton-Akron Electric Railway company has been granted a franchise by the city of Canton.

The Columbus, Delaware and Northern Electric Railway company has purchased the Stratford paper mill at Delaware, and it is said that a power plant costing $90,000 will be installed.

The Cleveland and Eastern Electric Railway company has applied for a 50-year franchise through Trumbull County.

The rights-of-way obtained between Columbus and Chillicothe by the Columbus and Southern Electric Railway company will be sold at public auction.

The Cleveland, Wadsworth and Southern Electric Railroad company of Cleveland has been incorporated, with a capital stock of $10,000.

An organization of the Mansfield, Cardington and Delaware Electric Railway company has been effected as follows: President, A. A. Whitney; vice-president, R. F. Chase; secretary, C. W. Schaaf; treasurer, A. W. James.

The Cleveland City Railway company will erect new car barns on Woodland Hill. The company has also decided to put a lot of new machinery in the power plant and to erect a large paint shop. Thirty new cars have been ordered, and they will begin to arrive the last of this month.

It is said that the Ohio Trust company of Chicago has agreed to finance the Chillicothe-Hillsboro Traction company and that the work of construction will begin soon. The company has secured a contract to furnish electric-light service in Hillsboro.

O. M. C.

PERSONAL.

W. Worth Bean, president of the St. Joseph and Benton Harbor (Mich.) Electric Railway and Light company, was in Chicago last week.

M. L. Evans, an employe of the Northwestern Telephone Exchange company at Mankato, Minn., for several years, will go to Anaconda, Mont., and become manager of the local exchange.

Charles W. Reynolds of Spokane, Wash., has been appointed district manager of the Pacific States Telephone and Telegraph company, succeeding G. B. Bush, with headquarters at Spokane.

Dr. Henry Pritchett, president of the Massachusetts School of Technology, has been selected by the board of directors of the Pan-American Exposition to serve as superintendent of awards. A jury of awards will be selected to act with Dr. Pritchett.

Professor Charles Sexton James died at Cascade, Mont., on Saturday, June 8th. From 1851 to 1877 he was professor of mathematics and natural philosophy at Bucknell University, Lewisburg, Pa., and was later president of Monongahela College, near Pittsburg.

It is reported that Judge J. M. Thomas, manager of the United States Telephone company of Cleveland, Ohio, has been offered the presidency of the Telephone and Telegraph Cable company of New York city. He is said to have made no decision as yet in regard to what he will do in the matter.

The telephone trade in general will be interested to know that Secretary and Treasurer Arthur Stein of the Eureka Electric company, Chicago, was married on June 4th to Miss Freda Florsheim. The wedding took place at the Lakeside Club, Forty-second street and Grand boulevard, at 6:30 p. m. After the ceremony there was an enjoyable reception at the club. Mrs. Stein is the daughter of Mrs. Jennie Florsheim, her father before his death being a prominent shoe merchant in Chicago. After the reception the bridal couple departed for the East. Mr. and Mrs. Stein will continue their honeymoon for about a month. Their friends extend congratulations.

Professor Henry S. Carhart, professor of physics and electrical engineering of the University of Michigan, has been appointed the delegate of the American Institute of Electrical Engineers to the International Engineering Congress, which is to be held in Glasgow, Scotland, the first week in September. The officials of the congress have nominated him to be an honorary member. Professor Carhart has engaged passage on the new White Star steamship Celtic, sailing August 13th. While in England he will also attend the British Association meeting, beginning September 11th. Professor Carhart will attend the decennial celebration of the University of Chicago next week, as the delegate from the University of Michigan.

ELECTRIC LIGHTING.

The Union Pacific Railroad company contemplates installing its own electric-light plant at the union depot in Omaha, Neb.

William O. Turner, Eugene Wolfe and N. W. Dalton have incorporated the Upper Hudson Electric company, for the purpose of furnishing light for the villages and towns of Green County, N. Y. The company has an authorized capital stock of $100,000.

E. C. Folger, D. S. Collett, H. Jarvis and others have incorporated the Conestoga Electric Light and Power company of Carroll County, Md., with a capital stock of $100,000.

Ewald Rasch, replying in a German journal to a criticism on his electrolytic arc lamp by Dr. Nernst, mentions that by employing a more refractory material than that used in the Nernst lamp, his electrodes do not burn away at a prohibitive rate, and that his arc usually burns 15 minutes and sometimes three or four times as long, without being regulated. In the Nernst lamp, he points out, the incandescent rod has to be made of a material that becomes a conductor at a comparatively low temperature, and is therefore unsuitable for an electrolytic arc, as it burns away too quickly at higher temperatures, as Dr. Nernst has observed.

AUTOMOBILES.

Kenneth A. Skinner has established an automobile record by running from Boston to New York in 15 hours and 30 minutes. The distance covered was about 255 miles. His vehicle was an eight-horse-power motorette of the De Dion pattern, containing seats for three passengers.

PUBLICATIONS.

The "Red Book" is a handsome new catalogue of the Peru Electric Manufacturing company of Peru, Ind., of which a new edition has recently been ordered.

The Electric Appliance company, Chicago, is sending out a complete catalogue of telephone and annunciator systems for hotels, factories, apartment buildings, etc.

The Jandus Electric company of Cleveland, Ohio, is distributing to the trade attractive booklets, which treat of the company's standard enclosed-arc lamps and its fan motors.

A recent bulletin of the Paragon Fan and Motor company of New York is descriptive of the company's sewing-machine transmitter or motor for either direct or alternating current.

Different styles of alternating-current fan motors and an electrically driven dental and surgical air pump are described in new bulletins of the Emerson Electric Manufacturing company of St. Louis, Mo.

The Manhattan Electrical Supply company of New York and Chicago has just issued a fan-motor catalogue, illustrating the well-known G. E. alternating and direct-current fans and Lundell desk, ceiling and exhaust fans.

In a cleverly designed card Stephen L. Coles of the Shaughnessy agency, 5 Beekman street, New York, assures technical advertisers that he will prepare and print their catalogues, circulars, booklets and other advertising matter without the "ghost of a worry" to them.

The Monarch Fire Appliance company of New York city has recently published an illustrated booklet, which treats of the advantages of Kilfyre, a dry-powder fire extinguisher, for fires in electric-light stations, telephone exchanges, street-railway power houses, telegraph offices and subway manholes. holes.

The proceedings of the sixth annual convention of the Ohio Electric Light association, held at the Boody House, Toledo, Ohio, on August 14, 15 and 16, 1900, have just been published by the association. The report is issued in book form, with substantial and attractive cloth covers. It is a book of 150 pages and contains the full account of the meeting, with the papers read, discussions, etc.

SOCIETIES AND SCHOOLS.

Mrs. P. D. Armour has added $250,000 to the recent donation of $1,000,000 made by her and J. Ogden Armour to the Armour Institute of Technology of Chicago. Of this amount $200,000 will be used for the erection of a memorial hall in remembrance of the late P. D. Armour and $50,000 for a new shop building.

The summer meeting of the Northwestern Electrical association will be held at Sheboygan, Wis., on June 26th and 27th. Secretary Mercein says that reports and papers on subjects of special interest to central-station men will be read and discussed. An attractive entertainment programme is being arranged, and a pleasant and profitable time is assured to all who attend the convention.

In addressing the seniors at commencement on June 4th. President Prichett of the Massachusetts Institute of Technology announced that the fund for the Walker Memorial building was within $5,000 of the required $100,000. Within half an hour the senior class had pledged the $5,000, and three new buildings will be erected immediately, one of which will contain the laboratory of applied electricity. The laboratory and its equipment will cost $275,000.

An international engineering congress is to be held in Glasgow, Scotland, from September 3d to 6th. Lord Kelvin is the honorary president of the congress and James Manserg, president of the Institution of Civil Engineers, is president. Sir Douglas Fox is chairman of the London committee. The sections of the congress will cover railways, waterways and maritime works, mechanical engineering, naval architecture and marine engineering, iron and steel, and mining, municipal, gas and electrical engineering.

The proposed national meeting of electrical contractors to be held in Buffalo on July 17th promises to be a very successful one and to be attended by many delegates. Any information in regard to the object of the association can be obtained from the secretary of the United Electrical Contractors' association of New York state. W. H. Morton, Utica, N. Y. Information concerning hotel accommodations in Buffalo during the meeting can be obtained from H. I. Sackett, president of the Buffalo Contractors' association, Builders' Exchange, Buffalo, N. Y.

The thirty-first annual commencement exercises of the Worcester Polytechnic Institute, Worcester, Mass., were held from June 9th to 13th. The baccalaureate sermon on Sunday was delivered by the Rev. Daniel Merriman, while the annual commencement lecture before the Washburn Engineering society was given on Tuesday evening by Professor Elihu Thomson. On Thursday at the graduating exercises the commencement address was delivered by Professor Nathaniel S. Shaler, dean of the Lawrence Scientific School, Harvard University, his subject being "The Place of the Engineer."

ELECTRICAL SECURITIES.

The Financial Times of London is recommending to English investors the purchase of shares in some of the prominent electric-traction companies of this country. Among the "recommended purchases" are mortgage bonds of the Metropolitan Street Railway and the Third Avenue Railway companies of New York city, Cleveland Electric Railway, Milwaukee Electric Railway and Light, New Orleans City Railroad, Kansas City Metropolitan Railway and Chicago Metropolitan West Side Elevated Railway companies. C. A. Jamison, an expert electrical engineer, recently visited Cleveland in the interest of an English banking syndicate, which is looking for electric-railway securities.

MANUFACTURERS AND DEALERS.

An attractive souvenir, given out at the Buffalo telephone convention, was a convention button distributed by William J. Murdoch & Co. of Chelsea, Mass. Hanging from the button by a silk cord was a model of the Murdoch solid telephone receiver, which is said to have absolute adjustment.

The Ericsson Telephone company, 296 Broadway, New York city, states that its telephone was awarded first prizes at Paris in 1881, Madrid in 1883, Vienna in 1884, Stockholm in 1886, Copenhagen in 1888 and Chicago in 1893. The Ericsson exhibit in Paris in 1900 was from the St. Petersburg (Russia) factory, which was also awarded a first prize. This year the company's exhibit of a 50-subscriber switchboard and a few of its different telephones at the Pan-American Exposition at Buffalo is made in Section S of the Electricity building, and W. Jac Marland will have charge of the exhibit. The company extends to all its friends and patrons a cordial invitation to see the exhibit, which is shown in connection with others in a collective electrical exhibit.

The American Electric Fuse company of New York, Chicago and San Francisco has just perfected a new telephone fuse, which it claims to be the best fuse on the market to-day. The fuse resembles in appearance the old style of fuse manufactured by the company, but the fuse wire is enclosed between two pieces of mica, absolutely preventing any possibility of breakage. The wire is left loose in the middle of the fuse, so that it fuses thoroughly. The fuse wire, which is the only delicate part of the fuse, is enclosed entirely and protected against any possibility of damage. The fuses are furnished in any amperage desired for telephone work, either in Western Union or Postal style, 50 or 100 being packed in a box. The company has made a large number of tests in order to secure the perfection of this device, and announces that samples of the fuses are now ready for the market. No fiber or like substance is used in any way in connection with them, and they are said to be absolutely moisture-proof and indestructible.

TRADE NEWS.

Kilfyre, the dry-powder fire-extinguishing compound manufactured by the Monarch Fire Appliance company of New York city, has been adopted by the officials of the Pan-American Exposition for the protection of the switchboards and electrical apparatus about the exposition grounds.

A petition in bankruptcy was filed in the United States Circuit Court at Chicago on June 5th by Clinton E. Woods, general manager of the Woods-Waring company of Chicago. Liabilities amounting to $31,800 are scheduled in the petition. The principal creditor is said to be A. V. Woods, for $12,250.

The annual meeting of the stockholders of the Barney & Smith Car company of Dayton, Ohio, was held recently, and all the reports showed that the last year had been the most prosperous one the

company has ever enjoyed. There is a surplus of $300,000, and the increase in net earnings for the year ended March 31st was $375,000.

After June 10th the Cleveland office of the Westinghouse Electric and Manufacturing company will be located at No. 1007 New England building, instead of No. 1310, as at present.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 25th, for the installation of an electric elevator in the United States courthouse and postoffice building at Harrisburg, Pa. Copies of the drawing and specification may be obtained at the office of James Knox Taylor, supervising architect.

The Bario-vacuum company, 106 East Twenty-third street, New York city, is manufacturing a Crookes tube vacuum regulator, which enables the operator to do his Roentgen-ray work in a scientific and accurate manner. The operator is enabled by means of this adjustment to do all the work with one tube, which heretofore has necessitated the use of a series of different vacuum tubes, with the additional advantage that the liability to puncture is practically done away with. With this regulator the tube can be brought to a proper degree of vacuum for the desired case instantly. The operator can employ the full current capacity of his exciting apparatus to the best advantage, thus obtaining the maximum radiance possible with the amount of current. The use of the adjuster also does away with the necessity of expert manipulation, and when once placed in operation requires no further attention during that exposure. This regulator can only be used in conjunction with the General Electric tubes of all kinds, but the company has an especially designed tube which will give better satisfaction for fluoroscopic work and is much stronger and more easily handled than the regular type. The regulator can be used with equal advantage in connection with any type of exciting apparatus. It can be attached to any ordinary tube stand, and there is nothing in connection with it to get out of order.

BUSINESS.

The Memphis Light and Power company, Memphis, Tenn., has purchased a 125-horsepower, compound, direct-connected engine from the Ball Engine company, Erie, Pa.

W. N. Matthews & Bros. of St. Louis, Mo., report that the first week in June brought them orders for as many Stombaugh guy anchors as they received in the whole month of May. This device seems to be winning friends all over the country.

Hylo lamps are carried in stock by the Central Electric company of Chicago. These are double-filament regulating lamps, which, besides being economical, are found to be very convenient as all-night lights, in halls, bath rooms, sick rooms, etc.

The American Tourist association of 1423 Marquette building, Chicago, of which Reau Campbell is general manager, is arranging an extended tour to Yellowstone Park, via the Chicago, Milwaukee and St. Paul railway, the train leaving Chicago (Union station) at 10 p. m. on Tuesday, July 9th. A leisurely itinerary, with private coaches for the exclusive use of the party during the drive in the park, is planned.

Charles H. Besly & Co. of Chicago report that they have recently made shipments of complete shop equipments to points in Illinois, Indiana, Ohio, Wisconsin and Minnesota. They have just received an order from the Rock Island arsenal for several hundred vises, cutters, reamers and other small tools. The firm says it has never sold as many Gardner grinders as at the present time, and shipments are being made almost daily to all parts of the world. Its new 300-page illustrated catalogue is now ready for distribution.

The Electric Storage Battery company of Philadelphia, Pa., has recently closed contracts for five Chloride accumulator plants to be installed at rotary sub-stations on suburban electric roads about to be built in the vicinity of Pittsburg, Pa., by the same interests which now control the Monongahela Light and Power company, the Monongahela Street Railway company and the Pittsburg and Birmingham Traction company. Three of these plants will be installed on the Pittsburg and Charleroi road, now under construction, one will be located in McKeesport, and the fifth at Springdale, Pa., on the projected Allegheny Valley street railway. One of the important objects obtained by these battery installations is to permit current for both railway and lighting work to be taken from the same 60-cycle alternators.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 4, 1901.

675,373. Graduated Resistance Coil. Frank Comminge, Pittsburg, Pa. Application filed March 29, 1901.

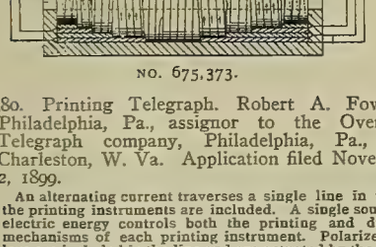
This device consists of one or more cylindrical layers of insulating material wound around with conducting wire terminating in one attaching terminal. The other end of the wire is connected with a contact terminal, and a switch device is adapted to connect such contact device with the other attaching terminal. The contact device and switch mechanism are mounted in an insulating base incorporated with the coil. There is a surrounding covering of impervious substance. (See cut.)

675,377. Signaling Device for Telephone Switchboards. Harry C. Dodge, Cleveland, Ohio. Application filed December 21, 1900.

A drop, a spring-jack, a switchboard plug to enter the spring-jack and a toggle system of levers are combined in this device. The levers are adapted to engage with the drop and to co-operate with the switchboard plug to restore the drop to its normal position. The switchboard plug has a recess in the body thereof to permit the toggle system of levers to recover their normal position whereby the drop may display a signal when suitably energized while the plug is in the spring-jack. The switchboard plug is adapted to co-operate with the levers to restore the drop upon the withdrawal of the plug.

675,378. Pay Telephone. Charles E. Egan, Durham, N. C. Application filed March 15, 1901.

A coinway or channel is formed adjacent to a telephone casing. Circuit terminals are arranged to be bridged by a coin deposited in the coinway or channel. An ejector or plunger normally projects into the coinway or channel and forms a temporary support for the deposited coin and holds the same between the circuit terminals. A finger extends into the coinway or channel. Means are provided for retracting the ejector or plunger from the coinway, and there are also means for securing a return movement thereof and forcing the coin into the interior of the casing.



NO. 675,373.

675,380. Printing Telegraph. Robert A. Fowden, Philadelphia, Pa., assignor to the Overland Telegraph company, Philadelphia, Pa., and Charleston, W. Va. Application filed November 2, 1899.

An alternating current traverses a single line in which the printing instruments are included. A single source of electric energy controls both the printing and driving mechanisms of each printing instrument. Polarized relays are included in the line and are actuated by the alternating current. A type-wheel shaft forms part of the driving mechanism of each instrument and an electric motor is included in a local circuit controlled by the polarized relays and positively drives and controls the type-wheel shaft.

675,383. Automatic Electric Cut-out. Frank E. Greenstreet, Holborn, and Edwin J. Selby, Birmingham, England. Application filed June 12, 1900.

A box having a central partition has an insulating slab fixed on each side of the partition and a pair of hollow carbon arms pivotally mounted upon each slab in suitable positions. A length of fusible wire forms a continuation of the — lead or conductor and passes through one pair of the arms and holds them with their ends in close juxtaposition. A similar length of fusible wire passes through the other pair of arms on the other slab in continuation of the + lead or conductor. Means are provided for turning the arms on the axes of their pivots upon the breaking of the fusible wire, thereby breaking the arc.

675,390. Battery Casing for Motor Bicycles. Robert M. Keating, Middletown, Conn., assignor to the R. M. Keating Motor company, Portland, Me. Application filed December 8, 1900.

A generally cylindrical casing lies alongside the frame-bar of a bicycle and is secured thereto. The casing is secured to the bar by suitable clamps, and has a removable cover, whereby battery cells may be introduced. A rib projects from the generally cylindrical surface of the casing. The battery wires may be enclosed within the rib.

675,398. Adjustable Protecting Device for Electric Lamps. Edwin J. McAllister, Almon D. Page and Louis C. Werner, Newark, N. J., assignors to William Farley Brewster, New York, N. Y. Application filed February 28, 1901.

This device is a socket or receptacle for an electric lamp which is combined with a cylindrical section of sheet metal having its upper edge bent inward to engage the surface of the lamp globe. Means are provided for clamping the cylinder in position.

675,419. Galvanic-battery Cell. Carl T. Sittig, Gross-Lichterfelde, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Application filed May 11, 1899.

A casing providing a fluid chamber is combined with a chamber containing cellular material separated from the fluid chamber, a cell or sack containing deoxidizing material and also containing one of the electrodes. The cell or sack is arranged within the fluid chamber and is in communication with the cellular material, and vents are provided which afford outlets for gas from the chamber containing the cellular material. (See cut.)

675,427. Electric Heater for Electric Glower Lamps. John Van Vleck and William N. Stevens, New York, N. Y. Application filed April 27, 1900.

A glower is provided with an electric heater. There is a holder for the heater and a support for the heater holder, and also contact terminals respectively on the holder and the support. The holder and the support are constructed and arranged so that circuit shall be established by contact of the terminals when the holder is applied to the support and broken when the holder is removed from the support. The heater may also be placed in operative position with respect to the glower or removed from the position without interference with the glower.

675,455. Process of Manufacturing Lead Salts by Electrolysis. John B. Tibbits, Hoosick, N. Y.; Le Grand C. Tibbits, administrator of John B. Tibbits, deceased. Application filed March 6, 1894.

A process of manufacturing colored pigments is described which consists in electrolytically dissolving in an alkaline solution an electrode consisting of lead and another substance capable of imparting a color to lead salts and supplying carbon dioxide to the bath.

675,459. Apparatus for the Electrolytic Production of Pigments. John A. Yunck, Hoosick, N. Y., assignor to Le Grand C. Tibbits, Hoosick, N. Y. Application filed December 16, 1898.

A tank is adapted to hold the electrolyte, and has a detachable cover adapted to be fitted thereto airtight. Provisions are provided within the tank for independently suspending electrodes therein which are adapted to be connected with the opposite poles of an electric generator or a battery. A conduit leading from the exterior into the tank has a terminal at or near the bottom of the tank and an opening thereinto. A diffusing agitator within the tank is provided with arms, each of which is equipped with a number of vanes between the agitator shaft and the walls of the tank. All of the vanes, however, which rotate in the same vertical orbital field, are inclined in the same direction. All those occupying an adjacent vertical orbital field are inclined in an opposite direction, and the whole is adapted by its action to induce opposing vertical currents in the electrolyte.

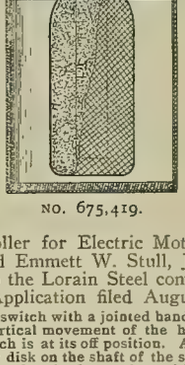
675,460. Process of Manufacturing White Lead by Electrolysis. John A. Yunck, Hoosick, N. Y., assignor to Le Grand C. Tibbits, Hoosick, N. Y. Application filed February 25, 1899.

This process consists of passing an electric current through an anode of lead combined with a supplemental anode of a non-soluble conducting material, an alkaline electrolyte containing in solution a substance capable of yielding carbon dioxide and a non-soluble cathode.

675,495. Writing Telegraph. Anton Pollak and Josef Virag, Budapest, Austria-Hungary, assignors of one-half to Vereinigte Electricitats Actien-Gesellschaft, Budapest, Austria-Hungary, and Friedrich Silberstein, Vienna, Austria-Hungary. Application filed June 28, 1900.

675,496. Writing Telegraph. Anton Pollak and Josef Virag, Budapest, Austria-Hungary, assignors of one-half to Vereinigte Electricitats Actien-Gesellschaft, Budapest, Austria-Hungary, and Friedrich Silberstein, Vienna, Austria-Hungary. Original application filed June 28, 1900. Divided and this application filed December 7, 1900.

Methods are described of telegraphically controlling a writing receiver, which is adapted to trace a continuous line. For each character of the message to be transmitted, a definite and predetermined number of current impulses are imposed on the circuit and these are adapted to actuate the receiver to trace the message in script. This is accomplished by perforating a transmitting strip or body with a predetermined number of perforations in groups which correspond to the characters to be transmitted. This strip is moved past a series of contacts electrically connected with sources of current of different strengths, thereby imposing upon the circuit for the characters of the message to be transmitted groups of current impulses of different durations and strengths. These are adapted to actuate the receiver. In the receiver vibrating parts are adapted to respond to these impulses and to cast a ray of light from one reflecting means upon another reflecting means, and members are adapted to move the reflecting means in such manner as to move the ray of light in transverse directions, thus following the current impulses and tracing the message in script characters on a photosensitive surface. This surface is continuously moved past the point of impingement of the ray of light. (See cut on next page.)



NO. 675,419.

675,517. Controller for Electric Motors. Frank A. Merrick and Emmett W. Stull, Johnstown, Pa., assignors to the Lorain Steel company of Pennsylvania. Application filed August 28, 1900.

A regulator switch with a jointed handle has means for permitting vertical movement of the handle on its joint when the switch is at its off position. A reversing switch has a plate or disk on the shaft of the switch. This plate has an aperture therein for each position of the switch. A locking lever has a pin arranged to engage any one of the apertures. Means are provided whereby vertical movement of the handle actuates the lever to release such engagement.

675,518. Armature Ventilation. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed October 25, 1900.

The device described is a spacer for armature cores which consists of a short piece of non-magnetic metal which has reduced and shouldered ends. These are adapted to engage adjacent plates or laminæ of the cores and form abutments therefor.

675,522. Trolley Pole. Charles Nicholson, Springfield, Mass. Application filed September 5, 1900.

A lower section comprising compartments has guide rollers in one of the compartments. An upper section is disposed in the compartment and is in engagement with the rollers. A block is attached to the upper section and is fitted in the compartment, and the block has facial

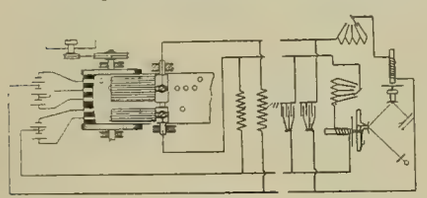
grooves provided with balls in contact with the walls of the compartment, pulleys and counterbalancing weights. Flexible connections are attached to the upper section and to the counterbalancing weights and are passed over the pulleys to hold the upper section normally projected.

675,523. Street-car Fender. George A. Parmenter, Cambridgeport, Mass. Application filed August 22, 1900.

Hanger irons are pivoted to brackets carried by a car. An independent fender or scoop is removably carried by the hanger irons. A rock shaft in the rear of the hanger irons has arms adapted to engage the rear portions of the hanger irons, and means are provided for operating the rock shaft.

675,532. System of Electrical Distribution. Lewis B. Stillwell, New York, N. Y. Application filed February 14, 1901.

A main switchboard having circuit-controlling devices has means provided for operating the devices. A pilot switchboard has devices which represent the main switchboard devices, and there are controlling connections between the pilot-switchboard devices and the main operating means whereby the pilot devices control the operation of the main devices and also indicate the movements and positions thereof.



NO. 675,495.

675,555. Electrolytic Production of White Lead. Edwin D. Chaplin, Winchester, and Henry G. Halloran, Boston, Mass. Application filed July 5, 1900.

This process consists in electrolytically forming from metallic lead as an anode a solution of a soluble salt thereof in the presence of a soluble chloride salt, to transform the lead salt into chloride of lead, oxidizing the latter to form oxychloride, and carbonating the latter to produce a hydrated carbonate of lead.

675,557. Electric Igniter for Explosive Engines. Walter H. Cotton, Chicago, Ill., assignor of one-half to Albert Kunze, Chicago, Ill. Application filed May 21, 1900.

A circuit leading from a generator has an electromagnet incorporated into it. There is a branch or shunt circuit leading from the first-named circuit and an induction coil is incorporated into this branch or shunt circuit. There is also a pair of spring-separated electrodes in the branch or shunt circuit. Means actuated by the electromagnet for closing the electrodes against the resistance of the spring are provided. A circuit-breaker is also included.

675,586. Electrical Storage Battery. William J. Buckley, Chicago, Ill. Application filed July 5, 1900.

This device comprises a receptacle and a positive and a negative active plate. A metallic partition divides the receptacle into cells. Projections from the partitions retain the plates. There are spaces between the partitions and the inside surfaces of the plates, and separators within the spaces are adapted to exert an outward pressure upon the plates for maintaining the plates in electric contact with the partitions.

675,587. Secondary Battery. William J. Buckley, Chicago, Ill. Application filed February 2, 1900. Renewed April 29, 1901.

This battery is provided with a series of cells. Each cell has two electrodes or plates with a liquid-tight frame around the edges of the plates. A liquid reservoir is provided for each cell above its respective frame. There is a filling of loose granular carbon between the plates.

675,588. Storage Battery. William J. Buckley, Chicago, Ill. Application filed October 9, 1899. Renewed April 29, 1901.

A separator extends between two plates. There are compartments in the separator, and also passageways in the walls of the separator. A tube communicates with the compartments and extends above the cell.

675,599. Electric-Arc Lamp. Daniel Higham, Winthrop Highlands, Mass., assignor to the General Electric company of New York. Application filed November 21, 1900.

A magnet winding includes two coils, both of which are traversed by current flowing through the arc. Means are provided for causing a variation of current in the arc to produce momentarily a greater proportional change of current in one of the coils than in the other.

675,600. Storage Battery. George W. Hough, Evanston, Ill. Application filed December 20, 1900.

This battery comprises a positive and a negative element, independent of each other. Each element consists of a pile of non-perforated cup plates composed of lead alloy for containing the active material. The plates of each pile are of the same shape and dimensions and are arranged one above the other, and each is provided with a projection on one side. A bar is cast upon and connects all of the projections and terminates in a binding post. One or more bars are cast upon and connect the plates at other points. Blocks or strips of insulating material are secured to one of the piles or elements and bear against the others so as to maintain the piles in electric separation.

675,614. Electric Switch. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, Boston, Mass. Application filed January 17, 1900.

A rack bar has teeth on opposite sides. Pivoted levers or arms are provided with gear teeth in engagement with the teeth on the rack bar. A spring connects the levers or arms. Means are provided to effect a loose yet positive connection between the rack bar and switch.

675,640. Apparatus for Removing Electric-light Bulbs. Frederick H. Renard, Wilkesbarre, Pa. Application filed January 2, 1901.

Intermeshing gears are mounted on a handle. Bulb-engaging means are carried by one of the gears, and a drum or pulley is carried by the other gear. Means are provided for rotating the drum for communicating motion to the bulb-engaging means.

675,643. Electric Time Switch. Oscar Springer, Springfield, Mass. Application filed October 16, 1900.

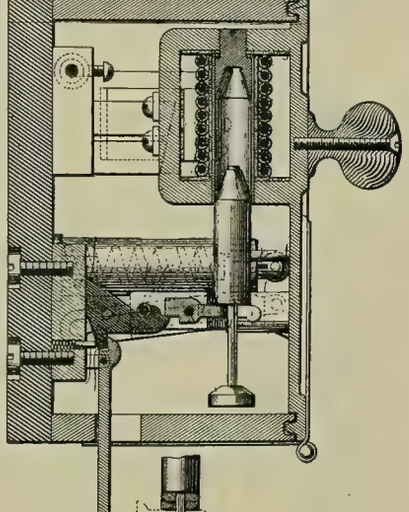
A base is adapted to be secured to a vertical wall. Duplicate circuit controllers are arranged parallel to each other and at an interval apart, and comprise each an insulating base. Conducting blocks are mounted at an interval apart on the bases and are provided with binding screws and sockets adapting them to secure the ends of conducting wires. Conducting posts are seated on the blocks, a pair to each block, and removed from each other. Contact bars are supported and guided to reciprocate between the posts and are removed from contact therewith. Two sets of flat springs are secured opposite each other to the contact bars to extend upward at an acute angle and with free ends, and are adapted to be compressed between the two sets of posts upon the downward movement of the contact bars—and an insulated crosshead uniting the tops of the contact bars, which are all arranged to open or close the circuit from the conducting wires.

675,653. Electric-bell Mechanism. Walter E. Foster, Carnegie, Pa., assignor to the Sargent Automatic Railway Signal company, Rochester, N. Y. Application filed December 8, 1899.

A gong has a solenoid adjacent to the gong, and a hammer is adapted to be moved away from the gong by the solenoid and to fall, by gravity, against the gong. Means supplemental to the solenoid for moving the hammer out of contact with the gong after each stroke are provided. An electric circuit includes the solenoid, and a switch in the circuit is operated by the hammer.

675,667. Electric Brake for Railway Cars. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed March 28, 1900.

The essential features of this device, on an electrically operated car, are a motor, a controller, a reversing switch, a brake device and a braking switch, which is adapted to disconnect the controller from the main supply or trolley line and to connect the field lead of the motor with the supply lead to the controller, and by the same movement to connect the brake device with the field lead from the reversing switch. The motor, the controller and the brake device are thereby connected in a local brake circuit to which current regulable by the controller may be supplied by the motor acting as a generator.



NO. 675,865

675,668. Electric Brake. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake company, Pittsburg, Pa. Application filed April 28, 1900.

An electric circuit for braking purposes is combined with a running controller, a braking switch and means whereby the braking switch may be operated from either end of the car to cut off the supply of current from the main line to the controller and apply the brakes when the running controller is in any position.

675,675. Armature and Magnet-adjusting Device for Relays or Other Electric Instruments. Ulysses G. Rogers, New York, N. Y. Application filed March 5, 1901.

The reach rod and its adjusting-pin-holding head are formed in integral construction and bored for reception of an adjusting pin slightly smaller than the pin, and are radially split for expanding to receive the pin and to grip and hold the pin by the natural contracting effect of the expansion produced by the pin.

675,685. Extension Bell for Telephones. Vandiver J. Van Horn, Keokuk, Iowa. Application filed April 12, 1900.

A circuit-closing device is associated with a moving part of an electric bell included in an electric circuit and is adapted to close a supplemental signaling circuit automatically when the bell is actuated and to open the supplemental circuit automatically when the bell ceases to operate. The supplemental signaling circuit is both automatically closed and automatically opened by the bell.

675,690. Contact Plug. Charles Wagner, New York, N. Y., assignor to Edward F. Caldwell & Co., New York, N. Y. Application filed February 28, 1901.

This device comprises a socket of non-conducting material which has a recess. Binding posts are secured in the socket in the back thereof and have spring arms extending into the recess. A plug of non-conducting material has a shank for insertion in the socket. The plug is provided with a central opening in its head, from the inner end of which opening lead angular openings. Contact plates are secured to the shank at opposite sides, for engaging the spring arms in the socket. The outer ends of the contact plates extend into the angular openings.

675,708. Battery Tray. James R. Blackwell, New York, N. Y. Application filed February 15, 1901.

The device described is a tray for holding a series of battery cells which comprises a frame with a zinc bottom. A number of carbons are supported in the frame and are out of contact with the zinc. An alarm device in electric circuit with the zinc and carbons is provided.

675,749. Electrolytic Cell. Alfred Merry, Liscard, and John H. Noble, Liverpool, England. Application filed November 19, 1900.

A porous tube or cell surrounds but does not touch the anode. This cell is practically impervious to ascending globules of chlorine or other gaseous anion, while pervious to the electrolyte. An exit is provided for exhausted electrolyte from the top of the space immediately surrounding the anode and an entrance is provided for fresh electrolyte in the space outside the porous tube or sleeve. A porous diaphragm separates the cathode from the anode and the electrolyte surrounding it. A cell contains the whole.

675,755. Apparatus for Indicating the Presence of Dangerous Gases. Henry G. Prested, London, England. Application filed October 15, 1900.

A porous vessel has a plug at its lower end. A tube extends through the plug and there is a flexible diaphragm at the outer end of the tube, and this has a piece of platinum on its outer face. A chamber surrounds the diaphragm and has a plug of insulating material in one end of the same. A nut is fitted in the last-mentioned plug. A screw passes through the nut, having a platinum point, and a battery is electrically connected respectively with the diaphragm and screw. The connections include a signal.

675,802. Electric Water Filter. William L. Teter and John A. Heany, Philadelphia, Pa., assignors to the Teter-Heany Developing company, Philadelphia, Pa., and Charleston, W. Va. Application filed September 1, 1900.

A disk of non-conducting material in a casing containing filtering media separates the inlet from the outlet and has an opening. Two perforated metal plates are situated in the opening, and a positive and a negative conductor connect the respective poles of a source of electric energy with the plates.

675,811. Equipment of Electric Cranes. Henry Burrell, Glasgow, Scotland. Application filed October 1, 1900.

The upper and main decks of a vessel are combined with a crane mounted upon the vessel. Its crane post or pillar passes through the upper and main decks. A jib is adapted to swing from the upper deck. Controlling means are carried by the cranes, above the upper deck. Electric motors are connected to the controlling means for operating the cranes.

675,846. Motor. Andrew Benson, Chicago, Ill., assignor of three-fourths to Robert P. Price and John P. Price, Chicago, Ill., and John B. Benson, Marinette, Wis. Application filed November 4, 1899.

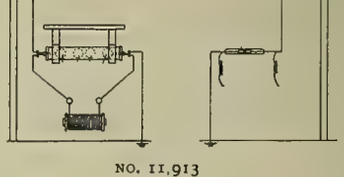
An engine has a speed regulator. A dynamo or motor is mechanically connected with the engine shaft. A controller is provided for varying the current between a storage battery and the motor. An operative connection is provided between the controller and speed regulator of the engine.

675,847. Motor. Andrew Benson, Chicago, Ill., assignor of one-half to Robert P. Price and John P. Price, Chicago, Ill. Original application filed November 4, 1899. Divided and this application filed December 26, 1899.

A main circuit includes an electric generator and a storage battery. Means are provided for opening and closing the circuit at will. A potential switch is actuated by two magnets or solenoids which are included respectively in normally open and closed circuits in parallel to the battery and generator, and a magnet or solenoid controlling the normally open circuit included in a permanently closed parallel circuit, whereby the battery circuit is closed when the potential of the battery is less than that of the generator and broken when it rises above that point.

675,848. Motor. Andrew Benson, Chicago, Ill., assignor of one-half to Robert P. Price and John P. Price, Chicago, Ill. Application filed January 31, 1901.

A combined electric generator and motor has its armature operatively connected mechanically with the engine shaft of a reversible explosive engine. Means are provided for checking the speed of the engine. Means are provided for conducting the current of the generator into a storage battery. There are means for conducting the current of the battery to the motor and also means for reversing the latter current through the motor.



NO. 11,913

675,865. Automatic Circuit-breaker. Charles E. Starr, Camden, N. J., assignor of one-half to Richard L. Young, Philadelphia, Pa. Application filed November 22, 1899.

An electromagnet is mounted upon a switch-carrying arm. An armature therefor has a stem provided with shoulders. A lever is mounted upon the arm and has one end situated in the path of the shoulders. There are rigid stops for the lever, one of the stops being situated to support the lever and the armature. A catch engages the arm and is adapted to be actuated directly by engagement with the lever and moved out of engagement with the arm thereby. The other stop limits the movement of the lever when thus actuated. (See cut.)

REISSUE.

11,913. Transmitting Electrical Impulses and Signals and Apparatus Therefor. Guglielmo Marconi, London, England, assignor to Marconi's Wireless Telegraph company, Limited, of England. Application filed April 1, 1901.

In the receiver of this apparatus are combined an imperfect electrical contact with tuned metallic plates and choking coils connected to it. There is an earth connection to one end of the contact and an insulated conductor connected to the other end. There is a circuit through the contact, and means controlled by the circuit are provided for shaking the same. A tube having metallic plugs and a mixture of metallic powder and mercury between the plugs is also combined in the receiver. A spark producer at the transmitting station has an earth connection at one end and an insulated conductor connected to the other end. (See cut.)

WESTERN ELECTRICIAN

EVERY SATURDAY.

Vol. XXVIII. CHICAGO, JUNE 22, 1901. No. 25

Power and Lighting in the Chicago Inter Ocean Building.

The structure erected by the Chicago Inter Ocean at 106 to 110 Monroe street in this city has been built with sole reference to the needs of a large city newspaper establishment. In arrangements, construction and equipment it is one of the most complete buildings in the country that is devoted exclusively to the publishing of a newspaper.

The building has a front on Monroe street of 68 feet, is 190 feet long and three stories in height. A modern steel construction has been used throughout, particular attention being paid to light and ventilation. The front, which is illustrated in Fig. 2 on the next page, is made of white enameled terra cotta, with touches of gold burned in on the ornamental work. Green terra cotta is used for the domed entrance, which is ornamented by a glass mosaic ceiling studded with electric lights.

The building has its own lighting and power plant located in the rear of the basement. Fig. 1 illustrates a view in the engine room, while Fig. 3 shows the boilers. The boilers are two in number and are of the Cahall type, manufactured by the Aultman & Taylor Machinery company. They are of the water-tube, safety type, and are rated at 200 horsepower each. Smokeless furnaces of the Murphy extended-grate pattern are used. The steam pressure carried is about 135 pounds. In rear of the boilers the boiler room is provided with a boiler pump, a steam injector, an open feed-water heater and other necessary appliances. City water is used for the boilers, and the return water from the house, engines and steam traps is emptied into the heater and is then pumped into the boilers.

The engines, shown in Fig. 1, are tandem-compound, non-condensing machines of the Phœnix Iron Works manufacture. The larger engine has cylinders 16 and 28 inches in diameter, with an 18-inch stroke. It is rated at 300 horsepower, with 180 revolutions a minute. The smaller engine is 11 and 20 by 15 inches in size and develops 160 horsepower at 225 revolutions. Both engines are of the side-crank, enclosed, direct-connected, self-oiling type. A special feature of the engines is that the low-pressure cylinder is separately supported by an extra sub-base, which brings the high-pressure cylinder between the low-pressure and the crank. This construction is very rigid and makes both cylinders easy of access. Both high and low-pressure valves are controlled by the same eccentric and Rites governor. Lubrication of the cylinders is supplied by a Phœnix lubricating pump. These engines are said to be the first of their type installed in Chicago.

Direct-connected to each engine is a Western Electric L-type generator of 228 and 124 kilowatts' capacity, respectively. These machines are guaranteed to carry an overload of 25 per cent. for three hours and a 50 per cent. overload for two hours without injurious heating or sparking. The dynamos are rated at 240 volts' full load. The larger machine is designed to carry the entire motor and lighting load during the time the plant is in full operation, while the smaller unit is used during the daytime, when fewer lights and less power are required.

A 220-volt, three-wire system is supplied by the generators, the load being balanced by a 50-ampere compensator, shown in the foreground of Fig. 1. The lights are carried on 110-volt circuits, while all the motors, except for the linotype machines, are 220-volt.

FIG. 1. POWER AND LIGHT IN THE CHICAGO INTER OCEAN BUILDING.—ENGINE ROOM.

Connected to the generators is a four-panel, white-marble switchboard, shown in Fig. 4. One of the panels is used for power, one for wattmeters and two for lighting. The power and lighting circuits are connected with a switch, so that they can be thrown in together on one generator or operated separately. Each machine is provided with a wattmeter, circuit-breaker and ammeter. An ammeter is also provided on each side of the compensator circuit. Three voltmeters are supplied, one to use in starting the machines and as a ground detector, and two for the compensator.

From the switchboard are run three power circuits and four lighting circuits, which lead to two shafts, recessed in the west wall of the building. Cut-out boxes are provided on each floor. The shafts are paneled, so that they can be opened from floor to ceiling, making the wiring easily accessible. The electric wiring about the building is divided into concealed work run on knobs in the attic for the third-floor lights, iron-armored conduit on the first and second floors and molding work in the basement and pressroom.

There is an equivalent in lighting of about 2,500 16-candlepower lamps. For the illumination of the front of the building there are 50 lamps in the frieze and 25 lights in each of the three arches. In the loggia 115 lights are used, these lamps all being of eight candlepower. The two large lanterns at the sides of the entrance are each lighted by seven 32-candlepower lamps. An electric sign projecting from the roof of the building is lighted by 360 four-candlepower lamps, 180 on a side. For one of the stores on the ground floor that is rented to an outside party, an electric sign of 200 lamps is used.

Electric power is used quite extensively throughout the different departments of the building. In the type-setting department at the front of the third floor are located 23 duplex linotype machines, each belt-driven by a one-fourth-horsepower motor of the Browning type. These motors operate on 110-volt circuits at 350 revolutions a minute. Two extra motors are kept on hand for reserve in case of accident. In this room a lathe is driven through a cone pulley by a one-horsepower motor, two proof presses are belted to one-fourth-horsepower motors and a saw to a one-half-horsepower motor.

At the rear of this floor is the stereotyping department, illustrated in Fig. 5. At the left of the picture is shown a three-horsepower motor, which drives a steam or drying table, used for drying and pressing the matrix. From this machine the matrix is taken to a semi-circular casting box, where the stereotype is cast from the matrix. The plates are then carried to two trimmers, geared to two-horsepower motors, seen in the foreground of the illustration. Two shavers, operated by one-horsepower motors, shave the inside of the plates to a certain form. A splitting block, driven by a one-fourth-horsepower motor, seen at the right, consists of a traveling saw, operated by means of a worm and gear. This device is used for splitting the stereotype plates for a double-page advertisement. A Gordon press, also on this floor, is operated by a one-horsepower motor, while another motor of the same size drives an exhaust fan.

On the second floor are the offices of the editor-in-chief and other editors, the city reporters' rooms, library, telegraph room and news bureau. In the telegraph room are accommodations for 18 operators. At the rear of the second floor are the rooms for artists, photographers, etchers, etc. In the etching room a router, trimmer, saw, planer and two rocker boxes are all separately driven by electric motors. Three 25-ampere, arc-light projectors are used for photographic purposes.

The general offices of the paper are located on the first floor. At the entrance to this floor is a rotunda with 154 lights in the arches and a 60-light chandelier. In the basement, besides the boiler and engine plant,

is a large pressroom, with storage capacity for 600 1,000-pound rolls of paper. There are three Scott web perfection cylinder presses, each having a capacity of 2,400 12-page papers an hour. Each press is at present driven by a 25-horsepower motor, but the presses are soon to be changed to the capacity of a 16-page paper, when 50-horsepower motors will be installed. There are also located on this floor a paper-cutting machine, driven by a one-horsepower motor and a Bostedo blower for operating the pneumatic tubes connecting the building with

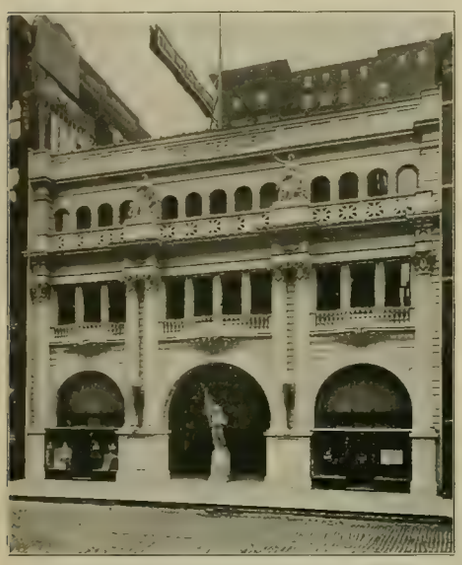


FIG. 2. THE CHICAGO INTER OCEAN BUILDING.

the City and Associated Press offices, driven by a 7½-horsepower motor.

Among the auxiliary apparatus that is installed in the engine room is an electrically driven 10-horsepower Christensen air compressor for supplying air to operate four paper lifts at the presses, a sidewalk lift, an ash lift and two mailing lifts. The compressor is self-governing and maintains a pressure of 80 pounds in a large storage tank. A triplex house pump is electrically driven and automatically controlled by a float in the water tank on the roof. The seepage and boiler drainage in the basement are raised to the sewer level by a Youmans three-horsepower electric rotary bilge pump.

The heating of the building is supplied by low-pressure steam on the Van Auken system, the exhaust from the engines being circulated at from three to four inches below atmospheric pressure, while a 15-inch vacuum is maintained on the automatic air valve. The heating in the mailing room is by indirect radiation, the hot air being driven in by two 30-inch fans operated by two-horsepower motors. The remainder of the heating is supplied by direct radiation.

A complete drinking-water system is installed, the water being filtered and cooled in a refrigerator. A system of pneumatic clocks for the different departments is controlled from one master clock in the center of the building. All the departments are connected by telephones with a local switchboard. Twenty-three instruments are installed, five of which are connected with the local telephone system. An electric freight elevator in the rear of the building is operated by a 15-horsepower motor. It is rated to lift one ton at 150 feet a minute.

The power plant is run continuously night and day, but on account of the nature of the work in a newspaper office the load on the engine and generators is fairly evenly distributed. Kohler Bros. of Chicago installed the switchboard and were the contracting electrical engineers. The consulting engineering work was done by W. Carbys Zimmerman, the architect of the building. C. A. Denniston is the chief engineer in charge of the power plant, while Arthur Hamilton, superintendent of the building, has had charge of the motor and light installation.

Northwestern Electrical Association.

Indications point to a very enjoyable gathering at the summer convention of the Northwestern Electrical association, which is to be held at Sheboygan, Wis., on June 26th, 27th and 28th. Special cars will be attached to the Chicago and Northwestern train leaving Chicago at 5 p. m. and Milwaukee at 7:30 p. m., on Tuesday, June 25th. This train will arrive at Sheboygan shortly after 9 p. m. The arrangements for the Chicago party that will go to the convention are in the hands of James Wolff, 192 Desplaines street. The headquarters of the association at Sheboygan will be at the Lake View Beach Hotel, where special rates have been secured.

The following programme for the three days' meeting has been arranged by Secretary Thomas R. Mercein of Milwaukee:

WEDNESDAY, JUNE 26TH.

10 a. m. Business session.

2 p. m. Paper—"Incandescent Lamps," by Guy V. Williams.

Paper—"University Summer Schools," by Professor B. V. Swenson.

4 p. m. Baseball match, "Benedicts" versus "Bachelors."

8:30 p. m. Invitation concert and hop.

THURSDAY, JUNE 27TH.

10 a. m. Paper—"Shunt Motors," by Budd Frankenfield.

Paper—Subject not announced, by A. L. Searles.

2 p. m. Paper—Subject not announced, by H. G. Underwood.

3:30 p. m. Trap-shooting contest.

5 p. m. Olympian games.

8 p. m. Theatrical entertainment.

FRIDAY, JUNE 28TH.

9:30 a. m. Trolley party to Sheboygan Falls.

11:30 a. m. Midday smoker at Elks Lodge.

Afternoon. Adjournment.

Handsome prizes will be awarded the winners in the athletic contests. All electrical men are cordially invited to attend the meeting and bring their friends.

Niagara-Welland Power Development.

An order passed by the Ontario (Canada) government a short time ago gives authority to the Niagara-Welland Power company to commence work. The company's plan is to tap the Welland River, east of the canal, and by means of a cut to carry the water of the Niagara and Welland rivers to the high bluff near the city of St. Catharines, Ont., where a fall of over 180 feet may be obtained, the discharge flowing into Lake Ontario. This route also gives three other falls of 33 feet and 56 feet below the bluff, or a total fall of about 300 feet. The capacity of the waterway will be over 100,000 water horsepower, which, at the first fall, will produce over 75,000 electrical horsepower at the wheel, still leaving three falls for later development. There will be a primary installation of 30,000 electrical horsepower, a large part of which the company hopes to transmit to Toronto, the balance to be utilized at St. Catharines.

Proposed Cincinnati-Detroit Electric Railway.

The Everett-Moore syndicate of Cleveland, Ohio, is said to have gained complete control of the Miami and Erie Transportation company, and it is now claimed that the electric line from Cincinnati will be made a portion of the big electric-railway system which this syndicate has been forming for some time, and it is possible that within a reasonable length of time there will be a line running from

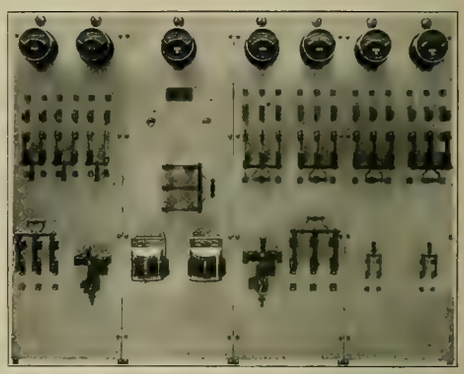


FIG. 4. POWER AND LIGHT IN THE CHICAGO INTER OCEAN BUILDING.—SWITCHBOARD.

Cincinnati to Detroit and Pontiac, Mich., by way of Toledo. A few additional switches will equip the road originally proposed for freight service on the banks of the canal, and it can be used as a through passenger road. A few days ago the Detroit and Pontiac road was purchased by Messrs. Everett and Moore, and the Detroit and Toledo Short Line was consolidated with the Detroit and Toledo Shore Line, which is owned by the syndicate. This gives exclusive lines from Toledo to Detroit. The canal line will extend from Cincinnati to Toledo, the portion from Cincinnati to Dayton being completed first, at an estimated cost of $3,000,000. The other portion will be built later on, as the work can be reached. At a meeting held in the office of M. J. Mendelbaum & Co., recently, the following-named directors of the Miami and Erie company were chosen: W. H. Lamprecht, T. N. Fordyce, E. G. Tillotson, R. A. Harman, J. R. Nut, F. N. Wilcox, D. J. Ryan, H. A. Everett, F. T. Pomeroy, M. J. Mendelbaum, Harrison B. McGraw, L. J. Wolf, E. W. Moore, Will Christy and C. W. Collister. The following-named gentlemen are the officers of the company: President, W. H. Lamprecht; secretary, W. S. Hayden; treasurer, Otto Miller. It is said that the capital stock of the company has been largely oversubscribed, and that a reduction had to be made in the allotment. There is a total of about 305 miles in the proposed system, which will be one of the most extensive ones in the country. It is probable that the road will be equipped with cars containing all the modern conveniences, including dining and sleeping cars. Mr. Fordyce and Will Christy have contradicted some of the statements made in regard to the matter, but it is believed they do not care to encounter possible opposition now.

An electric road is to be built from Baraboo to Portage, Wis. The promoters of the enterprise are T. Hamilton, H. Green and T. B. Carter.

Fig. 3. Boilers.

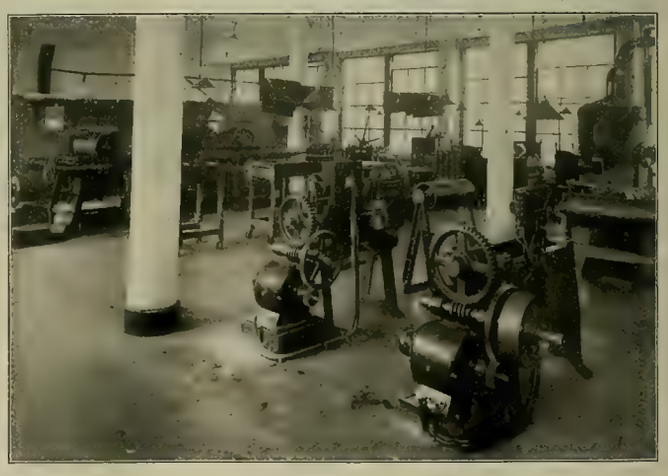


Fig. 6. Stereotyping Room.

POWER AND LIGHT IN THE CHICAGO INTER OCEAN BUILDING.

Blue-printing by Electric Light.[1]

By H. G. Reist.

In large manufacturing establishments the short and frequently dark and cloudy days of winter are the occasion of great inconvenience and delay in the production of blue-prints. A printing plant suitable for making the required number of prints in summer will be entirely inadequate for the same production in winter. Unfortunately, this is a department which ordinarily cannot be worked overtime in order to make up for the loss. Suffering much on this account because of the large number of blue-prints required, the General Electric company some time ago tried several methods of printing by electric light. In one plan a small room was arranged with nine arc lamps, placed about 18 inches apart, suspended from the ceiling, and by a suitable arrangement of reflectors a large portion of the light was thrown downward on printing frames arranged on trucks, being the same frames which are used ordinarily for printing by sunlight. The reflectors are hinged so that the light may be thrown to the position wanted. With a rapid printing paper the time required for printing with this arrangement is from six to eight minutes.

Another arrangement for printing, and one which is being used extensively with somewhat more satisfactory results, is shown in the accompanying illustrations. In Fig. 1 is shown the apparatus in detail and in Fig. 2 is given a view of the blue-printing room. It will be seen that there are two lamps, each being a standard five-ampere, 110-volt, enclosed-arc lamp, enclosed by a metal hood a little larger in size than the printing frame. The hood is strongly constructed of sheet-iron, with parabolic sides, which are finished on the inside with white enamel, having good reflecting power. The hood is supported on the lamps, and in order to prevent the parts from overheating, an effective ventilating device is provided at the top. There are also handles on the side, so that it may conveniently be moved along the track. The lamps in turn are supported on a small trolley arrangement, made from the parts used for sliding folding doors, and on each side there is a conducting wire from which a small trolley wheel carries the current to the lamps. The tracks on which the lighting device is supported are of sufficient length so that five printing frames can be set under each of them, and the lamps readily moved to cover any one of them. The printing frames which we are now using are the standard frames used for sun printing, although they can be somewhat simplified if they are made specially for printing by electric light. The lamps are enclosed in white opal globes. This diffuses the light and the white interior of the reflector projects it downward, so that the area over the print to be made is very uniformly lighted, there being no perceptible difference in the tone of the print in the middle from what it is in the corners. When the first print has been exposed a sufficient length of time, the light and the hood are moved along the track to the next frame, while work is begun on the first one to replace the printing paper or tracing, as the case may be.

The time required for printing naturally varies widely with different tracings and different makes of paper. In general, it may be stated that the time required is three or four times as long as with bright sunlight. With one grade of paper which we are using, the time by sunlight in the middle of the day during February is about 35 seconds, and by electric light, 1½ minutes. It will readily be seen that there are great advantages in having a printing establishment which is independent of the season, or of the condition of the weather. With an electric equipment, blue-prints may be put into the factory almost immediately after the completion of the tracing, regardless of the time of day.

In summer it is possible to print all the time during office hours, and the percentage of time lost on account of cloudy and rainy weather is small. In winter it is not practical to print after about four o'clock in the afternoon, and the amount of bad weather is a large part of the total time. In the belt in which I live it is cloudy as much as 60 per cent. of the time during the months of December and January. In cloudy weather the time required for printing is about eight to 10 times as great as on a clear day, and on a rainy day it is not possible to print at all out of doors, except by a specially devised waterproof printing frame; but at such times the time required for changing prints is greatly increased, as the frame has to be wiped to keep from injuring the tracing.

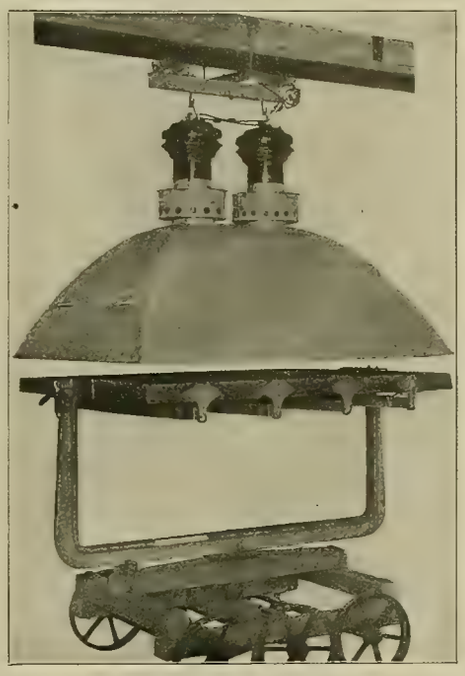


FIG. 1. BLUE-PRINTING BY ELECTRIC LIGHT.—PRINTING LAMP AND FRAME.

From curves of the actinic value of sunlight for different times of the day and for different seasons, I have calculated that with a paper so rapid that it will print in eight seconds in the sun at noon during the month of July, the mean time required for making a print in January for the hours from 8 to 12 and from 1 to 4 is 2.33 minutes. Similarly, in July the mean time for the hours above, except that the time is extended to 5:30 in the afternoon, is 0.59 minute, or the mean time for clear days during the year is 1.40 minutes.

Taking all the above into account, I find that the average number of prints made by one operator in winter per day is 26.4. In summer the number of cloudy days is about 25 per cent., and the average number of prints that may be made by one operator is 57.3, or more than twice as many as can be made in winter.

The cost of making prints by electric light is much smaller than one would expect, and the following figures indicate that it is cheaper to use artificial light than sunlight for this purpose.

In printing by electric light it is assumed that the cost of electricity is 12 cents per kilowatt-hour, which I believe is a fair commercial rate. The lamps are turned off when not in use. They are in use only 85 minutes for each operator, as shown in the table below. Each lamp requires 550 watts, and the cost is 18.7 cents per day.

Labor is assumed at the rate of $1 per day.

	Sunlight.	Electric Light.
Number of prints per day, mean per year	41.9	56.5
Cost of printing, per print	2.39 cts.	2.09 cts.

The time required for changing a print in sunlight is a little longer than when the artificial light is used, because the whole frame has generally to be moved, and the frame has to be adjusted to the proper angle to get the most effective sunlight. The time allowed for changing prints is seven minutes when printing by electric light, eight minutes when printing by sun, while when printing during a rainy day as much as 20 minutes may be required.

It will then be found an advantage to use electric-light printing as a supplement to the ordinary method, even if the latter method is not entirely superseded. Among other advantages may be mentioned the smaller space required for an installation for a given output than for sun printing; also, there will be less paper wasted, as the time for printing is much more uniform.

This method of making prints will especially appeal to manufacturers who are located where there is a tendency to have fogs or where tall buildings may interfere with the normal sunlight.

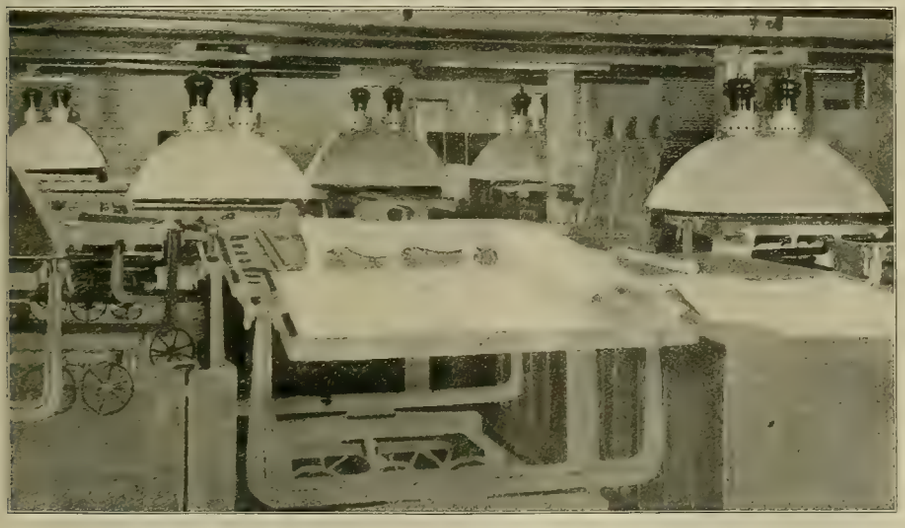


FIG. 2. BLUE-PRINTING BY ELECTRIC LIGHT.—BLUE PRINTING ROOM.

1. Read before the American Society of Mechanical Engineers at Milwaukee, Wis., May, 1901.

The Philadelphia Street-railway Situation.

Much comment has been caused by the rapid passage through the Pennsylvania Legislature of two bills amending the Passenger Railway act of 1889. One measure provides for the construction of a passenger railway in any street not already occupied and the other provides for the construction of elevated and underground railways. The bills grant to companies chartered under the act the right of eminent domain, specifying that they must begin the work of construction within two years after the granting of the charter, and the companies are given an exclusive privilege during the two years' interval. One bill is so drafted that it will set aside all acts of the Assembly, ordinances of the councils, or contracts with municipal authorities of Philadelphia to prevent the laying of tracks on Broad street.

Directly after the passage of the bills there was a rush for trolley charters, and 92 companies were chartered by the state. Among the Philadelphia companies chartered are the Northern Rapid Transit, the Eastern Rapid Transit, the Southern Rapid Transit, the Western Rapid Transit and the Central Rapid Transit. The total mileage of streets will be 120, and the capitalization $100,000 per mile, or $12,000,000 for the five companies. It is said that four companies will be incorporated for the purpose of building elevated railroads in Philadelphia. The routes will be along Market street, Front street, Frankford avenue and Ridge avenue.

The passage of the bills and the granting of the charters have been followed by a letter from ex-Postmaster-general Wanamaker to Mayor Ashbridge of Philadelphia, offering $2,500,000 for the powers, rights and franchises granted under some 14 rapid-transit ordinances which were "railroaded" through the councils and were at that time awaiting the mayor's signature. Mr. Wanamaker declares that these franchises are of enormous value and should not be made a free gift to anyone. He says that he has no intention of embarking in the railway business, but he will not stand idly by and see gifts of such enormous value being made without any return to the people from whose pockets will come every dollar that goes into the corporate treasuries. As an evidence of good faith, Mr. Wanamaker deposited $250,000 in the Real Estate Trust company.

Mayor Ashbridge ignored Mr. Wanamaker's offer and on June 13th signed the ordinances passed by the City Councils granting franchises for city railways, surface, elevated and underground. It is rumored that as a result of the mayor's action in signing the ordinances, the courts will probably be appealed to for an injunction, and a long and tedious litigation is likely to follow.

Toledo Street Railway Sold to Everett-Moore Syndicate.

Announcement has been made by E. W. Moore of Cleveland, Ohio, that the Everett-Moore syndicate has purchased the Toledo (Ohio) street-railway property, the consideration being $11,000,000. At the same time it purchased the Rapid Railway company of Detroit, Mich., and secured control of the Toledo, Fremont and Norwalk Electric Railway company. The price paid for the Rapid railway was in the neighborhood of $3,000,000. The Everett-Moore syndicate, it is said, now owns or controls every mile of street and suburban tracks between Warren, Ohio, and Port Huron, Mich., with the exception of the property controlled by the Pomeroy interests and the Little Consolidated street railway of Cleveland. The direct mileage is 360, and, with its feeders and auxiliaries, amounts to about 1,000 miles. This system is one of the largest in the world.

Syntonic Wireless Telegraphy.[1]

By Guglielmo Marconi.

[United States letters patent have just been issued to Mr. Marconi for an improved system of wireless telegraphy, which is described in the following abstract taken from the London Electrician.]

As the title of my paper implies, it is my intention to describe fully the efforts I have made in order to tune or syntonize the wireless system, efforts which I am glad to say have been crowned with complete success. So long as it was possible to work only two installations within what I may call their sphere of influence, a very important limit to the practical

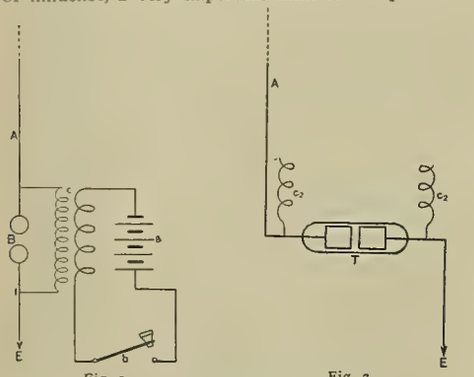


Fig. 1. Fig. 2.

SYNTONIC WIRELESS TELEGRAPHY.

utilization of the system was imposed. With simple vertical wires, as shown at (A) in Figs. 1 and 2, connected directly to the coherer and spark gap at the receiver and transmitter, as used by myself before 1898, no really satisfactory tuning was possible. It was, however, possible to obtain a certain selection of signals if various stations in the vicinity used vertical wires differing very considerably in length. Thus two stations communicating over a distance of, say, five miles and using wires 100 feet long would not interfere with the signals transmitted by the other two stations, say two miles from the first, which were using aerials only 20 feet long, and communicating over a distance of about one mile. The new methods of connection which I adopted in 1898, i. e., connecting the receiving aerial directly to earth instead of to the coherer, and by the introduction of a proper form of oscillation transformer in conjunction with a condenser so as to form a resonator tuned to respond best to waves given out by a given length of aerial wire, were important steps in the right direction.

Leaving this subject for the present, I shall endeavor to describe the various steps made in the development of my syntonic system. I realized a long time ago that one great difficulty in achieving the desired effect was caused by the action of the transmitting wire. A simple straight rod in which electrical oscillations are set up forms, as is well known, a very good radiator of electrical waves. If this was in the beginning an advantage, by allowing signals to be received with a small amount of energy over considerable distances, it proved later to be one of the chief obstacles in the way of obtaining good resonance in the receiver. Now, as Dr. Fleming points out so clearly in his Cantor lectures on "Electrical Oscillations and Electric Waves," delivered before this society in November and December of last year, there is in connection with this part of the subject one point of great interest. "Both theoretical and experimental research show that in the case of conductors of a certain form the electric oscillations die away with great rapidity." In all what we call good radiators, electrical oscillations set up by the ordinary spark-discharge method cease, or are damped out very rapidly, not necessarily by resistance, but by electrical radiation removing the energy in the form of electric waves. Many mechanical analogies can be quoted which will point out the necessity of designing a persistent oscillator, in order that syntony may become apparent in properly tuned resonators. Acoustics furnish us with numerous examples of this fact, such as the resonance effects produced by the well-known tuning-fork experiment. Other illustrations of this principle may be given, e. g., if we have to set in motion a heavy pendulum by means of small thrusts or impulses, these must be timed to the period of oscillation of the pendulum, since otherwise its oscillations will not require any perceptible amplitude. The same kind of effect happens in a very small fraction of a second when we try to induce electrical oscillations in a good resonator. If the form of this resonator be such as to cause it to be a persistent vibrator, i. e., one in which the electrical oscillations are not rapidly damped by resistance or radiation of waves, then it is necessary for us to employ a number of properly timed electrical oscillations will not acquire any perceptible amplitude. to the period of the resonator we desire to affect.

As I pointed out before, a transmitter consisting of a vertical conductor as shown in Fig. 1 is not a very persistent oscillator. Its electrical capacity is comparatively so small and its capability of radiating waves so great that the oscillations which take place in it must be considerably damped. In this case receivers or resonators of a considerably different period or pitch will respond and be affected by it. From the results obtained it would seem as if the transmitter were sending out a great variety of electric waves, resembling therefore a source of white light, and that each resonator picks out and responds to its own particular wave length. This view, however, is incorrect; the fact that, given certain conditions, various resonators will respond, even if their period be different from the natural period of oscillation of a transmitter, is to be accounted for by the consideration that all the energy of the transmitter is radiated in only one or two swings, with the result that oscillations may be induced in resonators of different periods, while, if the same amount of energy be distributed in a great number of individual feeble impulses, their combined effect can only be utilized or detected by a resonator tuned so as to respond to their particular frequency. The tuned resonator will not then respond to the first two or three oscillations, but only to a longer succession of properly timed impulses, so that only after an accumulation of several swings does the electromotive force become sufficient to break down the insulation of the coherer, and cause a signal to be recorded.

Notwithstanding the disadvantages for obtaining electrical tuning, attributed to the form of transmitter shown in Fig. 1, selection of messages is possible when using, say, two or three transmitters having wires of considerably different lengths, and the induction coil or oscillation transformers on the receivers wound with varying lengths of wire in their secondary circuits, in order to cause them to be in tune or resonance with the length of wave of the transmitted oscillations. The following experiment, which has been successfully tried, proves this point. At St. Catherine's, Isle of Wight, we had a transmitting station having a vertical wire 45 meters long, and at sea, 10 miles from our receiving station at Poole, a ship with transmitting wire of 27 meters. It is, therefore, obvious that the wave length of the electric oscillations radiated from St. Catherine's differed considerably from those radiated from the ship. Now, if at the receiving station at Poole we connected to a vertical wire two receivers, one having

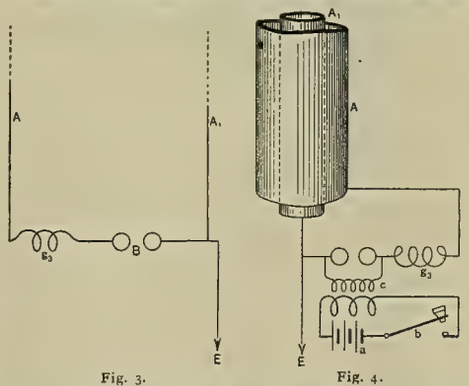


Fig. 3. Fig. 4.

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an induction coil with secondary in tune with the length of wave emitted by St. Catherine's and the other with that emitted by the 27-meter wire on the ship, if St. Catherine's and the ship transmit simultaneously two different messages, these will be picked up at Poole, and each message will be reproduced distinctly on its receiver. The best results are obtained when the length of wire of the secondary of the induction coils is equal to the length of the vertical wire used at the transmitting station; therefore the length of the secondary of the receiving induction coils was made equal to that of the transmitting wire.

These results, although in a way satisfactory, did not appear to my mind a complete solution of the problem. I found it impossible to obtain the two messages at the receiving station if the two transmitting stations were placed at equal distances from it.

It thus became apparent that some different form of less damped radiator was necessary in order to obtain more practical and more useful results. I carried out a great number of experiments by adding to the radiating and receiving wires inductance coils, on a principle similar to that suggested by Lodge in his 1898 patent, but without obtaining any satisfactory results. The failure was probably due to the fact that the electrical capacity of the exposed conductors became too small in proportion to their inductance. I then tried various methods for increasing the capacity of the radiating system. The first and obvious mode of effecting this is by an augmentation in the size of the exposed conductor, but this method is not entirely satisfactory, in consequence of the circumstance that an increased surface means increased facility for radiating the energy during the first oscillations, and also because large plates or large exposed areas are impracticable on board ship, and are always difficult to suspend and maintain in good position during windy weather.

The way out of the difficulty was discovered by adopting the arrangement shown in Fig. 3. Here we have an ordinary vertical radiator placed near an earthed conductor, the effect of the adjacent conductor being obviously to increase the capacity of the electrical radiating wire without in any way increasing its radiative power, and, as I had expected, syntonic results were not difficult to obtain with such an arrangement. Satisfactory results were obtained, and I was encouraged to continue my researches in order to improve the system. Early in 1900 I obtained very good results with the arrangement shown in Fig. 4. This arrangement is fully described in a British patent application applied for by myself on March 21, 1900, No. 5,387. In it the radiating and resonating conductors take the form of a cylinder, the earthed conductor being placed inside. This form of radiating and receiving areas is much more efficient than the one I have previously described. One necessary condition of this system is that the inductance of the two conductors should be unequal, it being preferable that the large inductance should be joined to the non-earthed conductor. I presume that, in order to radiate the necessary amount of energy, it is essential that there should be a difference in phase of the oscillations in the two conductors, as otherwise their mutual effect would be to neutralize that of each other. In the first experiments mentioned by Captain Ferrie this was obtained by simply using an earthed conductor shorter than the radiating or resonating one. When I used an inductance between the spark gap or oscillation producer and the radiating conductor, I found it impossible to cause the electrical period of oscillation of the receiving cylinder to correspond to that of one out of several transmitting stations, from which one alone it would receive signals.

The results obtained by this system have been remarkable. By using cylinders of zinc only seven meters high and 1.5 meters in diameter, good signals could easily be obtained between St. Catherine's, Isle of Wight, and Poole (distance 31 miles), these signals not being interfered with or read by other wireless-telegraph installations worked by my assistants or by the Admiralty in the immediate vicinity. The closely adjacent plates and large capacity of the receiver cause it to be a resonator possessing a very decided period of its own, i. e., it becomes no longer apt to respond to frequencies which differ from its own particular period of electrical oscillation, nor to be interfered with by stray ether waves, which are sometimes probably caused by atmospheric disturbances, and which occasionally prove troublesome during the summer. It seemed very remarkable to me during my first test that an arrangement similar to that shown in Fig. 4 should prove to be a good radiator and should enable such a considerable distance to be achieved with cylinders of so moderate a height. It is probable that the great majority of the electrostatic lines of force pass directly from one cylinder to the other, but it must be also true that a certain number leave the outer part of the external cylinder, exactly as in the case of an ordinary radiator. The receiver is not shown in the sketch, but consists of similar cylinders to those used for transmitting the receiving induction coil or oscillation transformer, being placed where the spark gap is shown in Fig. 4. The capacity of the radiator due to the internal conductor is, however, comparatively so large that the energy set in motion by the spark discharge cannot all radiate in one or two oscillations, but forms a train of slowly damped oscillations, which is just what is required. A simple vertical wire, as shown in Fig. 1, may be compared with a hollow sphere of thin metal which, when heated, would cool very rapidly, and the concentric cylinder system with a solid metal sphere, which would take a very much longer time to cool.

Another very successful syntonized transmitter and receiver system was the outcome of a series of experiments carried out with the discharge of Leyden jar circuits. Taking for granted that the chief difficulty with the old system, as shown in Fig. 1, lies

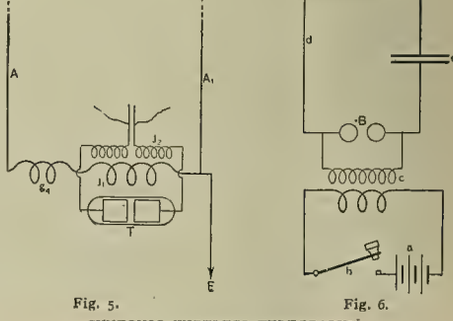

Fig. 5. Fig. 6.

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in the fact, as already stated, that the oscillations are very dead beat, I tried by means of associating with the radiator wire a condenser circuit, which was known to be a persistent oscillator, to set up a series of persistent oscillations in the transmitting vertical wire.

An arrangement as shown in Fig. 6, which consists in a circuit containing a condenser and a spark gap, constitutes a very persistent oscillator. Professor Lodge has shown us how, by placing it near another similar circuit, it is possible to demonstrate interesting effects of resonance by the experiment usually referred to as that of Lodge's syntonic jars. But, as Lodge points out, "A closed circuit such as this is a feeble radiator and a feeble absorber, so that it is not adopted for action at a distance." I

1. Abstract of paper read before the British Society of Arts May 15, 1901.

very much doubt if it would be possible to affect an ordinary receiver at even a few hundred yards. It is very interesting to notice how easy it is to cause the energy contained in the circuits of this arrangement to radiate into space. It is sufficient to place near one of its sides a straight metal rod or good electrical radiator. The only other condition necessary for long-distance transmission is that the period of oscillation of the wire or rod should be equal to that of the nearly closed circuit.

Stronger effects of radiation are obtained if the radiating conductor is partly bent round the circuit, including the condenser (so as to resemble the circuits of a transformer). I first constructed an arrangement which consists of a Leyden jar or condenser circuit, in which is included the primary of what may be called a Tesla coil, the secondary of

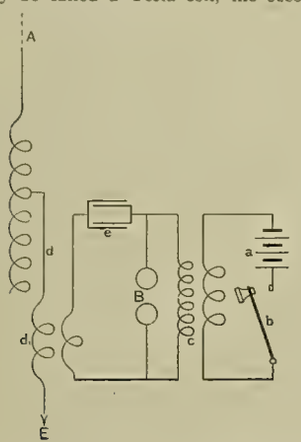

FIG. 7. SYNTONIC WIRELESS TELEGRAPHY.

which is connected to the earth or aerial conductor. The idea of using a Tesla coil to produce the oscillations is not new. My idea was to associate with this compound radiator a receiver tuned to the frequency of the oscillations set up in the vertical wire by the condenser circuit. My first trials were not successful, in consequence of the fact that I had not recognized the necessity of attempting to tune to the same period of oscillation (or octaves) the two electrical circuits of the transmitting arrangement (these circuits being the circuit consisting of the condenser and primary of the Tesla coil or transformer, and the aerial conductor and secondary of the transformer). Unless this condition is fulfilled, the different periods of the two conductors create oscillations of a different frequency and phase in each circuit, with the result that the effects obtained are feeble and unsatisfactory on a tuned receiver.

The syntonized transmitter is shown in Fig. 7. The period of oscillation of the vertical conductor (A) can be increased by introducing turns, or decreased by diminishing their number, or by introducing a condenser in the series with it. The condenser (C) in the primary circuit is constructed in such a manner as to render it possible to vary its electrical capacity. The receiving-station arrangements are shown in Fig. 8. Here we have a vertical conductor connected to earth through the primary of a transformer, the secondary circuit of which is joined to the coherer or detector. In order to make the tuning more marked, I place an adjustable condenser across the coherer in Fig. 8. Now, in order to obtain the best results, it is necessary that the free period of electrical oscillations of the vertical wire primary of transformer and earth connection should be in electrical resonance with the second circuit of the transformer, which includes the condenser. I stated that, in order to make the tuning more marked, I placed a condenser across the coherer. This condenser increases the capacity of the secondary resonating circuit of the transformer, and in the case of a large series of comparatively feeble but properly timed electrical oscillations being received, the effect of the same is summed up until the electromotive force at the terminals of the coherer is sufficient to break down its insulation and cause a signal to be recorded.

In order that the two systems, transmitter and receiver, should be in tune, it is necessary (if we assume the resistance to be very small or negligible) that the product of the capacity and inductance in all four circuits should be equal.

Although little difficulty has been encountered in measuring the capacity used in the various circuits, the measurement or calculation of the value of the inductance is not so easy. I have found it impracticable by any of the methods with which I am acquainted directly to measure the inductance of, say, two or three small turns of wire. As for calculating the inductance of the secondary of small transformers, the mutual effect of the vicinity of the other circuits and the effects due to mutual induction greatly complicate the problem.

Experiments have confirmed the fact that the receiving induction coils having the secondary wound in one layer and at a certain distance, say two millimeters (to cause the capacity to be so small as to be negligible), have a time period approximately equal to that of a vertical conductor of equal length. If, therefore, we are using an induction coil having a secondary 40 meters long on the receiver, I should use a vertical wire 40 meters long at both transmitting and receiving stations. By so doing I have the two circuits at the receiving station in tune with each other, and I only have to adjust the capacity of the condenser at the transmitter, which can easily be done, either by means of a condenser having movable plates that can be slid, more or less, over each other, or by adding or removing Leyden jars.

If we start with a very small capacity which we gradually increase, a value of the capacity will be reached which will cause signals to be recorded on the receiver. Supposing the receiving system to be within the sphere of action of the transmitter, then the signals will be strongest when the capacity of the condenser is of a certain value. If we still increase the capacity, the signals will gradually die away, while if we go on increasing the capacity, and, at the same time, add inductance to the aerial, to keep it in tune with the condenser-jar circuit, we are still radiating waves, but these do not affect the receiver. If, however, at the receiving station we add inductance or capacity to the wire (A) Fig. 8, and also to the ends of the secondary of (J_2) we find ourselves able to receive messages from the transmitter although we are utilizing waves of a different frequency.

It is easy to understand that if we have several receiving stations, each tuned to a different period of electrical vibration, and of which the corresponding inductance and capacity at the transmitting station are known, it will not be difficult to transmit to any one of them without danger of the message being picked up by the other stations for which it is not intended. But, better than this, we can connect to the same vertical sending wire, through connections of different inductance, several differently tuned transmitters, and to the receiving vertical wire a number of corresponding receivers. Different messages can be sent by each transmitter connected to the same radiating wire simultaneously, and received equally simultaneously by the vertical wire connected to differently tuned receivers. This result, which I believe to be quite novel, I showed to several friends of mine, including Dr. Fleming, F. R. S., in the summer of last year, and to an Admiralty Commission. A further improvement has been obtained by the combination of the two systems. In this case the cylinders are connected to the secondary of the transmitting transformer, and the receiver to a properly tuned induction coil, and all circuits must be tuned to the same period as already described. (See Fig. 9.)

The tuning of the receiver to respond to the period of the transmitter, as used in the old form of transmitter shown in Fig. 1, or in the new one shown in Fig. 7, has enabled results to be obtained over considerable distances with moderate heights. As already published by Dr. Fleming, signaling has been successfully carried out over a distance of 50 kilometers, with a cylinder only 1.25 meters high, 40 inches in diameter. This has led to the possibility of constructing portable apparatus for army

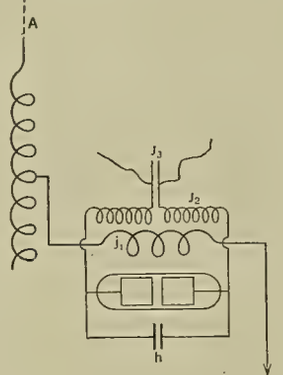

FIG. 8. SYNTONIC WIRELESS TELEGRAPHY.

purposes which should be of great service in the field. I have succeeded in constructing a complete installation on a steam motor car. On the roof of the car there is placed a cylinder which can be lowered when traveling, its height being only six or seven meters, and by this means communication has been easily carried out with a syntonized station over a distance of 31 miles. A 25-centimeter spark induction coil worked by accumulators and taking about 100 watts is used for transmitting, and the accumulators can be recharged by a small dynamo worked by the car motor. I believe such an appliance might have been of use to the besieged garrisons in South Africa and China. A strip of wire netting laid on the ground is sufficient for earth connection, and by dragging it along communication can be established even when the car is traveling. I have recently obtained as good results by not using any "connection" to earth, but only utilizing in lieu of earth the electrical capacity of the boiler of the motor car. I also find that signals can be transmitted a considerable distance with the cylinder in a horizontal position.

Last spring I recognized the desirability of carrying out tests between stations situated at much greater distances apart than had been attempted heretofore. A station was established at the Lizard, Cornwall, and on the first attempt communication was effected with St. Catherine's, Isle of Wight, over a distance of 186 miles, which, I believe, is the record distance over which signals have been sent through space without wires. It is interesting to observe that signals were obtained over this distance with the transmitting apparatus as shown in Fig. 1, or with the arrangement shown in Fig. 7, provided always that a suitable resonating induction coil was employed at the receiving station. The amount of energy used for signaling over this distance is not more than 150 watts, but experiments with a larger amount of energy will shortly be carried out. In the case of the 186 miles' transmission, the aerial conductor consisted of four parallel vertical wires 1.50 meters apart, 48 meters long, or in a strip of wire netting of same length. It is interesting to note that in order to communicate between my sta-

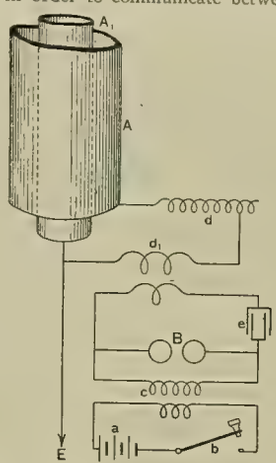

FIG. 9. SYNTONIC WIRELESS TELEGRAPHY.

tions at Poole and St. Catherine's (distance 31 miles) with the same amount of energy and the same kind of aerial wire this must be 20 meters high to obtain signals of about the same strength as those obtained between the 186-mile stations with the 48-meter aerials. This goes to confirm many other results previously obtained, which indicate that with a parity of other conditions the distance varies with the square of the height of the vertical conductors at the two stations. I have always found this law fulfilled, if the height of the conductors at the two stations is approximately equal, although an attempt has been made recently to throw doubt upon its correctness.

You will admit that the progress achieved in syntonic space telegraphy must have enormously increased its field of application and usefulness, since a very great number of non-interfering stations can now be worked in the immediate vicinity of each other. It will probably be of interest if I give you a few examples of the progress made in the practical utilization of my system. An eminent electrician recently expressed a doubt whether there was at present a single circuit worked commercially on a practical system of wireless telegraphy. If earning a revenue from working installations can be termed a commercial working, even such an incomplete list of these as time will now permit me to give you, and which are now all in permanent working order, may be sufficient proof that a beginning at least has been made in the commercial utilization of the system.

In March, 1900, there were in use in the Royal Navy, in South African waters, five installations of my system. The Admiralty was apparently well satisfied with its working, since in May of last year they decided to extend its adoption to 32 more ships and land stations. The conditions of the contract were that each apparatus before being accepted should be satisfactorily worked by naval signalmen between two ships anchored at Portsmouth and Portland, over a distance of 62 miles, a considerable portion of which—i. e., 18 miles—lies over land, with intervening hills, and the height of aerial wire was specified not to exceed on each ship 49 meters. The apparatus was delivered in a comparatively short time, no sets having been found unsatisfactory. The apparatus supplied to the Admiralty is, so far, all of the old pattern—i. e., the non-syntonized system; and I have been informed that messages have been transmitted and received by naval signalmen between ships more than 160 kilometers apart. It sometimes occurs that the unfamiliarity of the operators with the particular kind of apparatus used caused unsatisfactory results to be obtained, but I believe this trouble will soon disappear. I am glad to be able to state that arrangements are being made to install my new syntonic apparatus upon several of His Majesty's ships. I believe that in no other navy in the world is wireless telegraphy being worked regularly over such considerable distances. My system is also used for communication between the Borkum riff and Borkum lightship in Germany, where an ordinary commercial charge is made for messages received from ships, and it is employed, further, on the Nord Deutscher Lloyd's mail steamer Kaiser Wilhelm der Grosse.

According to an official report of the imperial

[*Continued on page 432.*]

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CONVENTIONS AND EXPOSITIONS.

Independent Telephone Association of Wisconsin, La Crosse, Wis., June 25th and 26th.
Northwestern Electrical association, Sheboygan, Wis., June 26th and 27th.
United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.
American Institute of Electrical Engineers (general meeting), Temple of Music, Buffalo, N. Y., August 20th to 24th.
Ohio Electric Light association, Put-in-Bay, Ohio, August 20th to 22d.
Pennsylvania State Street Railway association, York, Pa., September 4th.
International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.
New York State Street Railway association, Rochester, N. Y., September.
Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.
Roentgen Society of the United States, University of Buffalo, Buffalo, N. Y., September 10th and 11th.
Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.
American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.
South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Visitors to the Pan-American Exposition will find the Western Electrician's space in Section F 2 in the Electricity building, where they will be cordially welcomed.

The scarcity of platinum is beginning to cause some concern among the electrical manufacturers of the country. For about five years the price of this valuable metal has steadily risen, until to-day it is listed at a higher price than ever since its discovery, and every indication points to still higher prices. Platinum is now quoted at about $36 an ounce, about twice the quotation of gold, while five years ago it sold as low as $5 an ounce. Since the flooding of the platinum mines in the Transvaal, which occurred after the breaking out of the Boer war, manufacturers have had to rely on Siberia for their supply of the valuable metal. Some little hope was held out that platinum would be found in Alaska and other northern mining countries, but no such discoveries have been made.

Platinum is used in the manufacture of incandescent lamps and for many electrical and physical appliances, as well as in medicine and for the manufacture of crucibles where high temperatures are required. A comparatively recent demand for the metal has come from its use in photography. The platinum-finished photographs have been very popular and the use of platinum for this purpose has drawn largely on the supply. With a view to regulating the use of the metal, the German Reichstag recently considered a measure prohibiting the use of platinum in photography. The advocates of the bill claimed that as platinum was absolutely essential in medicine and electrical work, its use for purposes which were not necessary should be stopped. The measure was not passed, but its introduction called attention to a condition which is said by scientists to be rapidly becoming serious.

An indication of the increasing value of electric-railway securities in this country is shown by the desire recently manifested by English investors to obtain American traction shares. Some of the large financial houses of England have sent representatives to the United States to look into the traction securities in the larger cities, and now the Financial Times of London appears with the announcement that it purposes to investigate desirable urban transportation properties in this country, with a view to their substitution for steam railways, so much in favor with English investors. The London journal thinks that the limit of profits from American trunk lines must soon be reached, and advises its readers to buy American traction shares while they can get them cheap. Among the number of stocks and bonds listed by the Financial Times as "recommended purchases" are those of the Metropolitan and Third Avenue companies of New York city, the Cleveland City Electric Railway company, the Kansas City Metropolitan company and the Metropolitan West Side Elevated Railway company of Chicago.

The suggestion is also made that Englishmen attempt to secure an interest in the Chicago Consolidated Traction company "as a means of carrying the war into the enemy's country," inasmuch as that corporation paid Mr. Yerkes $10,000,000, "with some of which money he is no doubt now beleaguering London."

Whatever may be the direct cause of the anxiety of our English cousins to invest in our street-railway stocks, it is certain that American traction securities have lacked the public interest they deserve as compared with the prominence given the securities of the steam railroads. A street-railway system in any large city is almost certain to be a profitable enterprise. It enjoys a fixed income, unhampered with the costly competition and heavy operating expenses to which steam roads are subject and its stocks and bonds should prove safe securities for investment.

It is very evident from a perusal of the monthly export table prepared by the statistical branch of the Treasury Department that the exportation of electrical goods from the United States is no longer a matter of experiment, but that our electrical manufacturers have satisfied themselves that it is feasible to dispose of their surplus productions in various quarters of the world and have addressed themselves seriously to the study of the conditions which are requisite for healthful and permanent growth. During the nine months ended March, 1901, the exports of electrical machinery reached a total valuation of $4,339,106, a large increase over those for the same period of 1900, the nine months' exports in that year amounting in value to $2,906,031. The gain in the exports of instruments and apparatus for scientific purposes, including telegraph, telephone and other electric appliances, is not so striking, the figures for the nine months ended March, 1901, being $5,495,309, against $4,750,474 for the corresponding period of the previous year. A general conclusion that may be arrived at from a study of these figures, taken in connection with those of other lines, is that the commercial expansion of the United States is a fact of constantly enlarging proportions which opens up new vistas in the struggle for ascendancy among the industrial nations. Prolific as it has been of great surprises, especially in the electrical field, it is doubtful whether similar phenomena will spring from its undemonstrated forces. It would seem, now that the causes of our unlooked-for triumphs are known and are being carefully weighed and studied, that the future will be one of fruition, of the gradual maturing of our powers, rather than of sudden blossoming of some novel capacity of competition. The day, perhaps, is not far distant when the more intelligent of our rival nations will be able to meet us upon more nearly equal terms, and when it will be necessary to supplement our natural advantages and our highly developed industrial efficiency with the appliances of education, of special training, of technical skill, of more scientific methods of extending trade, which have already secured rich returns, to Germany, for example, in quarters of the globe where our goods as yet have made but little, if any, headway.

One of the most remarkable examples of rapid street-railway legislation is that just recorded in the state of Pennsylvania. Two bills were presented in the state Legislature that related to the granting of city traction privileges. One of these measures permits the laying of tracks upon any unoccupied streets in any of the cities of Pennsylvania, with municipal consent, and the other permits the building of elevated and underground railways. Within 48 hours from the time the bills were introduced in the state Senate they had been "railroaded" through and passed. Six days later they had become laws by action of the lower house of the Legislature and the affixing of the signature of the governor. The passing of the bills caused a flood of applications for traction charters to pour into the state department. Within two days nearly a hundred charters were granted. The most valuable grants went to Philadelphia, although capitalists in Scranton, Pittsburg and Allegheny received very important charters.

In Philadelphia the situation has aroused widespread interest. Fourteen traction franchises, from as many companies, all said to be controlled by one syndicate, were hurriedly passed by the city government in a time so brief that the members voting for them could not have had a chance to read them after their introduction. These franchises cover practically all the available streets not already occupied by the Union Traction company's lines. Appreciative of the magnitude of the gift of these valuable franchises to private citizens without return to the people, Mr. John Wanamaker, in a letter to the mayor of Philadelphia, offered to pay the city $2,500,000 for the 14 franchises. This offer was ignored by the mayor, who refused to veto the measures.

The privileges of the Philadelphia franchises bear a striking contrast to those of similar measures that have been considered by other American cities. The franchises are for perpetuity. They exact small compensation for the use of the streets. They make no provision for lower fares, for transfers, or for adequate accommodations, and none of the safeguards to public interests are imposed that have been employed in other cities to such great advantage. One of the most valuable rights covered by the new ordinances is the permission to operate a railway on Broad street, Philadelphia's principal boulevard. The right to tear up that street will be vigorously contested by the Union Traction company, and doubtless other long and tedious litigation will ensue before the conditions of the franchise grants will be fulfilled.

Electric Light for Small Houses.[1]

By R. D. Summerfield, A. M. I. M. E.

The question of electric illumination for the class of small dwelling houses, occupying in point of size the position between the workman's five-roomed cottage and the detached villa, is one which it is earnestly to be hoped will soon have more attention paid to it, both on account of the enormous number of people who would be benefited by being able to light their houses by electricity as cheaply as by gas or oil, and also on account of the great impetus which would be given to the electric-light industry if all such small houses now using gas were to adopt electricity instead. The class of houses mentioned above constitutes a large proportion of the dwelling houses proper in most towns, but as yet very little has been done in the way of supplying them with electric light. This is chiefly owing to the very limited demand for light from such houses, causing the electric-lighting companies and corporations, as a rule, to pass them by with very little consideration, and to make small effort to develop business in this quarter; but if whole streets of such houses could be induced to make use of the light, they would become most profitable customers.

On the score of health, electric lighting is far more important for small houses than large ones, as small rooms so soon get hot, stuffy and unhealthy when lighted by gas or oil; in a room 14 feet by 12 feet the writer recently noticed a difference of five degrees Fahrenheit in the temperature just below the ceiling and against the wall less than four feet lower down, after three hours of lamplight, but with no fire in the room. This gives some idea of the overheated state into which small rooms soon get when using the ordinary artificial lights; but those who are obliged to sit for several hours in such rooms during winter evenings will need no telling that gas or oil are not the proper illuminants to use in such confined spaces, while the blackened ceilings and dingy curtains prove that the bad effects of the light are not confined to human beings only. Yet the small householder puts up with these disadvantages, considering that electric light is quite beyond him; he may earn his living in an electrically lighted office, may be able to afford more for light than he is paying, and may even have an electric-light cable laid in the street before his door, yet he seldom seems to think of taking up the question of electric lighting seriously. This may be because he considers it dangerous, as even now a great number of people imagine that they might be killed or seriously injured by touching any kind of electric wire; but the objection which probably weighs heaviest with most people is the trouble and expense involved in wiring and fitting up their houses for the electric light, and as they have very little data to go upon, they are apt to form very exaggerated estimates of the cost, besides imagining that the house will have to be partially pulled down to run the wires.

Now, a small, seven-roomed house—such as are rented in the suburbs of London at about £30 per annum—could be fitted up with an installation to give a quite sufficient degree of illumination at a cost of £1 per 16-candlepower lamp, this sum including lamps, plain but sound fittings, switches and accessories, wires, and labor in wiring, and fixing. Such an installation would consist of two 16-candlepower lamps each in the front and back sitting rooms, one in the hall, one in the kitchen, one each in the first and second bedrooms, one eight-candlepower lamp in the third bedroom, and one eight-candlepower lamp in the bathroom—or 10 lamps in all, equivalent to 18 eight-candlepower lamps. Now, a central-supply station, charging, say, 6d. per Board of Trade unit, will receive an average revenue of about 6s. per eight-candlepower lamp per annum; but as this average includes shops and business premises, as well as private houses, we may take the cost to the small householder at 6s. 6d. per eight-candlepower lamp per annum, as he burns his lamps for longer hours than a shopkeeper or the tenant of an office. In the case under consideration, with an equivalent of 18 eight-candlepower lamps fixed, the annual cost of current would come to £5 17s. at 6d. per Board of Trade unit; and if we add 10s. for meter rent, the annual cost would be £6 7s. The cost of gas at 3s. 6d. per 1,000 cubic feet for the same number of burners as electric lamps, and to burn for the same number of hours, would come to about £2 5s. per annum, including rent of meter. The difference in cost, therefore, between gas and electric light would be £4 2s., and although this seems large, yet when the longer life of curtains, pictures and furniture and the less frequent necessity for painting and whitewashing is taken into account, not to speak of the very great benefit to health, the difference becomes very small—in fact, the advantages gained by using electricity more than counterbalance the increased cost. Of course, with current at 3d. or 4d per Board of Trade unit, the difference between the cost of electricity and gas is decreased, or the cost becomes equal. In Brighton, for instance, electric light is cheaper than gas, and is therefore used in the smallest shops, while small dwelling houses, at rents of £20 and £25 per annum, are wired for electric light instead of having gas-pipes put in while building.

The first cost of an installation, however, sometimes prevents the householder from putting one in, although he might be quite willing to pay the extra annual cost for light, as against gas. The installation of 10 lamps mentioned above would cost £10, and the tenant might hesitate to spend this lump sum, especially as he would have to leave, at any rate, part of the installation behind him in case of removal. This difficulty is, however, overcome by such concerns as the National Free Wiring company, which will put in a complete installation free of cost in the first instance, and charge for the use of the same a rent of about 1d. for each Board of Trade unit consumed, as registered by the meter. Several corporations have also commenced to hire out fittings to their customers at a nominal rent. Electric wires in private houses should be run in steel conduits, as the risk of fire is much less when the wires are carried in this manner than when run in wood casings; besides which, the cost of labor in wiring is from 30 to 40 per cent. less. In some cases it might be possible to draw the wires into existing gas-pipes by altering the sharp bends and introducing junction boxes at intervals; but the insulation of the wires would probably be damaged by the burrs on the ends of pipes unless the greatest care was exercised.

If, by using the electric light, the occupiers of small houses benefited in health and comfort, the suppliers of the light would also benefit from a pecuniary point of view, as such customers would be very profitable ones. The maximum demand for current from the class of houses in question would not occur until most business places were closing, and would continue until 11 or 12 at night, thus flattening the peak of the load curve at the lighting station and increasing the load efficiency of the plant. Of course, it would not pay to lay cables down a street to supply one or two small customers only, and electric-light companies and corporations should therefore canvass thoroughly all the streets of smaller houses in their districts, leaving at each house little pamphlets, setting forth in the plainest manner the advantages of the electric light, together with the approximate cost of installing same or hiring fittings, and the actual average annual cost of current per 16-candlepower and eight-candlepower lamps, etc.

To charge by meter for the small quantity of current required in the cases we are considering would be expensive for the lighting company, and might result in a dead loss to it, as sometimes the meters will not record very small currents. One system of charging which has been tried is to charge a fixed price per annum for each lamp fixed; this gives satisfaction to the customer, as he always knows how much he has to pay, and can burn his lamps as long as he likes; it affords means, however, for unscrupulous persons to cheat the supply company. Another system, especially applicable to new houses, is for the landlord to put in a complete installation, including lamps and fittings, and to charge a slightly higher rent to cover cost of current and hire of fittings, so that the tenant has no need to trouble about the light at all. This system is giving great satisfaction in many blocks of flats in London; large blocks sometimes have their own generating station in the basement, in which case the current can be produced very cheaply.

The value of the small customers mentioned at the beginning of this article to the supply company or corporation depends upon the number of them in a given length of street; if the number who now use gas were to use electricity instead, they would probably be the most valuable class of customers. But it does not pay to take a main down a long street to supply only one or two such customers, and supply companies, therefore, generally demand a guarantee that a certain number of units will be consumed before they will lay a main in a new district. In one large London suburb the corporation requires a guarantee that it shall receive a return of at least 15 per cent. per annum on its outlay before it will make an extension of mains. Where a main is already laid in a street, the supply company can afford to connect almost any customer, as the average cost of such connection varies from 50s. or 60s. for shops where the pavement only has to be crossed, to £5 or £6 for private houses with gardens in front. In the case of the small houses under consideration, the total cost of a connection from the street main to the house meter would come to about £4, and if the revenue per eight-candlepower lamp per annum from such houses is taken at 6s. 6d., one lamp would cover the interest on this outlay and the proportion of the meter inspector's time.

For some of the latter figures in this article the writer is indebted to the officials of the Croydon corporation electric-light department.

1. From the London Electrical Engineer.

Andrew Carnegie's Gift to House the Wheeler Electrical Library.

The interesting announcement is made that the American Institute of Electrical Engineers has just received from Mr. Andrew Carnegie a check for $6,880.28, with which to house, catalogue and complete the Wheeler electrical library. This sum is said to duplicate exactly the cost to Dr. Schuyler S. Wheeler of the Latimer Clark library presented to the Institute on May 21st. Mr. Carnegie's gift will enable the conditions imposed upon the Institute for cataloguing and housing the library to be fulfilled soon.

Roanoke, Ala., is in the market for machinery and supplies for an electric-light plant.

Architecture of the Electric Tower.

[Ernst Knaufft in the Review of Reviews.]

The original plans of the Electric Tower [at the Pan-American Exposition] designed by John Galen Howard did not call for such a broad structure, but in the exigencies of construction it was necessary to add two feet to the width. It is, therefore, not Mr. Howard's fault that the tower is not more elegant in its lines. Seen in the daytime, there is much, we think, to criticise in the details of the building. The conspicuous stairway in the circular colonnade on top is suggestive of utilitarian rather than ornamental architecture, as though the building were a lighthouse, and the stairway were to protect the keeper from wind and storm. The finials everywhere are heavy. The detached stars upon the top seem commonplace, and the star patterns within the circle which forms the panel on the shaft are suggestive of the spent pinwheel of the fifth of July. It must be acknowledged, however, that the night effect is remarkably imposing; that the heavy details we have spoken of vanish, and that the whole tower is lightened a hundredfold. The perpendicular lines of electric lights, which bring out a pilaster on each side, seem to narrow the building to a proper proportion, and our pinwheels become veritable pyrotechnics of greatest elegance. It was intended to throw flashlights from the flambeau of the "Goddess of Light." But it was later found that no one could be obtained who would undertake the venturesome task of wiring the figure at the dizzy height of some 400 feet. We think that, artistically, there is a gain in this change of plan, that the paramount beauty of the exhibition consists of the reticent way in which the lighting has been accomplished. The effect of the absence of the calcium, colored and arc lights, and the limitation to the delicate incandescent eight-candlepower lamps, which shine like dewdrops upon some night-blooming exotic, is far more charming without the trombone note of gigantic searchlights.

The tower is tinted an ivory yellow, picked out here and there with a light green, suggesting the color note of Niagara. Some of the panels, the top of the Corinthian columns, and the spandrel figures over the doorway at the back of the tower are gilded, while the two niches in front, behind the figures, to the left of "Lake Huron," by Louis A. Gudebrod, and to the right, "Lake St. Clair," by Henry Baerer, are colored yellow in imitation of gold, and make most satisfactory spots of color upon the two wings.

COMMUNICATION.

Incandescent-lamp Renewals.

To the Editor of the Western Electrician:

I have read with interest your editorial of June 1st on my paper, "The Practical Side of the Incandescent Lamp." I am particularly interested in the point raised that the subject is viewed from the manufacturer's point of view. This criticism was made at the convention, but, unfortunately, was not brought up for discussion at the time the paper was read. The reply to this criticism is simple and plain.

The system of free and liberal lamp renewals does assist the manufacturer to sell more lamps, but objection is not to be raised thereto unless it can be shown that the said benefit is the only benefit or a greater benefit than the central-station service receives therefrom. It is idle to object to any system of the value and benefit that free lamp renewals are to the central-station service on the ground that it incidentally assists some other interest. While assisting the lamp manufacturer, it assists the central-station and lighting service also, and in a much larger degree. The central station that can improve its lighting results 50 per cent. with free lamp renewals certainly cannot reasonably object to the 15 or 20 per cent. increase in lamp purchases which goes to the benefit of the manufacturer. No one objects to modern transformers and arc lamps because they may incidentally assist the manufacturer to sell more apparatus and supplies.

Central stations should not be concerned about the manufacturer, but should favor any system which can be logically shown and proven by experience to assist their interests, no matter whom else it may benefit.

F. W. WILLCOX.

Harrison, N. J., June 11, 1901.

Another Consolidation Rumored.

Boston dispatches in the daily press, confirmed by advices from the Boston correspondent of the Western Electrician, state that an effort is being made in that city to consolidate the General Electric company and the Westinghouse Electric and Manufacturing company. The matter is said to be only in the tentative state at present. It is also reported that the combination, when effected, will absorb the Sprague Electric company.

Mr. B. E. Sunny of Chicago, western manager of the General Electric company, when asked if he could confirm or deny the rumor, stated that there was "absolutely nothing in the report." He stated further that President C. A. Coffin, Vice-president Eugene Griffen and J. Pierpont Morgan, all directors of the company, were in Europe, and that nothing could be done in a step of that nature without their co-operation.

DEVELOPMENT OF THE TELEPHONE FIELD.

Seely Multiple-switchboard Patent Decision.

Advices from St. Louis, Mo., state that Judge John A. Marshall has sustained the Seely patent involved in the suit of the Western Electric company against the Kinloch Telephone company of St. Louis. The opinion holds that the Kellogg switchboard of the defendant Kinloch company, in each of its divisions, contains the invention of the Seely patent. This patent, as is well known, relates to providing extra spring-jack switches for answering the subscribers' calls. These extra jacks are placed in a certain relation to the annunciators. The first claim of the patent involved is as follows:

In a multiple-switchboard system in which the individual annunciators are distributed in groups upon the different boards, switches for all the lines on each of the boards, and, in addition thereto, sets or groups of switches on the different boards corresponding to the different groups of individual annunciators, each group of annunciators and its corresponding group of switches being placed relatively to each other in the same position on each of the boards, whereby the manner of answering the subscribers is made uniform upon all the boards.

This invention was made by John A. Seely in June, 1884, and patented November 10, 1885, the Western Electric company acquiring the patent.

The suit was argued in the Circuit Court at St. Louis, Mo., on April 26th and 27th, before Judge Marshall. The complainant was represented by Frederick P. Fish and George P. Barton and the defendant by Judge Robert S. Taylor of Fort Wayne, Ind. C. E. Scribner appeared as an expert witness for the complainant, and Professor Henry S. Carhart of the University of Michigan and F. W. Dunbar as experts for the defendants.

The suit was originally brought on the Firman patent, No. 252,576, issued January 17, 1882; the Haskins and Wilson patent, No. 266,287, issued October 24, 1882, and the Seely patent, No. 330,067, issued November 10, 1885. The two first-named patents expired during the process of the suit.

A decree of injunction and accounting has been issued against the defendant, but the injunction has been stayed for 30 days to allow the defendant to reorganize its switchboard.

Milo G. Kellogg, president of the Kellogg Switchboard and Supply company of Chicago, stated to a representative of the Western Electrician that the matter was one of minor importance and that the victory was a barren one; that the case would be appealed; that if the Appellate Court should finally decide the patent to be valid and infringed, certain changes would be easily made in the Kinloch board which would remove all claim for infringement. He stated that in 1898 his attention was called to the fact that the Western Electric company claimed that the Kinloch board infringed the Seely patent, and from that time, in every other board which has been made by his company, the construction has been such that it could not be claimed that the apparatus infringes the patent. He also said that any change that might be made in the Kinloch board in order to avoid any possible claim for infringement would not affect in the slightest the efficiency of the service of the Kinloch company.

A company has been organized to build a telephone line from Angleton to Damon Mound, Texas.

The Telephone Situation in Richmond, Va.

The application for a franchise in Richmond, Va., by the Southern Bell Telephone and Telegraph company is meeting with bitter opposition by the Richmond (Independent) Telephone company. The Bell company, after having defied the city since December 15, 1895 (at which time the council repealed its franchise), by doing business under the protection of prolonged litigation, carried on in the federal courts, has now applied for a franchise. This ordinance has not passed the council committee, to which it has been referred, and public opinion seems to indicate that it will not pass both branches of the council and thus become a law.

The Richmond Telephone company has issued a number of pamphlets to the citizens of Richmond and vicinity which describe the telephone situation very thoroughly. According to a circular letter which the company has issued, it pledges itself, should the citizens refuse to grant the Bell company a franchise, "to proceed at once to install an entirely new equipment and to give to the people of Richmond as good service as can be had in any city in the United States."

The Richmond Telephone company is giving long-distance connections to Independent companies in Manchester, Louisa, Fluvanna, Gordonsville, Charlottesville, Staunton and Harrisonburg, and it expects soon to have connections with Lexington, Roanoke, Lynchburg, Bristol and Memphis, Tenn., Petersburg, Newport News, Hampton, Berkley, Norfolk, Portsmouth, Old Point, Virginia Beach, Winchester, Hagerstown, Md., Baltimore, Md., and the northern states. Connection will also be made to Danville, and from there all the North Carolina cities will be reached. The officers of the Richmond Telephone company are: President, John C. Robertson; general manager, C. E. McCluer, and general counsel, A. B. Guigon.

Independents Petitioning for a Franchise in Buffalo.

A second petition for a telephone franchise was recently presented to the board of aldermen of Buffalo, N. Y., by the Queen City Telephone company. After an attempt on the part of several aldermen to explain their devotion to the Bell company, the petition was sent to the committee of the whole and a public hearing was set for June 28th, when the subject will be thoroughly considered. In the petition submitted the company repeats its request for a franchise and pledges itself not to disturb the streets until November next, or until the exposition is over. The company's previous petition had been objected to by the committee to which it was referred on account of the necessary confusion which might result in tearing up the streets during the exposition. The petition was signed by H. H. Littell, president of the Queen City Telephone company.

F. P. Fish Elected President of the American Telephone and Telegraph Company.

[By Telegraph from the Boston Correspondent of the Western Electrician.]

At a meeting of the directors of the American Telephone and Telegraph company, held June 19th, Alexander Cochrane resigned the presidency, to take effect June 30th, and Frederick P. Fish was elected president to succeed him. The regular quarterly dividend of 1½ per cent. and an extra dividend of three-fourths of one per cent. were declared, payable July 15th.

Telephone News from the Northwest.

The Fulda (Minn.) Telephone company has been incorporated, with $25,000 capital stock.

The Twin City Telephone company of Minneapolis and St. Paul has filed an amendment to its articles of incorporation, limiting its indebtedness to $1,000,000. The company has just ordered two large new switchboards for the Minneapolis and St. Paul exchanges, to be ready in December. The installation will include the very latest in telephone appliances. The telephone storage batteries, it is said, will be the largest in use in the United States.

The Northwestern Telephone company is building a metallic circuit from Sheboygan, Wis., to Ada, Franklin, Johnsonville and other points. Connection will be made at Plymouth or Campbellsport with the Fox River Valley Telephone company.

The La Crosse Telephone company of La Crosse, Wis., has concluded to make extensive additions to its underground work this season.

Anton Erne was the highest bidder for the North Dakota Telephone and Electrical company in Wells, Foster and Eddy counties, at $3,510.

The Iron Range Electric Telephone company expects to install a local exchange for Grand Rapids, Minn., in July.

A rural telephone line has been completed between Mount Horeb and Verona, Wis

A telephone line will be built from Ogilvie to Mora, Minn.

The Rocky Mountain Bell Telephone company has begun work on a line between Billings and Big Timber, Mont.

The Tabor (Iowa) Telephone company expects to construct 150 miles of new lines this year. New switchboards will be put in at Glenwood, Silver City, Emerson, Hastings, Macedonia and Farragut.

It is proposed to unite the different mutual telephone companies in Blackhawk County, Iowa, in and around Waterloo, into one company. The Cedar Valley Telephone company has made a proposition to sell its exchange at Hudson, Iowa, to a local company, and this may be included in the proposed consolidation.

The Standard Telephone company has bought the Gruenwaldt telephone line at Littleport, Iowa.

The Martin Telephone company has withdrawn its proposition for a local exchange for Dayton, Iowa. There is now some talk of forming a home company and establishing a mutual system.

The Maxwell Telephone company has filed articles of incorporation at Maxwell, Iowa.

W. H. Fowler has become sole owner of the telephone exchanges at Pella, Iowa, having bought the Central line.

The Trans-Mississippi Telegraph and Telephone company, which was recently formed at Des Moines, Iowa, to build a telephone line across the state, has let contracts for materials sufficient to build a line from Iowa City to Council Bluffs. It is possible that the line will be continued on east to Davenport before cold weather sets in.

The Interior Telephone company has been granted a franchise for a local exchange at Grinnell, Iowa. The voters have approved the franchise.

The Jasper County Telephone company has bought the local exchange at Colfax, Iowa. The new owner will at once make extensive changes in the service and will expend $6,000 to $8,000.

The Michigan Telephone company has cut over a new switchboard at Sault Ste. Marie, Mich., of 1,600 connections.

The Western Electric Telephone company has asked a franchise at Butte, Mont., for a local system, and proposes to put in an exchange involving an investment of $200,000.

The Adair Telephone company has been incorporated at Adair, Iowa, with a capital stock of $10,000.

E. B. Goldsberry of Fort Madison, Iowa, suc-

REPRESENTATIVE GROUP OF INDEPENDENT TELEPHONE MEN AT THE BUFFALO CONVENTION.

ceeds M. G. Stokesberry as manager of the Iowa Telephone company's exchange at Clarinda, Iowa. Mr. Stokesberry goes to Red Oak, Iowa.

Gustave O. Miller of St. Paul recently sought to build a telephone line from his store at White Rock, Minn., into Goodhue, Minn., 14 miles. He was refused entrance to the latter place, but was advised by his attorney that a franchise was unnecessary in a town of that size, and proceeded to build anyway. He was barred in favor of a local system, and so when work was started Miller was arrested for stringing wires without a franchise. Now the town is all split up into two hostile camps over the advent of a competing telephone line. Miller declares he will fight the case to the last court. R.

Ohio Telephone Notes.

The Toledo Home Telephone company, Toledo, has made application to the Probate Court for a franchise to build a plant in that city and lines to connect with outside towns. Application was made to the City Council four months ago, but nothing has been done, with the exception that it was referred to the street committee. The company makes the claim that it is being delayed unnecessarily. In the application to the court all the plans are set out and statements are made as to what will be done. The city offices will be furnished service free, and the prices set for business service are $44 per year and for residence telephones $26 per year. It is proposed to file two $10,000 bonds, one to insure the plant being completed and the other to indemnify the city against damages. In concluding the application the company asks the court to substitute for anything that may not be satisfactory in the proposition.

John W. Warrington of Cincinnati and Judge Gilbert H. Stewart of Columbus met with the state board of appraisers a few days ago and presented arguments under the Nichols law that would tend to change the manner of taxing telephone instruments which are rented or leased by the operating companies. They contended that Section 12 of that law covers the point where it states that local companies shall pay the taxes on lines owned or leased by them. The attorneys hold that the instruments are a part of the lines, as they would not be complete without them. Should the board look at the matter in that way it would probably cut down the dividends of the operating companies to a considerable extent or cause an advance in the price of service.

At the annual meeting of the stockholders of the Cleveland Telephone company, a few days ago, the following-named directors were chosen: Philip Dexter, R. Foster, Charles J. Gliddin, Thomas Sherwin, Frank Hickox, A. B. Hough, Lee McBride, W. J. McKinnie, J. P. McKinstry, E. P. Williams and E. P. Wright. The organization was as follows: President, Charles J. Gliddin; vice-presidents, J. P. McKinstry and H. J. Pettingill; secretary, George B. Perham; treasurer, Walter Abbott; general manager, P. Yensen.

The United States Telephone company has begun work on the extension of the line from Logan to Nelsonville.

The telephone girls at the Warren office of the Central Union went on a strike a few days ago because the manager would not re-rate the wages for Sunday work.

The Stark County Telephone company of Canton is now engaged in the work of wiring the residences and business houses. The latest apparatus is being used and the construction of the plant is equal to anything seen in the large cities. Work is progressing nicely on the new building being erected especially for the exchange.

The Napoleon Home Telephone company, with a capital of $50,000, has been incorporated to build and operate an exchange at Napoleon and other towns in Henry, Fulton, Defiance, Wood and Ottawa counties, and to operate toll lines between Napoleon and Ridgeville, Napoleon and Liberty Center and Napoleon and Holgate, with necessary branches to other places. The incorporators are James S. Brailey, James S. Brailey, Jr., H. A. Barber, Oliver C. Handy and W. C. Fink. The Messrs. Barber and Brailey are members of a firm which does construction work at Wauseon.

The Jerseyville Telephone company of Shade, Athens County, has been incorporated, with a capital stock of $3,000, to operate a telephone line between Jerseyville and Athens, with branches to other places. The incorporators are F. A. Copeland, W. O. Copeland, E. C. Hecox, J. D. Morse and W. H. Tremaine.

The Columbus, London and Springfield Railway company is constructing a system of telephones to be used in directing the movement of cars.

Injunction proceedings against the Akron People's Telephone company, recently brought by some of the citizens of Northfield, have been settled, and the line between Akron and Cleveland will be opened up at once.

The Star Telephone company of Ashland has been granted a franchise to operate a plant at Spencer, Ohio.

The Paulding Home Telephone Company, Paulding, will build exchanges at Paine, Grover Hill and some other places, and will build a number of branch lines to neighboring towns.

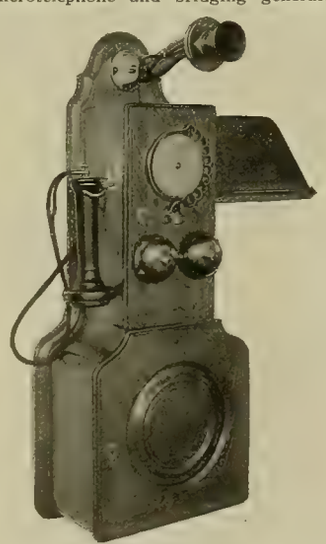
The Home Telephone company of Portsmouth has made connection with Jackson by way of Oak Hill. The company now has in operation over 700 telephones. It will have long-distance connection with other outlying towns soon.

The Cleveland Telephone company has been granted a franchise by the village council of Glenville, to lay cables and conduits and to have the right generally to operate its business in the town. O. M. C.

Lambert Schmidt Telephone Apparatus.

Two portable field telephone switchboards, recently made by the Lambert Schmidt Telephone Manufacturing company of New York city for the United States Army, are of a novel construction. One board is of 10 drops, while the other provides for six drops. No cords or jacks are used. All the parts of the 10-drop outfit are enclosed in a heavy, compact oak case, with doors at the front and back. Inside at the front is a hard-rubber panel, on which are mounted in the first row 10 drops, in the second row 10 red ringing cams, the third, fourth and fifth rows being composed each of 10 black cross-connecting cams, and the sixth row, three white listening cams. Below is a nightbell cam. There is one ringing cam for each line and one listening cam for each row of black cams. The cross-connections on the first call would be made on the first row of black cams, using the first listening cam to the left; the second cross-connection would be made on the second row of black cams, using the second listening cam, etc. The ringing on any line can be made by the individual red ringing cams. The board is provided with the company's army-type hand microtelephone and bridging generator, and with binding posts at the top for line connections. The board weighs 63 pounds, is compact and can be shipped at a moment's notice. A strap at the top is used for carrying.

LAMBERT SCHMIDT TELEPHONE APPARATUS.



STROWGER AUTOMATIC TELEPHONE.

These two portable army field switchboards were exhibited by the company at the recent Independent telephone convention in Buffalo. The accompanying picture illustrates the exhibit. Other apparatus shown was a 40-drop, regular type army board and a 100-drop, combined series and bridging switchboard. The company also showed army telephone field sets, its regular exchange telephone, consisting of generator call and common-battery wall telephones, portable desk telephones, microtelephones, its automatic reset intercommunicating wall and desk sets, combinations of private-line instruments, and parts in detail of the cordless adjustable arms, transmitters, receivers, etc. The Schmidt company made a particular feature of showing the inside of both switchboards and telephones, as illustrating the fine workmanship throughout. The company was represented by Lambert Schmidt, president, Mr. Schwartz and W. W. Bostwick, Jr.

Strowger Automatic Telephone.

The telephone system manufactured by the Strowger Automatic Telephone Exchange of Chicago, including an automatically operated switchboard, has been in operation at New Bedford, Mass., for some weeks and is now being installed at Fall River, Mass. The telephone instrument, illustrated herewith, is provided with a calling device which consists of a simple revolving dial, with 10 finger slots on one side, numbered from 1 to 0, which, used in combination, will call any number desired. The operation of calling is quick and simple. The figures of the number required are separately pulled down to the stop; by this action connection is made; the signal button is then pressed, ringing the bell of the desired subscriber. The Strowger company recently sold 2,500 of these automatic telephones to A. F. Blundell, general manager of the Havana Telephone company of Havana, Cuba, the order requiring immediate shipment.

GENERAL TELEPHONE NEWS.

Detroit dispatches state that the Everett-Moore syndicate has incorporated the People's Telephone company at Detroit, Mich., with a capital stock of $2,500,000.

The Erie Telephone company reports a net gain of 3,564 subscribers in May and of 8,545 subscribers from January 1st to May 31st. The total number connected May 31st was 150,144, and 3,374 were awaiting connection.

The following is a comparative statement of the output of instruments by the American Telephone and Telegraph company for the month ended May 20th:

May:	1901	1900.
Gross output	85,118	54,340
Returned	37,744	23,868
Net output	47,374	30,472
Since December 21st:		
Gross output	373,623	290,533
Returned	160,348	106,989
Net output	213,275	183,544
Outstanding, May 20th	2,166,091	1,764,049

MANUFACTURERS AND DEALERS.

The Farr Telephone and Construction Supply company of Chicago, owing to its largely increased space, has decided to open a telephone-cable and wire department, giving this part of the telephone business close and proper attention. The company will run this branch as a department by itself under a competent manager. The Farr company carries a full stock of single rubber-covered telephone wire, duplex twisted in pairs, twisted in pairs and braided, and braided and twisted in pairs.

Village Exchanges and Farmers' Lines.[1]

By S. P. Sheerin.

One of the many good fortunes of the farmer is to have constantly at hand some man (or men), from any or all the other vocations of life, ready and willing to tell him what he ought to do. I regret to say, however, that, notwithstanding the very excellent opportunities afforded him to follow the advice of other people, the farmer still persists in having a will and a way of his own. With all due respect to our farmer friends (and in my high regard for them I allow no man to go before me), I do not believe that they yet appreciate the great blessing the telephone has brought them.

The telephone—which, after all, has only had its development in the last six or seven years—is a greater boon to farmers than to any other class of people. The great drawbacks of country life are its isolation, its meager opportunities for social intercourse and its still fewer opportunities for protection.

When we add to these the disadvantages of being out of touch with the market and out of reach of the great news pulse of the country, the sum of the country life's shortcomings is complete.

The telephone changes all this. It comes as a benefactor, exceeding all others in its possibilities and usefulness. No man can fully estimate its benefit to the farmer. It brings his ear close to the market tickers of the world; brings the weather report to his door in time to protect his crop and cattle; and travels, what would be to him and his horses, weary miles, in the ordinary transaction of his every-day business.

The telephone should be welcomed by the farmer —with open heart and ready hand—to the best of everything he has. I regret to say that this is not always done. Our farmer friends still insist, in a great many localities, upon being somewhat beggarly in their treatment of the telephone.

The telephone cannot (any more than any other agency) perform its proper functions except under fairly good conditions. It is entitled to the very best we can give. It is no longer an experiment; it has demonstrated its usefulness and its right to a fore-front position in the economies of life as completely as have the locomotive, the steamboat, the reaper and the thrashing machine. It was extremely unfortunate in its birth, and its boyhood associations were not good; but it is fast approaching a glorious American manhood—"redeemed, regenerated and disenthralled."

Men do not now hesitate to put sufficient money into railroads; the steamboats on our lakes and rivers are perfect floating palaces, and the wise farmer pays a good price and gets a good article of reaper and thrashing machine when he has reaping and thrashing to do. It is, I am afraid, a slight reflection on the usual good sense of the average farmer who has progressed, in other respects, out of the cheap way of doing things, to find him insisting upon putting up cheap, grounded telephone lines, on native poles, 300 and 400 feet apart, marring the landscape and furnishing temptations to profanity by those who have to use them. A poorly constructed and badly managed country telephone line is many hundred times worse than no telephone at all. There was a time when those things served their purpose as educators, but that time has passed.

The large-letter primer (while a very excellent thing in its time and place) is not to be considered as a means of education by the chap who has reached the fifth reader, and is already fishing his jaw-breakers out of the Century dictionary. We live in a progressive country. It is our duty to progress with our neighbors. We have no business to be clogs upon the wheels of progress. It is the duty of every fair-minded citizen to undertake to discharge, faithfully and well, his fair share of the obligations of citizenship. The farmer who fails to do this falls short of doing his full duty. The country telephone is fast becoming the most important feature of rural life. It should be treated with the respect and liberality which is its natural due.

The country telephone line (and all other telephone lines which go along the country road) should be considered as part and parcel of the road itself. They should not (in my judgment) be considered as tenants of the road, or as something that is there by sufferance, or by the permission—grudgingly given —of those who, for the time, do not appreciate its advantages; but it should be regarded as a part of the road itself.

One of the primary functions of roads was that of facilitating messages between civilized peoples. The savages of the forest used their foot and bridle paths to transmit messages of peace or war, love or hate. Civilization early found its use for the messenger, and so well were his rights established that, I believe, it was laid down in the early common law that the pedestrian, bearing a message along the public highway, has rights superior to the horseman. The telephone is a messenger. More than that, it is a troop of messengers. It carries, from home to home, from heart to heart, the messages of the people. It should be as highly regarded and as free from interruption on the highways of the country as the bearer of a writ of habeas corpus. There are no other means by which messages can be transmitted with so little wear and tear to the roadway.

I look forward to the time when telephone lines will be regarded as such sacred property that men and boys will no more think of interfering with a country telephone line than they do now of throwing stones at windows or killing song birds, as they pass along.

In order, however, to be entitled to this high regard of the public, the telephone must, by its outward appearance, command the respect of the people. We are apt to say, sometimes, that "clothes do not make the man." I think this is true; but we cannot deny that outward appearances go a great way toward giving good or bad impressions of people and things.

Telephone lines should be substantially and neatly constructed. They should be of the very best material—good, heavy, well-shaped poles (no pole shorter than 25 feet nor smaller than six inches in diameter at the top); cross-arms should be of regular length, and the wire put on in a thoroughly mechanical manner.

I have an impression that, as time goes on, and our high regard for the telephone increases, we may get along with shorter poles, and put our wires as near to the ground as electrical conditions will permit. My thought is that we will not have to use very high poles anywhere, except at road crossings, and it is barely possible that we may reach a condition where it will be found easier to go under cross-roads than over them.

Wherever it is possible, I think that not more that one line of poles should occupy the same side of the road. It will be entirely possible to build a line sufficiently strong and symmetrical to take on all the lines that should go along any particular roadway.

Of course, it goes without the saying that all lines should be iron or copper-metallic, and, as nearly as possible, the maintenance of the whole line should be under the control of one head, without reference to how many persons or companies may be interested in the pole line.

One of the great troubles of the country telephone line—as, indeed, it is one of the drawbacks we all have in cities—is the trees. In the cities, we are able to escape this annoyance, very largely, by the use of cable; but, of course, it would be impossible to do this in the country. Not taking into account the great additional cost of that sort of construction, there are electrical considerations that make a continuously long cable line an impossibility. The trees on the country roads should give way to the telephone.

I am an advocate of trees, and believe that we should cultivate our forestry in every possible way consistent with the discharge of our other obligations. But as it was necessary to trim away the original forests to make the roads, so I would trim away the trees along the side of the roads which interfere with that part of the road which belongs to the telephone. Trees along highways, near residences, can just as well be set back 25 or 30 feet. They have no business on the highway or overlapping the highway, when they interfere with the uses of the highway.

The telephone is a proper use of the highway. In many respects it is the most important use. Being a comparatively new thing, it may take legislatures and courts a little while to appreciate all this, but just as surely as our American legislation and jurisprudence have found a way to clear all other obstacles from the path of material progress, so they will find a way to order the trees along the highways set back out of the way of the telephone. They will do this because the people will demand it—and the people, here, always get what they want.

Now as to village exchanges: I believe they ought to be made just as numerous as the wants of the people may require; in fact, I think a great number of small exchanges is infinitely preferable to a number of long, heavily laden party lines. There is not only utility in this, but a good deal of economy, as well. The larger the number of people to be reached and the quicker we can reach those whom we desire to communicate with, the better our service will be.

In my judgment, village exchanges should be encouraged everywhere, and these village exchanges should have direct communication with the county-seat exchanges and the exchanges in other towns of the county, and these latter exchanges, in turn, should be connected with the long-distance exchanges of the several states. Our combination of lines and exchanges should be so complete that the farmer, sitting at his own hearthstone, can communicate by telephone with anyone, no matter where located, to whom he desires to speak.

The equipment of these country exchanges should be, in all respects, first class. I regret that this is not always the case. It is often very poor, and I come now to show some of the causes for this.

With all due respect to the manufacturers—and I think the manufacturers are entitled to a great deal of credit for the development of the telephone business—I cannot help the feeling that they are very largely responsible for a great lot of shoddy, inefficient and wholly abominable telephone equipment in the country. They go upon the theory that the farmer wants something cheap, and that the way to catch him is to present a very low-priced article, without very much reference to how long it will last or what service it may give him in the meantime. This is little short of criminal, and cannot be too strongly condemned.

This association, and all other people largely interested in the telephone business who want to escape responsibility for bad service by other people, as well as by themselves, should set their faces firmly against the manufacturers who make, specially, "Cheap John" equipment for farmers' lines.

The truth is that, for many reasons, the farmer ought to have better equipment than anybody else. It is very much more difficult for him to get repairs than it is for anyone else; and besides, in the very nature of things, he soon becomes very much more dependent upon his telephone than does the man living in the city, where distances between business associates and neighbors are very much less, and where other facilities for communication are very much more numerous.

Another explanation for bad equipment in the country is the very short-sighted practice indulged in by some city companies of selling their worn-out material to farmers at reduced prices. A chain is only as strong as its weakest link; the telephone or switchboard that is not fit for use in town is certainly not fit for use in the country. "Good equipment everywhere" should be the motto.

The battlefield of the great telephone war which has been raging in this country for the last five years, with the victories always on the same side, has been largely transferred from the cities to the country. The Bell companies, in the days of their monopoly—and, in fact, until quite recently—positively refused to furnish service to the farmer upon any terms. Now they have changed their minds about that, and seem to have concluded that the farmer and the villager are not such bad fellows, after all. But their repentance has come too late. The farmer and the villager have been doing a thing or two for themselves, in the meantime. And this is part of what they have done in Indiana. I feel that you will pardon me for talking a little about my own state.

We have had a most desperate fight in Indiana for the last five years, notably for the last two years. We have been threatened by the opposition with everything from total annihilation to everlasting abode in eternal darkness. We were assured upon the honor of the very clever gentlemen who manage the Central Union Telephone company that we would lose every dollar we put into the telephone business, with the further cheerful assurance that they knew what they were talking about, and would personally see to it that their prediction would come true. In furtherance of this last determination, they spent a good deal of their "war appropriation" in superhuman efforts to prevent our people from putting money into the telephone business. It would be amusing, now, to read some of their statements. We learned long ago in Indiana that the immortal Lincoln was right when he said that, while one might fool part of the people all the time, and all the people part of the time, he could not fool all the people all the time.

When the first Independent telephone exchange was constructed in Indiana, the Central Union Telephone company had been paying, for 12 years, on a capital of $6,300,000 (three-fifths of which was pure water), annual dividends ranging from four to six per cent. It had no bonded indebtedness and no floating indebtedness that was reported.

When the fight with the Independents began, it ceased paying dividends—the last one being paid in 1895. In 1897 it borrowed two and a half millions of dollars; in 1899 it borrowed six millions of dollars, two and a half of which was set aside to pay the holders of the first mortgage of two and a half millions. The company now has, in addition to this $6,000,000 mortgage (according to recent publications), a floating indebtedness of $1,250,000.

Now, let me tell you what all this has resulted in: The Central Union now has (as shown by its own figures) 22,000 telephones in the state. The real number is smaller than this, but we can afford to be generous, and I propose to give it all it claims. The Independent telephone interests have in the state of Indiana by actual count 52,469 telephones. I know you will excuse me if I repeat those figures. After a "war expenditure" of seven and a quarter million dollars—begun upon the Independent movement when there were less than 3,000 Independent telephones in the state—the Central Union now has, for its expenditure, 22,000 telephones, and the Independent movement has 52,469.

The total population of Indiana (according to the census of 1900) is 2,516,000. There are 92 counties in the state, and there are 27 of these in which neither the Central Union nor any other Bell company has an exchange, large or small. The population of these 27 counties aggregates 491,000, and the aggregate number of Independent telephones in these 27 counties is 14,262. The total number of Central Union and other Bell company telephones used at toll stations only in those 27 counties is 197.

I submit this Indiana statement more especially for the benefit of our friends in different parts of the country who are just beginning their fight with the great monopoly. If you ask me how they fought us, I can simply say—every way. If there is any mode of guerilla warfare that they left untried, we have not been able to find it. The Independent development in Indiana has been accomplished by Indiana self-helpfulness and Indiana capital. Of the millions invested in the Independent telephone business in Indiana, less than $100,000 has come from outside of the state. More than that, the business is practically out of debt. The total indebtedness upon the Indiana Independent telephone property is less than 10 per cent. of its total value.

In this great success the farmers and villagers of the state have been of incalculable help. They realized (as all sensible men, similarly situated, must

1. Paper read before the Independent Telephone association of the United States at Buffalo, N. Y., on June 12, 1901.

have realized) that their only hope was in becoming a part and parcel of the great Independent movement.

The Independent movement gives opportunity for self-helpfulness and intelligent co-operation. That which a man can do for himself is most likely to be quickest done. The flexibility of the Independent plan is its greatest recommendation. There is no honest local movement that cannot find a warm welcome and a happy home in it.

It will not do to say that good service cannot be given by the Independents. Every unprejudiced man will say that the most indifferent Independent service in the country to-day is very much better than the average Bell service was when the Independent movement began.

The Bell companies, all over the country, are paying us the delicate compliment of imitation in many things, but more especially in their attention to the farmers and villagers whom, in their halcyon monopolistic days, they so severely let alone.

I would remind our farmer friends, the country over, who are skeptical, about this death-bed repentance:

"When the devil was sick
The devil a monk would be,
But when the devil got well
The devil a monk was he."

Discussion.

J. B. Ware, Detroit, Mich.: Mr. Sheerin has presented in such an able manner this subject that it is exceedingly difficult to discuss the paper, except in a very few minor particulars. There is no question but what the farmers' telephone is of greater importance to the entire telephone situation at the present time than the majority of us realize. There is a tendency in certain districts, because of a lack of communication by telephone, for the farmers to look after their own interests and develop that phase of business themselves. This has resulted in the establishing of a mutual or co-operative form of telephone business, with poor construction, the one object being to secure communication with neighbors. This kind of service is conducted, not upon a business basis, but upon more of a social basis. The rates are merely sufficient to pay the actual expenses of maintenance, and the maintenance is performed in as limited a manner as possible, with the result that an inferior service has been secured. The cost of the service, however, is so slight that those who thus build their own lines—and we naturally think more of our own than we do of that which belongs to others—have become satisfied to an extent with the conditions. If they are able in an emergency to reach their doctor or to call upon their neighbors for assistance, they see the advantage to be so great that they are contented, and continue under conditions which are extremely unfortunate for the entire telephone movement.

In other words, the farmers' telephone business naturally divides itself into two classes: First, the farmer who resides in the neighborhood of a large city or exchange of importance, so that his communication is desired particularly to that exchange center for commercial and business purposes largely. There is no difficulty in providing metallic circuits and good bridging telephones, if party lines are used, and giving service which is entirely satisfactory to the farmer and at a price which is, in a general sense, satisfactory to the exchange owner. With that class of rural telephones we are having no particular trouble. But the second class, which might be termed the social class of farmers, is formed of those who do not live in the vicinity of a large city, who have no produce to market, and who do not see the advantages of a good telephone service, as a general rule.

I was very much surprised a few months ago in discussing the matter of farm telephones with a man who has built a number of such social farmers' lines, having from 12 to 25 telephones on a single ground-wire circuit. I urged the advisability of putting up metallic circuits with not over six instruments on a line. He said to me: "Mr. Ware, you don't understand the farmers' proposition. You go out in that neighborhood, promise them a metallic service with six telephones on a line, and I will follow you, and give them the same rate and promise them 20 on a line, and I will get more contracts than you will get." And he was right, because what they wanted was to have as many farmers on a line as possible, for social purposes. Now, you and I can scarcely realize—at least I have had great difficulty in realizing that phase of the telephone business—that what they wanted was not the commercial advantages, but social advantages. Now, then, the evil of that is that no company desiring good service can afford to build that class of telephone lines from a business standpoint.

The farmer has had no outlet, as I mentioned, and the result is that he and his neighbors have cut some slim hardwood poles, just as Mr. Sheerin graphically described, and they bought their telephones at $8, $12 or $15, and connected them by steel, and often fence, wire; and they are actually talking over this class of lines. Their example has inspired the neighbors over in the next township to do likewise, and it has spread, until a large portion of the county has been covered by this social telephone system. Some farmer will consent to allow both lines to center in his house; he has a family sufficiently large to take care of the switching as an accommodation, and the result is that a man talks 10 or even 20 miles over two or three circuits to another farmer, perhaps on the other side of an exchange, and it actually costs him nothing. The evils of this free service are apparent to every man in the room. You cannot develop a toll-line system to compete with this class of telephone service. I have great confidence, however, in the development of these communities along the line of good service. Free toll or exchange service cannot be given and secure good service.

The Independent companies have made perhaps one mistake more frequently than others in establishing rates that are too low. I am talking particularly of my own state, Michigan. Other states, I hope, are getting larger rates, but in Michigan $12 is the limit for telephone service in farmers' communities, and there is a large number of communities where a less price is maintained. I believe that that class of farmers who use their telephones for commercial purposes, who are not fully realizing the advantages to be gained by telephones in their residences, who are unwilling to pay more than $12 and are now satisfied to go on party lines, will, in two or three years, or, at the outside, five years, demand of you gentlemen that they be given separate lines at higher, yet reasonable, prices. In other words, my opinion is, and I believe yours is, that outside of this social farmers' element, the farmers will want separate lines, or party lines with but two or three instruments. This means that where we have pole lines with 4½-inch and five-inch tops, pole lines with two, four or six wires upon them with perhaps six-pin cross-arms, in the next two or three years we are going to be compelled to furnish additional circuits. We are in the business from a financial standpoint; we want to get as high rates as are reasonable and fair. The farmers will find that they cannot do business satisfactorily over party lines. Already in portions of Michigan the tendency is manifest to change from party lines to individual circuits.

Now then, what is the lesson as to construction? Simply this: If you are able financially to do it, do it right; if you are not, you ought not do it at all. You ought to put poles up large enough to carry 10-pin cross-arms, and pole lines should be run with the expectation that the wires are going to double or treble in number in the future. That fact is an advantage, and a very large advantage, to the telephone business, because as subscribers require these separate lines they are willing to pay higher rates, and it gives us a chance to grow properly. They will pay rates that will give a reasonable return upon the investment, and every honest farmer and business man expects the telephone men to have a reasonable return upon their investments.

I am deeply impressed with the correctness of the statement made by Mr. Sheerin, that the farmers' telephones have proven of such immense value to the Independents in the past, and that the Bell companies, or at least a portion of them, have reached the point of realizing the importance of this class of business. I am delighted to be informed that the $100,000 president of the Central Union and Chicago and other Bell interests is opposed bitterly to farmers' lines, and in Indiana has recently caused them to be cut down in some instances. It is the best thing that could happen to the opponents of these Bell companies, because there is no way, in my judgment, for the Bell licensee companies ever to drive out Independent companies, except by getting the farmers' telephones and forcing the citizens of the cities, towns and villages to take Bell telephones in order to reach their farmer relatives. This rural business has heretofore been secured only by the Independents' friends, thus in many sections heading off the possibility of Bell competition.

But, gentlemen, there are a large number of Independent companies that have not developed the farmers' communities. Now, farmers' telephones, properly handled, are profitable, and they strengthen the exchanges in a way one cannot realize, until he has actually developed the rural territory. You must take care of your farmers, first, for your own good and for their good, and second, to weaken the enemy. If you don't do it this year, you will find the Bell companies will do it next year. They are at a point when they must do something, and I look before this year expires for a great development throughout their territory along the lines of farmers' telephones by all the Bell licensee companies. I am glad that in the territory with which I have been connected the farmers have been taken care of as a rule. The strength and success of the exchanges on the western side of the state and in the central portion of Michigan are owing largely to the fact that the farmers have been connected up only with the local Independent exchanges. But it pays to do what Mr. Sheerin says—it pays to build right; it saves rebuilding; it is economy in operation. It does not pay to buy inferior apparatus, and if there is any apparatus superior to others, it should be used on farmers' lines.

What has been said of farmers' lines is true to a very great extent of small village exchanges. I like the idea of connecting but few on a line, running numerous two or three-party lines to the farmers' exchange and then have trunking lines to the city or village exchange.

Personally, I want to thank the writer of that article on the very excellent paper, and I want to say in conclusion that we have found in Michigan not only the truth of the statement made by Mr. Sheerin as to quality of service, comparatively, between Independents and Bell, but we find that the Independent service in Michigan is better than the Bell in almost every instance. I don't know of an exception, and I challenge any man in this room to find an instance in which the Independent service is inferior to the Bell. The apparatus used by the Independents is the equal in quality, and in many instances the superior, to that used by Bell companies in a large portion of the territory developed. This is, as a rule, true as to the character of construction of all large Independent companies, as compared with Bell construction. There is no reason why we should not continue to keep ahead of the Bell in the next two years in telephone development, as the quality and apparatus and construction of our manufacturers are the most modern. There is no question about the final outcome, because we have the men and the material and the apparatus with which to give the very best service.

Speed of Rapid Transit Trains.

From the very first it has been the policy of the engineers of the Rapid Transit road in New York to make it a sine qua non that the rapid-transit road must be essentially a high-speed system, which will not merely possess an enormous carrying capacity, but will also transport passengers at a speed that has never been approached by any other road on the island. From the present terminus at City Hall Park, says the Scientific American, express trains are to be dispatched during the rush hours at two-minute intervals. They will make stops at Fourteenth, Forty-second, Seventy-second, Ninety-sixth streets, and the whole run to One-hundred-and-fifty-seventh street will be made in 16½ minutes. The fastest traveling at present provided for the public is by the express trains on the Ninth Avenue elevated railroad, on which the run, by actual timing, from Franklin street to One-hundred-and-thirty-fifth street, is made in about half an hour, the time between the same points by the local trains being 40 minutes. The average running speed of the Rapid Transit express trains, including stops, will be 38 miles an hour; and this means that, at times, the speed will rise to 50 miles an hour, and occasionally over that. The local trains will have an average speed of 18 miles an hour, which is about 50 per cent. greater than that of the present local trains on the Manhattan elevated roads. The express stations will be located at intervals of a little less than two miles, while the local stations will average about four to the mile. At one time the question of increasing the number of express stations was mooted; but the Rapid Transit Commission, by advice of its engineers, decided that, since the system was to provide, primarily, an express service, it would defeat the end in view to multiply the stops. It was further urged that the high speed of 18 miles per hour of the local service rendered it unnecessary to multiply the express stations, the passenger being able to quickly cover the distance between the express stations and his own particular stopping place by the fast local service. That an average speed of 18 miles per hour can be maintained with stations only a quarter of a mile apart is due to the rapid acceleration which is possible by electric traction, and also to the fact that the local stations are placed a few feet above the average grade of the line—an arrangement under which gravity assists the retardation of the train in approaching the station, and increases the acceleration when the train is starting.

Test of Wireless Telegraphy on the Lucania.

Marconi's system of wireless telegraphy was recently given a thorough test by the Cunard Steamship company in connection with the New York Herald. The Cunard liner Lucania had been fitted up with Marconi's instruments, both transmitting and receiving, and in her late voyage from Liverpool to New York messages were successfully transmitted and received by the steamer. As she steamed through the Irish Sea messages were sent to the training steamer Conway, stationed on the Mersey, and communication was held with her until the Lucania got out of range. After turning into St. George's Channel communication was opened up with a station at Holyhead and was maintained until 20 miles from shore. The tests are said to have been very satisfactory. The station at Nantucket lightship, which the Herald is installing, will be completed next month. It will then be possible to receive messages from an incoming vessel 12 hours before she is sighted off Sandy Hook.

Reduced Telegraph Rates Between Chicago and Milwaukee.

Announcement has been made by the Chicago and Milwaukee Telegraph company to the effect that it will transmit telegrams between Milwaukee and Chicago at the rate of 10 cents for 10 words and one cent for each additional word. The company accepts and sends any message, at the rates quoted, which can be delivered by telephone in either Chicago or Milwaukee. No arrangement has been made for the delivery of messages in any other way than by telephone, but they will be mailed to the persons for whom they are intended if they cannot be reached by telephone.

Syntonic Wireless Telegraphy.

By Guglielmo Marconi.

[*Continued from page 425.*]

postal authorities of Oldenburg, the total number of commercial wireless telegrams transmitted from and to the lightship between May 15th and the end of October amounted to 565, and of these 518 came from ships at sea, while 47 were transmitted to ships. Of the 518 telegrams, 35.7 per cent. were addressed to the North German Lloyd and 64.3 per cent. to other shipping firms. The installations are worked by ordinary operators in a most satisfactory manner, and on one occasion assistance was obtained for a man who was taken suddenly ill on the Borkum riff, and it was thus made possible to hand him over promptly for medical treatment on shore.

The system has been in operation at La Panne, near Ostend, and on the Belgian mail steamer, Princess Clementine, which plies to Dover. With a height of only 22 meters on the ship it has been found practicable to communicate from Dover Harbor to La Panne, 43 miles away, and this installation has proved of value in saving life and property. Thus, recently, a barque was wrecked on the Rattel bank. The Princess Clementine, which happened to pass near, at once sent a message to Ostend, and, before leaving, was able to tell the shipwrecked sailors that assistance was on the way. The men were all saved. On another day, coming within sighting distance of the Ruytingen lightship, situated about 15½ miles from Dunkirk, the captain of the Princess Clementine observed that he was being signaled. It appears that the lighting apparatus of the Ruytingen had got out of order. The captain of the mail packet immediately despatched a message, which was received by the installation at La Panne, and repeated to the lighthouse department at Dunkirk. A crew immediately set out for the lightship and effected the necessary repairs, and the great inconvenience and danger of the lightship not being able to have the lights in order were averted.

Another instance of the usefulness of the wireless telegraphy in an emergency was furnished when the Princess Clementine herself went ashore on the Belgian coast during a fog. Within a few minutes of the accident news of it was telegraphed from the stranded ship to Ostend, with the result that a tug was at once despatched to her assistance, and she got off at the next high tide. So successful has the installation of wireless telegraphy been on the mail steamer Princess Clementine, between Dover and Ostend, that similar apparatus is to be fitted on the other vessels of the same fleet.

The system has been in use, furthermore, since March 1st last for ordinary commercial telegraphy between the Sandwich Islands, where a regular charge is made for the same. An installation has also been successfully carried out by my assistants for the French government between Antibes, in France, and Corsica, a distance of 124 miles. As has already been published in the daily papers, much use has been made of my system in the navy during the voyage of the Duke and Duchess of Cornwall and York to Australia.

I have tried lately to ascertain how near a tuned transmitter which is radiating waves of a certain frequency must be to a receiver tuned to a different frequency in order that the said receiver shall be affected. I find that if we are working with oscillations which differ very considerably in period, a transmitter capable of sending signals 31 miles to a tuned receiver will not affect a non-tuned one at 50 meters. If the periods of oscillation of the two tunes are more similar to each other, then the non-tuned receiver may be affected even at several kilometers.

Considerable use is still made of the non-tuned system at my experimental stations, in order to be able to communicate with ships fitted with what I call the old system, and also in order to be able to communicate with the naval station at Portsmouth.

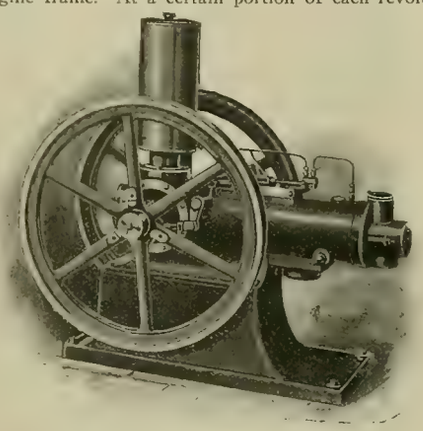
Time does not permit me to refer to a great number of experiments upon which I am now engaged, or which have been carried out by others, but I hope on a future occasion to describe better results. I have come to the conclusion that the days of the non-tuned system are numbered. The ether about the English Channel has become, in consequence of great wireless activity, exceedingly lively, and a non-tuned receiver keeps picking up messages or parts of messages from various sources which very often render unreadable the message one is trying to receive. I am glad to say, however, that I am now prepared with syntonic apparatus suitable for commercial purposes. And, as my final word on the general subject for the present, let me say that those who are responsible for the recent development of wireless telegraphy into a practical science cannot fail to find great satisfaction in the reflection that as already life has been saved that without this discovery would have been lost, so, in the future, apart from its manifold commercial possibilities, valuable as these are, humanity is likely to have before very long to recognize in telegraphy through space without connecting wires the most potent safeguard that has yet been devised to reduce the perils of the world's sea-going population.

Increase in the capital stock of the Wellsville Electric Light company of East Liverpool, Ohio, has been made from $30,000 to $100,000.

Mietz & Weiss Kerosene Engine.

The kerosene engine is becoming very popular for a small unit of power, where gas is not available, on account of its cheapness, its self-contained independence of operation and the low cost and ease of handling the fuel employed. In the accompanying illustration is shown a kerosene engine of the two-cycle type. An explosion occurring and an impulse being nominally imparted for each revolution, the claim is made that this type is more susceptible of easy and close-speed regulation than the four-cycle engine, while the governing device employed is highly effective.

The parts of an oil engine requiring lubrication are comparatively few, but it is of utmost importance for those to be properly attended to. Ring oilers in this case are used for the main bearing. The lubrication of the crank pin and the piston is taken care of by means of an oil reservoir placed at the side of the engine frame. At a certain portion of each revolu-



MIETZ & WEISS KEROSENE ENGINE.

tion there is a partial vacuum in the crank chamber and also in the cylinder, which is sufficient to draw the necessary oil up the copper tube and down past the sight holes, which permit its regulation by the sight feeds above. The oil for the crank drops into a groove on the top of the rod, whence it finds its way along to the pin.

These automatic oiling devices, it will be noted, are only operative when the engine is running; when the engine is stopped they require no looking after. One peculiarity of this, as of other oil engines, is that it has no throttle valve. When the engine is to be stopped it is only necessary to throw up the little finger which operates and regulates the admittance of oil. The Mietz & Weiss engine is manufactured by A. Mietz, 128 to 138 Mott street, New York city.

American Vitrified Conduit Exhibit at the Pan-American Exposition.

The American Vitrified Conduit company has an attractive exhibit of its manufactures in the east end of the Electricity building at the Pan-American Exposition. In the exhibit, which is illustrated in the accompanying picture, are included all the various styles of underground and interior conduits manufactured by the company, the whole making an interesting study for visitors to the exposition. The space occupied is ample to show off the wares with excellent effect, all being neatly arranged in a very pleasing manner. The interests of the American Vitrified Conduit company at the exposition are

AMERICAN VITRIFIED CONDUIT EXHIBIT AT THE PAN-AMERICAN EXPOSITION.

carefully looked after and guarded by W. E. Brown, a gentleman who has won many friends at the exposition by his attention to business and his courteous manner.

Improvements on Chicago City Railway.

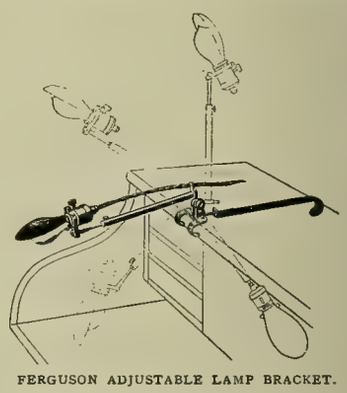
The Chicago City Railway company has about completed arrangements by which a great improvement will be made in its rolling stock. It is the purpose of the company to furnish the Wentworth avenue line with a complete new equipment of cars. Eight companies have made bids for the construction of the cars, but the railway company has not decided on the bids as yet. The number of cars to be constructed is 120, and they will be almost exact counterparts of the five cars recently put in service on the Wentworth avenue line, differing only in two or three small details. A description of these cars was given in the Western Electrician of March 2d. The cars will cost about $700,000 and the work of construction will be pushed as rapidly as possible, after the contract is let.

Bright Young Chicago Man Killed by Live Wire.

Frank Wiley, a bright young man employed as designer with the Chicago Laboratory Supply and Scale company, was instantly killed on June 10th by coming in contact with a heavily charged telephone wire. Young Wiley found the telephone at his home, 5226 Indiana avenue, out of order when he returned in the evening, and set out to discover the trouble. While sitting on an iron radiator he leaned out of the window and his little finger came in contact with the fuse block of the telephone line. A heavy current on the line passed through his body to the radiator, death resulting instantly. The coroner's jury found that the wire of the Chicago Telephone company had been crossed with a high-potential line of the Commonwealth Electric company, and in its verdict censured both companies. It is stated that a 10-ampere current of 2,000 volts was being carried on the Commonwealth lines at the time. Mr. Wiley was only 21 years of age, but was credited by his associates as being one of the very brightest young men of their acquaintance. He graduated from the English High School in Chicago in 1898 and served during the Spanish-American war with the United States Volunteers. Since his return he has been in the employ of the Chicago Laboratory Supply and Scale company, where his work as designer and original investigator was of an exceptionally high order.

Ferguson Adjustable Lamp Bracket.

The Smith & Hemenway company of New York is introducing the Ferguson adjustable lamp bracket, illustrated herewith, which is believed to be one of the best roll-top-desk lamps on the market. It is



FERGUSON ADJUSTABLE LAMP BRACKET.

adjustable to any size roll-top desk or upright piano and can be fastened on without the assistance of screws or nails. The reflector can be placed at any desired angle to prevent a glare in the eyes. It is ornamental because it is handsomely finished in enamel and nickel. The lamp is very durable, simple in construction and operation, and is quickly adjusted. There are no springs to get out of order or make bad contact. The accompanying cut illustrates a few of the angles at which it can be placed.

The Exide Automobile Storage Battery.

It has been reported that a recently perfected form of the Exide storage battery, produced by the Electric Storage Battery company of Philadelphia, has been selected by the New York Electric Vehicle Transportation company for service on the latter company's bus line on Fifth avenue in New York city. This Exide battery has been in practical use as a motive power for automobiles for the last three years, and has been used in all the vehicles recently put on the market by the Pennsylvania Electric Vehicle company of Philadelphia.

The Philadelphia Inquirer is authority for the following interview with Justus B. Entz, chief engineer of the Electric Storage Battery company: "The Exide battery has been evolved from the old-style lead-plate accumulator. It has been perfected, particularly for use in automobile construction. In three years' use on every type of automobile, from the light and speedy pleasure vehicle to the strongest and heaviest dray or delivery wagon, it has proven its perfect adaptability. While the battery made for general use on automobiles weighs only 62 pounds per horsepower, no effort has been made to secure lightness at the expense of strength or durability. A number of the 62-pound batteries have been in use in the auto-cab livery service in New York city for the last year. A more severe test could scarcely be applied to them. Over 2,500 miles have been covered by some of the cabs, and their batteries are still in good condition."

Morse Club Annual Banquet.

The Morse Club gave its sixth annual dinner at the Sturtevant House, New York, on Friday evening, May 24th, to celebrate the fifty-sixth anniversary of the transmission of the first telegraphic message. A short address, relative to the history and object of the club, was given by President Walter C. Burton. This was followed by brief addresses by Colonel A. B. De Freece, F. W. Jones, Gardner Irving, W. A. Van Orden, M. F. O'Brien and others. The following officers were elected to serve the ensuing year: President, Gardner Irving; vice-president, M. F. O'Brien; treasurer, M. F. Gaffney; secretary, M. H. Kerner; historian, W. A. Van Orden; governing committee, F. T. Meyer, F. W. Jones, W. C. Burton.

CORRESPONDENCE.

New York Notes.

New York, June 15.—Ten members of the Automobile Club of America took part in a run to Tuxedo last Saturday, which closed the series of club runs until fall. Cornelius J. Field and George Isham Scott were in the run as pacemakers. Kenneth A. Skinner, the motor-cycle racer, was the first to reach the Tuxedo Club. Coming home, Mr. Field covered the 36½ miles between Tuxedo and the clubhouse at Fifth avenue and Fifty-eighth street in one hour and 17 minutes.

Ground has been broken for the rapid-transit tunnel in the Borough of the Bronx at Gerard avenue and One-hundred-and-forty-ninth street. The tunnel will extend from Third avenue west to the Harlem River, where it will pass under the bed of the river. There are about 150 men at work there at present, and more will be added when necessary.

The Brooklyn Rapid Transit company has been compelled to return partially to steam power on several of its elevated lines. This has become necessary owing to the scarcity of electric power, as a result of the fires which have occurred recently in two of the company's power houses. Thirty locomotives have been put into operation.

The Glen Ridge Park association of Glen Ridge, N. J., has taken alarm at the fact that Thomas A. Edison has purchased the Hayden mill in Glen Ridge for the purpose of manufacturing his storage battery. The association communicated with the Borough Council and the latter body voted in favor of issuing $35,000 worth of bonds, to be used in purchasing the property for park purposes.

The property owners and business men of The Bronx are speculating as to the intentions of the New York and Port Chester Railroad company, which was recently incorporated. It announces that it is going to undertake the building of a third-rail system from One-hundred-and-thirty-second street, this city, to the state line in Port Chester. Representatives of the company have been in Port Chester, Mount Vernon, New Rochelle and other towns on Long Island Sound collecting signatures to a lengthy petition which the company will present at the meeting of the state railroad commissioners on June 21st to show that such a line is in demand by the public. The commissioners will then be asked to grant the new corporation a charter. The proposed route of the new road is through the towns of Rye, Harrison, Mamaroneck, New Rochelle, Mount Vernon and along the easterly portion of The Borough of the Bronx to East One-hundred-and-thirty-second street. A contest with the Union Railway company is looked for.

An ordinance is being prepared, by the president of the City Council, which is designed to prevent the crowding of passengers between the seats of open street cars. It will prohibit the transportation companies from carrying passengers in the aisles, and will contain a clause imposing a fine of $25 for every person that stands in the aisles, and on the conductor of any car who allows passengers to board a filled car.

The street-railway corporations owe the city $6,588,396.79, according to a special report made by Commissioners of Accounts Hertle and Owen to Mayor Van Wyck. This amount represents five years' arrearage, from 1895 to 1899, inclusive, and is the result of unpaid taxes for paving between the tracks, for franchise tax upon the gross receipts and car-license fees. According to the report, there is also owing to the state, by New York street railways, $3,077,868 for franchise taxes for 1900. M. L. G.

Information from Indiana.

Indianapolis, June 17.—The interurban railroad companies now entering this city have reached an agreement with the Board of Public Works on terms of the interurban franchise. The compensation is fixed at three cents a round trip over the city streets for the first 10 years of the franchise, four cents for the second 10 years and eight cents for the remainder of the franchise, which expires in 1933. It is agreed that the companies may continue to operate their cars over the streets until the first of the year without compensation, and gives the companies a year from the date of the franchise to provide freight stations or a joint station. The cars are required to keep off of Washington street, the most congested street of the city, and the franchise reserves the right to prescribe the routes upon which they may enter and leave the heart of the city.

The specifications for the city's new electric-light contract have been agreed upon, and bids will be advertised for in a few days. The new contract stipulates for a minimum service of 1,500 arc lights of normal 2,000 candlepower each, and as many more lights as the city may from time to time require. This is double the amount of lights contracted for eight years ago, but the city at present is paying for 1,227 lights. Each bidder is required to state the rate of per cent. which, if his bid is accepted, shall be paid to the city from the gross receipts of the public and private lighting supplied under the contract. The moonlight schedule is eliminated and the term limited to 10 years.

The Monticello electric-light plant changed owners during the week, the Tharp brothers selling to A. T. Barnes and George A. Harris of Antwerp, Ohio, for a consideration of $22,000.

The authorities of Cambridge City report having tried municipal ownership of electric lights for over a month and are well satisfied with the experience. There was in use during May 37 arc lights and 500 incandescent commercial burners, and these cost much less than the old company charged for half-night service. The streets are lighted better, and besides, the commercial revenues go to the city.

The work of surveying the extension of the Union Traction company's line from Elwood to Tipton has begun. The Tipton franchise expired a week ago, but it was modified and extended, giving the company until September to complete the line.

The Toledo and Indiana Railway company was incorporated on the 15th inst. at Columbus, Ohio, with a capital stock of $1,000,000. The company proposes to operate an electric-railway system having its terminal in Toledo, with branches reaching out into Ohio and Indiana.

Philip Mater, vice-president of the Union Traction company, and one of the directors of the Richmond Traction company, reports that the latter company has bought the abandoned local electric power plant of the Union Traction company, and will move it to Richmond at once. The plant consists of all the necessary engines and machinery for a first-class power station.

The Indianapolis and Vincennes Railway company (a steam road) has filed four petitions against the Indianapolis and Martinsville Rapid Transit company to enjoin the latter from encroaching on its right-of-way in at least four places along the proposed route of the electric line.

The war with the interurban lines continues. Two weeks ago the Big Four opened its fight against the competing interurban lines. The managers claim that they are cutting into the business of the trolley lines extensively, and have recovered a great deal of their lost patronage. An increased number of trains and reduced fare is doing the work, they say. The interurban people now propose to carry on the contest. Fares will be reduced and fast trains put in operation that will come near equaling the steam-train time.

Judge Jones of the Elwood Circuit Court, in the case against the Republic Iron and Steel company, rendered a decision upholding the weekly wage law recently enacted by the Legislature. The steel company has no right to withhold the wages of its workmen on the ground of their being indebted for house rent, the company owning the houses rented to its employes. F.

New England News.

Boston, June 15.—Secretary Driscoll of the state branch of the American Federation of Labor has sent a report on the linemen's strike to each central union and local labor organization in Massachusetts. The report asks for the support of the various members, and the organizations are invited to appoint committees to request their respective city or town governments not to grant permits of any kind to the New England Telephone company until the strike is settled.

Electric-car traffic has so seriously affected Sunday travel on the Medford branch of the Boston and Maine railroad that all Sunday trains have been ordered discontinued on and after June 30th. The order will remove 40 Sunday and 14 weekday trains.

The New England telegraph corps of the Associated Press held its annual banquet at Hotel Cecil in this city on Sunday, June 2d. E. M. Fisher presided. Every New England circuit was represented and there were a number of guests. Informal speeches were made and the members of the organization reviewed the past year. The association re-elected the following officers: President, Chief Operator E. M. Fisher of Boston; vice-president, G. W. S. Burroughs of Providence, R. I.; secretary, Park J. Stewart of Manchester, N. H.; treasurer, C. G. Rogers of Boston.

The New England Wireless Telephone and Telegraph company recently closed subscriptions to its stock. The proceeds from the stock sold are to be used in installing the wireless system. The company announces that the shares will receive all net earnings in quarterly dividends and that the directors have contributed 100,000 shares (par value, $1) of their individual holdings for the purpose of obtaining funds for a factory for wireless-telegraph instruments. It is stated that this stock will be entitled to regular dividends and three-quarters of the profits of the construction fund.

The Mechanics' Electric company, organized at Portland, Me., has filed certificate of organization with the Maine secretary of state. It proposes to do a general contracting business, with a capital stock of $100,000, of which the sum of $500 has been paid in. J. Ross Bates of Hyde Park, Mass., is president, and Henry N. Bates of Hyde Park, Mass., is treasurer.

In the city of Pittsfield, Mass., a new sewerage system is to be installed, and the Stanley Electric Manufacturing company, located there, is to furnish an electric motor for the pumping machinery. It is proposed to drive the triplex power pump by a directly connected synchronous motor of the Stanley make.

At 5:30 a. m., last Monday, the first public trains were started on the elevated road of the Boston Elevated Railway company, the route covered being between Sullivan Square, Charlestown, and Dudley street, Roxbury, a distance of about four miles, including the subway. Thousands of people have crowded the cars daily, most of them riding for the novelty of elevated transit. The immense crowds and minor accidents, due to the newness of things, caused many delays during the first day. The first trip from Dudley street was made in 50 minutes. It is expected that the trip will be made in 19½ minutes when matters are in their normal condition. The matter of free transfers is at present in a state of confusion, and during the first two days many rode over the route several times for one fare. The railroad commissioners inspected the elevated structure last week, and expressed their approval thereof.

New Haven, Conn., is to be connected with Waterbury, Meriden and Derby, Conn., by electric railways, the necessary legislation having been obtained. The main tendency of electric-railway construction in Connecticut is toward interurban lines.

It is reported that the United Gas Improvement company of Philadelphia will soon control the entire electric street-railway property of New Haven, Conn. This property is worth $6,000,000, and it earns large dividends. The purchase has been made through the Connecticut Lighting and Railway company.

The electric linemen who struck for a working day of nine hours at a minimum pay of $3 have been defeated. Many of them who were employed by the Boston Elevated Railway company, have returned to work at the old terms; others have modified their demands to suit the company, and others have sought work elsewhere.

Artemus Upham of Boston recently appeared before the Lowell (Mass.) city committee on wires and explained his trackless-trolley system and asked for a franchise in that city. When asked if his company would be willing to pay for a franchise, Mr. Upham said that the city ought to pay the company, since it would keep the streets in repair by means of a trolley road roller. The committee took the matter under consideration.

The Washington street subway bill just passed by the state Legislature authorizes the construction of an additional subway in Boston about one mile long, under or parallel with Washington street, from Broadway to Haymarket Square, where it will connect with the existing subway system; to be built by the Boston Transit Commission, the cost not to exceed $6,000,000; the money therefor to be furnished by the Boston Elevated Railway company; but the subway to belong to the city of Boston, which shall lease it free of charge to the railway company for 40 years, on condition that the company maintains and operates it without expense to the city.

The Senate has engrossed the bill providing for an inspector of electric meters.

The Waltham (Mass.) aldermanic committee on finance has recommended the erection of a building suitable for the electric-wires department of the city, the building to cost about $7,500.

Fire Commissioner Russell of Boston has called the attention of Boston elevated-railway officials to the danger offered firemen from the third, or feed, rail on the elevated structure. He suggests that the rail be boxed in some way so as to minimize the danger. B.

Northwestern Notations.

Minneapolis, Minn., June 15.—The council of Kaukauna, Wis., has granted a franchise through the streets of that city to the Wisconsin Traction, Light, Heat and Power company. The company will at once build a line from Appleton to Kaukauna.

The Clear Lake Electric Light and Telephone company of Clear Lake, S. D., contemplates putting in a gas plant instead of an electric-light plant.

A movement is under way at Mondovi, Wis., to form a stock company and absorb the electric-light plant and roller mills and operate both from one power plant.

The Des Moines Interurban Railroad company contemplates building an electric belt line north of Des Moines, Iowa, to operate both passenger and freight trains.

The extension of the West Third street car line in Duluth, Minn., is proposed, from its present terminus at Fortieth avenue West to the new Fairmount Park at West Duluth.

The Winnipeg Electric Street Railway company of Winnipeg, Man., is planning extensive improvements to its system. The improvements will include a new car shed, 135 by 300 feet in size, and a repair shop, 108 by 130 feet.

The Corning Electric company of Corning, Iowa, has put its new electric plant in operation. The old plant was burned March 26th.

The county commissioners at Tacoma, Wash.,

have granted a right-of-way through the county for the proposed Tacoma-Seattle interurban railway. The company will let contracts for the construction of the system at once. The officers hope to have the line in operation by the first of the year.

The Duluth-Superior Traction company has placed several long, double-truck cars in service in Duluth, Minn.

Arrangements have been completed for the construction of the projected electric-railway line from Sheboygan, Wis., to Elkhart Lake, via Plymouth. Work is to be started on the line at once.

B. E. Dwinell & Co. have been granted a franchise at Amherst, Wis., for an electric-light plant.

The Seattle Electric company of Seattle, Wash., will install a complete telephone system for the management of its cars. A regular system of dispatching will be inaugurated. Cars will report their arrival at the end of the line, also their departure. In case of accident, the trouble can be immediately reported. Crowds on holiday occasions can be reported, and in other ways the system will work to advantage. A regular train sheet will be kept of all the cars on the line.

It is reported from Eau Claire, Wis., that Arthur E. Appleyard of the Chippewa Valley Electric Railway company is interested in a project to construct an electric-car line from Eau Claire to St. Paul, via Menomonie, Hudson and Stillwater. The plans also include the ultimate construction of a line down the Chippewa Valley from Eau Claire to connect with the Burlington railway, but the construction of the latter is contingent upon the success of the former.

Joseph Parkin seeks a franchise from the council of Everett, Wash., for the construction of an electric railway from Silver Lake to Everett. The plans contemplate a line which shall reach southward to Seattle.

A trolley system or dummy line is projected from Rock Island to Aledo, Ill., to take in the towns of Andalusia, Edgington, Buffalo Prairie, Petersville and Marston.

Surveyors have begun work laying out an electric line which is projected to run between Baraboo, Wis., and Portage. Milwaukee parties are the promoters.

The Des Moines City Railway company of Des Moines, Iowa, has concluded its contract for cars, and will henceforth manufacture its own freight and passenger cars for its city and interurban lines.

The strike of electrical workers at Minneapolis has been ended and the men have returned to work. The employers will recognize the union and will pay the scale demanded, and the men will waive their demands regarding overtime.

The street-railway company has large double-truck cars in operation on the Grand avenue and Lafayette lines in St. Paul. The new trackwork on Wabasha street has been completed, and the interurban lines have returned to their old route.

The Twin City Rapid Transit company is considering the construction of an electric line from Minneapolis to Lake Minnetonka. The company also plans to construct the proposed power dam across the Mississippi River at Coon Creek, above Minneapolis.

An electric-car line is projected between Beaver Dam and Mayville, Wis. Fond du Lac capitalists are interested.

The Citizens' Gas and Electric Light company will erect a fireproof substation in Council Bluffs, Iowa, to distribute the current received from Omaha for lighting the city streets. The company will use the enclosed arc for street lighting, and it is a question if the towers in the city, of which there are nine, can be used.

The board of water commissioners of St. Paul will have an investigation made to determine the extent of damage done to water pipes by electrolysis. When this report is completed, the board will proceed to demand of the street-railway company that it take steps to prevent further damage by stray current.

Articles of incorporation have been filed by the Des Moines, Nevada and Eldora Electric Railway company, with $50,000 capital stock. The incorporators are: President, H. H. Polk; vice-president, W. F. Swaze; treasurer, Simon Casady; superintendent, G. B. Hippee; secretary, A. G. Maish, and F. C. McCall, Parker S. Davis, John Porter, Mark J. Furry and L. S. Cass.

Ottumwa, Iowa, will vote on July 8th, on granting a franchise to the Ottumwa Electric and Steam company for an electric-light and street-railway system.

D. O. Fisher of Grand Rapids, Wis., has asked the council of that city for a franchise to build an electric railway through its streets. It is to be part of the proposed electric railway from Stevens Point to Nekoosa.

The council of Appleton, Wis., has granted a franchise to the Fox River Valley Electric Railway company to lay tracks for the interurban line to Kaukauna.

The street-railway company in Duluth will replace the incline-railway system with a counterweight device and electric power. The system is to be ready for operation by October 1st.

L. V. Wells has let contracts for the establishment of an electric-lighting plant for Wenatchee, Wash.

The Interurban Railroad company of Des Moines, Iowa, has started work for an electric belt line to connect with some of the brick yards and coal mines in the vicinity of the city.

Sweeny & Ort have formed an electric-lighting company at Manning, Iowa, and will proceed to establish a plant.

Winterset, Iowa, voted a franchise for the proposed interurban line from Des Moines by an overwhelming vote. R.

PERSONAL.

Irvin Butterworth, formerly president of the Ohio Gas company at Columbus, Ohio, has been appointed to succeed Henry L. Doherty as general manager of the Denver (Colo.) Gas and Electric company.

Warren M. Bicknell, auditor of the Southern Ohio Traction company, has resigned, to become traffic manager of the Miami and Erie Transportation company. Manager Sloat of the Southern Ohio will also have charge of the construction work of the new road. C. S. Thrasher of Cleveland succeeds Mr. Bicknell.

The marriage of J. Arthur Jones and Miss Lillian Mae Wamser on June 5th has been announced. Mr. Jones is a popular young man connected with the Chicago office of the Northern Electrical Manufacturing company of Madison, Wis. Mr. and Mrs. Jones are at home at the Lexington, Twenty-second and Michigan boulevard, Chicago.

Prof. Eugene Haanel, who has been at the head of the department of physics in Syracuse University, New York, for the last 13 years, has resigned. The cabinet of the Dominion of Canada has appointed Professor Haanel superintendent of mines of Canada. He was a former professor in Victoria College and a charter member of the Royal Society of Canada.

William R. Holligan of Chicago has resigned his position of city superintendent of the Postal Telegraph-cable company and will associate himself in the brokerage business with W. J. Osborne. Mr. Holligan is well known to the telegraphic profession in numerous American cities. He began his career in 1872 as a messenger boy in the service of the Western Union Telegraph company and remained with that company until December 1, 1900. On that date he accepted the position of city superintendent of the Postal company, the post which he has just relinquished.

Mr. Edward R. Ford, cashier of the Western Electrician, was married on the afternoon of June 15th to Miss Mary E. Fox of Chicago. The ceremony was a private one and took place at the Church of the Covenant in Chicago, the officiating clergyman being Dr. Bryan. The bride is a daughter of Mr. and Mrs. John C. Fox of Minneapolis, Minn., and formerly resided in Cedar Rapids, Iowa. Mr. Ford has been connected with the Western Electrician for the last six years in his present capacity. After a short trip Mr. and Mrs. Ford will be at home at 520 East Sixty-fifth street, Chicago. The Western Electrician joins with their many friends in extending good wishes.

ELECTRIC LIGHTING.

A new power house is contemplated for the city electric-light and waterworks plant at Alexandria, La.

A company is being organized at St. Michaels, Md., with $10,000 capital stock, to erect an electric-light plant.

The Syracuse Lighting company of Syracuse, N. Y., has been incorporated, with a capital stock of $2,500,000.

The People's Gas, Electric and Heating company, Bloomington, Ind., has been incorporated by A. M. Barron, F. B. Sherman and others, with a capital stock of $10,000.

W. O. Turner, C. Wolfe and N. W. Dalton have incorporated the Upper Hudson Electric company at Hudson, N. Y., with a capital stock of $100,000. The purpose of the company is to furnish gas and electricity in the towns and villages in Greene County.

The deal consolidating the Birmingham (Ala.) Railway, Light and Power company, the Consolidated Electric Light company and the Birmingham Gas company into one corporation has been completed. The corporation will have a capital of $10,000,000.

A charter has been granted to the Corning Gas and Electric company of Corning, N. Y. The company will furnish gas and electricity to Corning and Hornellsville and the villages of Addison, Avoca, Bath, Hammondsport, Canisteo and other villages and towns in Steuben County. The company has a capital stock of $375,000.

ELECTRIC RAILWAYS.

Mr. Van Ginkel of Dallas, Texas, is planning a big interurban electric road approximating 200 miles of track, to be constructed from Dallas to Denison, thence to Paris, and back to Dallas by way of Greenville and intermediate towns.

A party of Baltimore and Philadelphia capitalists has purchased the San Francisco and San Mateo electric railway of San Francisco, Cal. The deal had been in progress several weeks when the owners of the property decided to accept the eastern capitalists' offer. The road will be extended to San Mateo and then on down the peninsula through Redwood City, Palo Alto, Menlo Park and Santa Clara to San Jose.

Representatives of the Kenosha Street Railway company have appeared before the town board of Pleasant Prairie, Wis., asking for a franchise from Kenosha to the state line. The company has practically secured the right-of-way between the state line and Waukegan. This will complete the through electric railway from Chicago to Milwaukee.

The Cortland County Traction company has been incorporated at Cortland, N. Y., to purchase, and operate under, the Cortland and Homer Traction company's franchises. The authorized capital stock is $320,000. The directors are C. D. Simpson, William B. Wait, Frank Battles, George H. Fisher, Herman Bergholtz, H. P. Simpson, G. H. Garrison, B. T. Taylor, Edwin Duffy and E. H. Brewer.

AUTOMOBILES.

The Essex Automobile and Supply company has filed a certificate of incorporation with the secretary of state of Maine. The company has an authorized capital of $125,000, and proposes to manufacture automobiles. Levi M. Hall of Haverhill, Mass., is president, and Horace Mitchell of Kittery, Me., is treasurer.

PUBLICATIONS.

The J. G. Brill company of Philadelphia has issued a catalogue devoted to the Brill convertible car. Exterior, interior and detailed views of cars are given, together with complete descriptions.

The Lea Electric Manufacturing company of Elwood, Ind., has recently issued a folder relating to its exhibit at the Pan-American Exposition. The circular also contains some appropriate electrical verses.

The close of the college year has brought forth a number of technical annuals from the engineering schools. No. 15 of the Technograph, published by the engineering societies of the University of Illinois, is a volume of 150 pages and contains some 20 articles on electrical, mechanical and mathematical topics. The Wisconsin Engineer, published by the students of the College of Engineering, University of Wisconsin, is a very creditable number, as is also the annual containing the proceedings of the Purdue Society of Civil Engineering, Purdue University. The field of technical college annuals is broadened this year by the first appearance of the Tufts Engineer and the Iowa Engineer. The former is issued by the Engineering Society of Tufts College and the latter by the engineering department of Iowa State College. Both contain valuable contributions to technical literature.

SOCIETIES AND SCHOOLS.

The ninth annual meeting of the Society for the Promotion of Engineering Education will be held in Buffalo, N. Y., on June 29th, July 1st and 2d. The programme includes 20 papers, in addition to the reports of committees, etc.

In view of the large number of students who will visit the Pan-American Exposition, the International Correspondence Schools of Scranton, Pa., have established an information bureau at their Buffalo office. Arrangements have been made to secure accommodations, both in hotels and private families, during the exposition. All correspondence intended for the information bureau should be addressed to the International Correspondence Schools, Ellicott Square building, Buffalo, N. Y.

MISCELLANEOUS.

At the meeting of the National Metal Trades association in New York city last week the recent action of the administrative council in asserting its independence of the International Union of Machinists was indorsed and it was unanimously decided to carry on the war resulting from the machinists' strike.

TRADE NEWS.

The Lacy Manufacturing company of Fayetteville, N. C., is in the market for immediate delivery of a 20-horsepower engine and a 100-light dynamo complete.

The Duncan Electric Manufacturing company, Chicago, Ill., has been incorporated, with $100,000 capital stock. The incorporators are Charles A. Brown, George L. Cragg and Harvey L. Harrison.

The Scientific and Electrical Exchange has been incorporated in New York city, with a capital stock of $25,000. The directors are W. F. Thompson, A. E. Hartcorn, F. S. Cutler and W. D. W. Miller.

The Automatic Boot Blacking Machine company, New York city, has been incorporated, with a capital stock of $2,000. The purpose of the company is to manufacture machines to polish boots and shoes by electricity.

Early on Tuesday morning, June 18th, a small fire broke out in the rear of the large machinery storage house in connection with the Gregory Electric company's warehouse and factory on Clinton street, Chicago. The fire was soon extinguished, only a small proportion of the machinery in the back

of the warehouse being slightly damaged by water. The Gregory Electric company is fully protected by insurance, and the small conflagration in nowise affects its business.

W. H. Miller, John W. Brown and J. E. Beyers have incorporated the United States Electric Manufacturing company at Camden, N. J., for the purpose of manufacturing electrical devices. The capital stock is $500,000.

The general offices and the engineering department of the Stanley Electric Manufacturing company at Pittsfield, Mass., have been moved into commodious quarters at the company's new works. Several of the other departments are also installed there, and by the end of June the new plant will probably be completely occupied.

The B. F. Sturtevant company has recently completed the purchase at Hyde Park, Mass., of a tract of land containing some 15 or more acres, and is preparing plans for the erection thereon of a large up-to-date plant for the manufacture of blowers, engines, motors, forges, heating apparatus, etc. The new site is on the same railroad line as, and only five miles from, the old plant, and is less than 10 miles from Boston.

The Western Electrical Supply company of St. Louis has recently gotten out two attractive bulletins covering fan motors and ceiling fans for direct and alternating current. The company is offering for direct current the now well-known Peerless ceiling and desk fans. The 1901 model of these fans embodies a large number of improvements, both in inside construction and artistic outside designs. For alternating current the company offers the Emerson desk and ceiling fans. The style of these fans does not materially differ from last year's. The manufacturer calls special attention to the Parker noiseless blades, with which all these fans are equipped.

BUSINESS.

A price-list recently sent out by the St. Louis Electrical Supply company of St. Louis, Mo., gives quotations on insulated and bare wires, lamp cord, etc.

The Electric Appliance company, Chicago, is putting out a new dry battery under its well-known name, Eaco. The company especially recommends this battery for telephone work and where heavy service is required.

The Beardsley Gravity Dam and Construction company of Elkhart, Ind., recently secured a contract for a dam for the Stanton Water Power company at Stanton, Neb., and one for a dam at Caro, Mich., for the Caro Electric Light and Power company.

In the machinery hall of the Chicago House Wrecking company, West Thirty-fifth and Iron streets, Chicago, are shown boilers, engines, dynamos and other mechanical and electrical machinery purchased from all parts of the United States. It is safe to say that no matter what a concern may wish to buy in the machinery line, it can be found in the establishment of the Chicago House Wrecking company. This machinery is warranted in every way, and a binding guarantee is given with every sale. All those in the market for machinery of any kind should get the company's new catalogue, No. 156, which would doubtless prove of interest.

The Falcon fan motor for direct current is one of the leading fan motors on the market. It is made in three sizes, 12-inch, 15-inch and 18-inch, finished in black enamel, with polished-brass fan and guard. In operation this fan is said to be perfectly noiseless. It is provided with a universal joint, which makes it adjustable for either wall or desk use. The Central Electric company of Chicago is agent for this fan motor and will be pleased to send to anyone upon request its 1901 fan-motor catalogue describing the Falcon, as well as numerous other fans, which include direct and alternating-current desk and bracket and ceiling fans, also battery fan motors.

The L. Wolff Manufacturing company, manufacturer of plumbers' supplies, recently contracted with the Northern Electrical Manufacturing company of Madison, Wis., through its Chicago office, for a complete equipment of generators and motors, to be installed in its large works located at Carroll avenue and Robey street, Chicago. Constant additions to the Wolff plant, coupled with the necessity of introducing modern methods to compete with other and younger manufacturers who have equipped their factories with electric-motor drive, were the principal reasons for making the change at this time. The installation will consist of two 200-kilowatt, 250-volt generators, direct-connected to Allis-Corliss engines, operated at a speed of 110 revolutions per minute. The motors will be slow speed, a number of them being entirely enclosed, and arranged, as far as possible, for individual driving of machines throughout the plant. They will range in size from 7½ to 80 horsepower.

ILLUSTRATED ELECTRICAL PATENT RECORD.

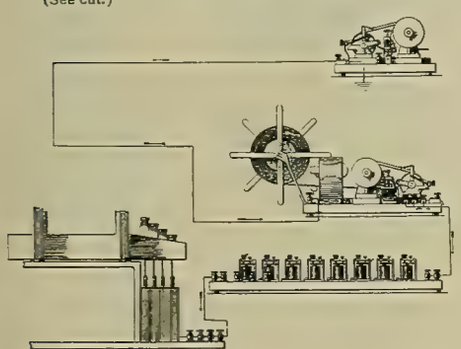
Issued June 11, 1901.

675,878. Electrograph. Michael Beck, Minneapolis, Minn. Application filed August 8, 1899.

A receiver and a transmitter are combined with an electric circuit which has means for interrupting the flow through it. The transmitter involves an impression plate coated with a substance, the electrical resistance of which is affected by varying shades of light. The receiver involves an impression plate having a coating or covering variably affected by the electric current of varying intensity. The transmitter and receiver each further comprises tracers and has means provided for moving the same in synchronism over their respective impression plates.

675,894. Printing Telegraph. Freeman H. Littlefield, St. Louis, Mo., assignor of two thirds to Mordecai Yarnall and J. O. Chenoweth, St. Louis, Mo. Application filed June 18, 1900.

This device comprises a pair of levers connected to the line wire which are adapted to co-operate with a perforated tape. Back stops for the levers are connected to opposite poles of grounded electric generators and a local circuit comprising a generator. A circuit-breaker is controlled by one of the levers, and an electromagnet having an armature is arranged to break the normal ground connection of the back stop of the opposite lever and to close a second circuit from ground through a generator of greater strength than the generator in the normal ground connection of the back stop of the opposite lever. (See cut.)



NO. 675,894.

675,895. Printing Telegraph. Freeman H. Littlefield, St. Louis, Mo., assignor of two-thirds to Mordecai Yarnall and J. O. Chenoweth, St. Louis, Mo. Application filed February 23, 1901.

A permutation system comprising a plurality of circuits and circuit-changing magnets is arranged to complete some particular circuit according to a predetermined code. There is a relay magnet in each circuit so completed, and also a local circuit for each of the relay magnets normally open at the armature thereof. Each of the last-mentioned circuits comprises a printing solenoid. A second magnet is provided for each of the relay magnets. Each of the second magnets is in a special local circuit and is arranged to act on the armature thereof. The circuit of the second magnet is normally open at the armature of the solenoid and is adapted to be closed thereby.

675,918. Storage Battery. Vincent G. Apple, Dayton, Ohio, assignor to the Dayton Electrical Manufacturing company, Dayton, Ohio. Application filed November 1, 1900.

An integral, metallic containing case is provided with two compartments with interior surfaces within each compartment which are susceptible of electrochemical activity. There are removable electrochemically active elements in each compartment, of potentially opposite character, with respect to each other and with respect to the interior surfaces of the compartments in which they are contained. (See cut.)

675,931. Electric Meter. Luigi E. G. Cauro, Naples, Italy. Application filed December 31, 1897.

This device is provided with an auxiliary winding in series connection with an induction or armature coil, the field of which is intended to overcome passive resistances. It is also provided with an automatic brake for preventing the moving parts revolving when the working apparatus is out of operation in the circuit, for which the meter counts the consumption. The brake comprises a disk on the shaft of the armature and a magnet having a tail to bear on the disk. The magnet is arranged adjacent to the field coil.

675,995. Method of Producing Phase Compensation. Ludwig Gutmann, Peoria, Ill. Application filed January 28, 1901.

This method consists in producing a flux of smaller angular displacement than required, by means of a current in a coil embracing a magnetizable core, inducing by the flux a secondary magnetic flux through the agency of a close-circuited conductor, in a core external to its core proper. The secondary flux is superimposed upon the magnetic core of the primary flux and thereby produces a magnetizing effect equivalent to the required angular displacement.

675,996. Electric Meter. Ludwig Gutmann, Peoria, Ill. Application filed June 6, 1900.

An armature engages with a counting train. A magnet influences the armature, and means are provided for producing two constant alternating magnetic fields acting on the armature having 90 degrees phase displacement, or approximately so, whose axes are identical. Means are also provided for producing a third and variable magnetic field reacting on the armature in such a plane that its flux path is non-intersecting with the magnet whose flux lags most.

676,006. Reception and Retransmission of Electrical Impulses. Alexander Muirhead, Shortlands, England. Application filed February 20, 1901.

A tongue in a telegraphic receiver is operated through the received impulses. A contact body upon or against which the tongue makes contact is divided into three conducting sections, the two outer of which constitute the terminals of a split battery. A local relay and battery is included in a circuit completed through the receiver tongue and the central conducting section of the contact body. Apparatus in the local circuit of the local relay serves to convert into the correct number of separate impulses the effect of any prolonged contact made by the receiver tongue.

676,035. System of Electric Propulsion. Henry Halberstadt, Kenosha, Wis. Application filed January 26, 1900.

A motor car has a platform at each end and a trolley pole is journaled to each platform. A spring on each trolley pole keeps the latter normally in a downward-projecting position. A line of beams is supported upon the track ties intermediate of the track rails. The beams have longitudinal grooves in the upper surface. A series of pointed screws or spikes is driven down through the grooves into the beams. A series of heads of insulating material is secured to the upper ends of the screws or spikes, below the top surface of the beams. The heads have grooves in the upper surfaces. A continuous feed wire is supported by the heads and fits loosely within the grooves below the top of the beams. A series of drain channels extends at intervals from the groove through the beams.

676,043. Electric Drill. John C. Lincoln, Cleveland, Ohio. Application filed November 22, 1899.

A platen is arranged between two magnets. Means are provided upon one of the magnets for moving the platen in one direction, and there are means upon the other magnet for moving the platen in a different direction.

676,068. Incandescent Electric Lamp. Levi Lobenthal, New York, N. Y., assignor of one-half to Thomas E. McIver, New York, N. Y. Application filed October 11, 1900.

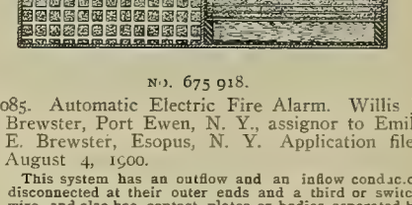
A primary and an auxiliary filament have a plate connected to the corresponding terminals of both. A slotted collar surrounds the base of the bulb and is connected with the opposite terminal of the primary filament. A contact piece is located in the slot of the collar and is connected to the opposite terminal of the auxiliary filament. There is an annular groove in the collar, and a rotating ring having a swelled portion is mounted within the groove and is adapted to make or break contact between the collar and the contact plate.

676,069. Incandescent Electric Lamp. Levi Lobenthal, New York, N. Y., assignor of eleven-twentieths to Thomas E. McIver, New York, N. Y., and John McCullough, Newark, N. J. Application filed April 1, 1901.

Two filaments have a plate connected to the corresponding terminals of both. A slotted collar surrounds the base of the bulb, and a number of contact plates are located in the slots of the collar adjacent to but insulated from each other. These are connected to the terminals of the filaments, and a ring is mounted on the collar having an open portion of a width substantially equal to the conjoint width of the contact plates and the space between them.

676,074. Incandescent Electric Lamp. John McCullough, Newark, N. J., assignor of three-fourths to Thomas E. McIver, Michael Lobenthal and Levi Lobenthal, New York, N. Y. Application filed April 2, 1901.

Two filaments within the lamp have contact plates upon the collar connected with the corresponding terminals of the filaments. A butt adapted to be received in a suitable socket is rotatably secured upon the collar and is adapted to make contact with either of the contact plates according to the rotation of the collar within the butt.



NO. 675 918.

676,085. Automatic Electric Fire Alarm. Willis J. Brewster, Port Ewen, N. Y., assignor to Emily E. Brewster, Esopus, N. Y. Application filed August 4, 1900.

This system has an outflow and an inflow conductor disconnected at their outer ends and a third or switch wire, and also has contact plates or bodies separated by a meltable, non-conducting substance. One of the plates has a conductor in electrical contact with the outflow wire and the other plate has a conductor connected electrically with the switch wire, and has an inflammable substance in proximity to the plates arranged to conduct heat to the meltable substance between the plates when the inflammable substance is ignited. The substance projects from the vicinity of the plates. An alarm, as a bell, has ringing or operating mechanism, one pole of which is connected with the switch wire and the other with the battery return wire.

676,091. Printing-telegraph Transmitting Apparatus. Kirk Himrod, Chicago, and John R. Tucker and Charles C. Hinckley, Aurora, Ill., assignors to the International Typal Telegraph company, Detroit, Mich. Application filed March 10, 1899.

A series of keys is combined with two or more sets of bodily immovable pole changers arranged radially. Means are provided for bringing the sets of pole changers consecutively under the operation of the keys. A trailing arm is provided for connecting the pole changers successively with the line. A spring connects the trailing arm with an intermittent arm, and a series of plungers is carried by the intermittent arm for engaging the pole changers successively.

676,092. Railroad Signal Apparatus. John K. Hoddinott, Baltimore, Md. Application filed April 30, 1900.

A pair of conductors is mounted parallel to the track and in such relation to one another as to be brought into contact by the crushing of their housing. A housing covers the conductors, and is adapted to be crushed by the fall of a heavy body upon it. A battery is in open circuit with the conductors. Means are provided for giving a signal actuated by the current when the circuit is closed.

676,098. Electrical Contact-making Device. Preston R. Papin, St. Louis, Mo. Application filed September 24, 1900.

An adjusting screw is provided for adjusting the position of the contact roller. A body portion is on the free end of a spring, and a contact roller is mounted in the body portion.

676,099. Electric Igniter for Explosive Engines. John V. Rice, Jr., Edgewater Park, N. J., assignor to the John V. Rice, Junior, company, Edgewater Park, N. J. Application filed August 12, 1897. Renewed November 3, 1900.

The cylinder, the piston and the explosion chamber of a gas or explosive engine are combined with fixed and reciprocating electrodes, one of which is rounded and horizontally rotative to prevent wear by friction, the other having a spring contact finger that is adapted to bear against the rotative electrode when contact is made.

676,105. Protecting Device for Coils of Electrical Apparatus. Percy H. Thomas, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company of Pennsylvania. Application filed November 9, 1900.

An electric coil and an adjacent body having electrostatic capacity therewith are combined with a shield of conducting material interposed between the coil and body but insulated therefrom and provided with an electrical connection to one terminal of the coil.

676,106. Sound-recording Apparatus. Louis P. Valiquet, New York, N. Y., assignor to the Universal Talking Machine company, New York, N. Y. Application filed June 8, 1899.

This device comprises the sound box, the metallic recording needle vibrated thereby, the electrode adjacent to but separated from the point of the needle, and an electric circuit whose terminals are connected to the needle and electrode respectively, together with the rotating tablet of fusible material in contact with the point of the needle, and the swinging frame on which both sound box and electrode are mounted.

676,108. Electric-railway System. George Westinghouse, Jr., Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing company, Pittsburg, Pa. Application filed June 21, 1890.

A suitably supported conductor which forms part of a normally open earth circuit is combined with a working conductor supported therefrom and a circuit-closing device for completing the earth circuit upon the passage of a car. (See cut.)

676,137. Printing-telegraph Receiver. John M. Joy, New York, N. Y., assignor to the Printing Telegraph News company, New York, N. Y. Application filed September 20, 1900.

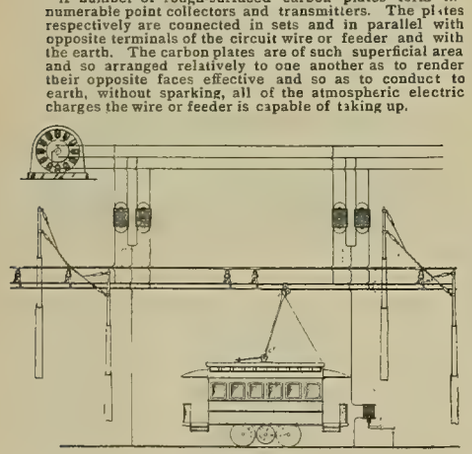
A type wheel is adapted to be rotated and moved longitudinally on its shaft. Means are provided for rotating the shaft. A double escapement comprises two escapement wheels having teeth at varying distances apart. Escapement detents co-operate with the teeth.

676,166. Regulating Roentgen-ray Tubes. Harry F. Waite, New York, N. Y. Application filed March 23, 1901.

A vacuum adjuster consists of a shunt circuit including, in the path of the current, a volatile salt within the vacuum enclosure and an adjustable spark gap enclosed in an air-tight receptacle.

676,185. Lightning Protector for Electrical Apparatus. Franz Gattinger, Vienna, Austria-Hungary. Application filed March 28, 1896.

A number of rough-surfaced carbon plates form innumerable point collectors and transmitters. The plates respectively are connected in sets and in parallel with opposite terminals of the circuit wire or feeder and with the earth. The carbon plates are of such superficial area and so arranged relatively to one another as to render their opposite faces effective and so as to conduct to earth, without sparking, all of the atmospheric electric charges the wire or feeder is capable of taking up.



NO. 676,108

676,202. Incandescent-lamp Socket. Walter H. Perkins, Waterbury, Conn., assignor to the Waterbury Manufacturing company, Waterbury, Conn. Application filed April 9, 1901.

The cap of the socket is provided with a bayonet slot having the inner end of its inner leg formed with a locking enlargement. The body of the socket is formed with a socket for the reception of a screw. These are combined with a coupling screw formed upon the inner face of its head with a locking shoulder, which is adapted to enter the enlargement for locking the cap and body together.

676,263. Automobile. Isidor Kitsee, Philadelphia, Pa. Application filed March 29, 1901.

A switch is adapted automatically to open a circuit containing the source of electric current and the motor propelling the vehicle, and to close simultaneously a circuit containing an electromagnetic device controlling the brake of the vehicle. Means controlled by the switch are provided for applying the brake, and additional means independent of the switch are provided for controlling the motor circuit to prevent operation of the motor until the brake is released.

676,267. Transformer. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed February 23, 1901.

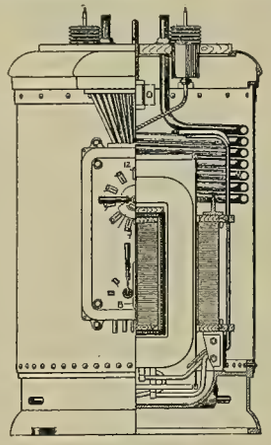
A transformer which has a number of secondary windings is adapted for supplying work circuits of different characters. One of the circuits requires a sensitive regulation and hence good inductive effect and low reactance between its secondary and the primary. The regulation of the other of the circuits may be benefited or at least not badly affected by higher reactances. The primary and secondary windings are divided into sections which are so intermixed that there is a low reactance between the primary and one secondary, but a correspondingly increased reactance between the primary and another secondary. (See cut.)

676,276. Means for Securing Pole-pieces. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed January 29, 1900.

A rotatable field structure, which is provided with radial holes and slots transverse to the holes, is combined with pole-pieces, bolts in the holes are secured to the pole-pieces, and are slotted where they cross the transverse slots. Keys in the transverse slots extend through the slots and the bolts.

676,280. Electric Switch. Eduard Schulz, Barmen, Germany. Application filed November 20, 1900.

This device comprises an insulating block formed with two semi-cylindrical sections arranged side by side. Each section is provided with a recess. An insulating plate is arranged between the adjacent faces of the sections. Contact making and breaking mechanism is located within the recesses, and recesses are formed in the upper ends of the semi-cylindrical blocks.



NO. 676,267.

676,281. Electrode for Primary Batteries. William T. Seddon, Philadelphia, Pa., assignor to Herman J. Dercum, trustee, Philadelphia, Pa. Application filed December 17, 1900.

A number of carbon plates have channels in their peripheries. A frame of cast lead surrounds and supports the plates. The frame has tongued projections entering the channels in the edge of the plates.

676,289. Switch for Electric Lamps. Charles Wagner, New York, N. Y., assignor to Edward F. Caldwell & Co., New York, N. Y. Application filed February 28, 1901.

This device comprises a stationary tube for the lamp wires, a contact holder of insulating material which is secured to the tube, spaced contact pins in the holder, connected at one end with the electric wires, and a second contact holder of insulating material mounted to turn on the tube. Contact pins yieldingly mounted in the second contact holder are adapted to move in and out of engagement with the contact pins in the stationary holder. A sleeve is mounted to turn and carry the movable contact holder.

676,298. Brush Holder. Asa F. Batchelder, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed February 28, 1901.

An independent contact plate has an extended surface in contact with the brush. A spring is carried by the holder to force the brush against the commutator, and there is a loose connection between the spring and plate, whereby the spring can move freely over the surface of the plate.

676,300. System of Electrical Distribution. Ernst J. Berg, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 9, 1900.

This system comprises an alternating-current circuit, a synchronously operating dynamo-electric machine connected thereto, and an asynchronous dynamo-electric machine also connected thereto and provided with a rotating member in mechanical relation to moving parts of high inertia. (See cut.)

676,305. System of Motor Control. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed March 5, 1900.

A cylinder carrying a set of movable contacts is adapted to engage with a set of fixed contacts. There are a number of independent actuating devices for moving the cylinder, step by step, through a series of operative positions. Means are provided for successively operating the actuating devices.

676,308. Brush Holder. Henry Geisenhöner, Schenectady, N. Y., assignor to the General Electric company of New York. Application filed February 20, 1901.

A support has a hole formed with a slot, and this is combined with a spring carrier movable in the hole and which is provided with a lug adapted to enter the slot. A spring is mounted on the carrier and is adapted to press the brush against the commutator. Means are provided for adjusting the spring.

676,309. Means for Controlling Electric Heaters. Edward E. Gold, New York, N. Y. Original application filed March 10, 1897. Divided and this application filed November 9, 1899.

There is a succession of electric heaters, each including heating elements of unequal heat-generating capacity. Two branch circuits traverse the successive heaters, the one including the minor heating elements thereof and the other including the major heating elements thereof. A switch at the junction of the branches with the main circuit is movable to as many different positions as the number of degrees of heat desired. In one position it connects the main circuit with only one branch circuit, in another position with only the other branch, and in a third position with both branches.

676,311. Mechanism for Controlling and Indicating Temperature Limits. Ernest H. Griffiths and William C. D. Whetham, Cambridge, England. Application filed December 19, 1900.

A pivoted receptacle has an inclined bottom. A wire passes through an insulating plug carried in the open end of the tubular receptacle and the end of the wire lies in the acute angle at the bottom of the receptacle. An electrical circuit includes the receptacle and the wire and normally has in it a gap between the end of the wire and the bottom of the receptacle. A fusible conducting substance is normally situated in the obtuse angle at the bottom of the receptacle and constitutes a gravity switch which operates to close the gap in the electrical circuit.

676,332. Apparatus for Wireless Telegraphy. Guglielmo Marconi, London, England, assignor to Marconi's Wireless Telegraph company, Limited, London, England. Application filed February 23, 1901.

See illustrated description on page 424.

676,333. Apparatus for Making Electrodes. George J. Miller, Kenton, Ohio. Application filed February 5, 1900.

A row of plungers is arranged at one side of the blank-receiving space. A row of plungers is arranged at the opposite side of the space and alternates with the first-mentioned plungers. Mechanism is provided for simultaneously operating the plungers and the arrangement of parts is such that each plunger shall enter the opposing side of the blank during the operation of the plungers and displace material in the direction of and beyond the opposite side of the blank.

676,334. Method of Making Electrodes for Storage Batteries, etc. George J. Miller, Kenton, Ohio. Application filed February 8, 1900.

Each side of an electrode-forming plate is provided with grooves or recesses and has the grooves or recesses upon one side alternating with the grooves or recesses upon the other side. The method of making the electrodes consists of simultaneously pressing or forcing material required to be displaced in the formation of the grooves or recesses inwardly and thereby widen the walls between adjacent grooves or recesses formed in each side of the blank by the inward displacement of the material required to form the grooves in the blank's opposite side.

676,339. System of Distribution. Horace F. Parshall, London, England, assignor to the General Electric company of New York. Application filed January 23, 1901.

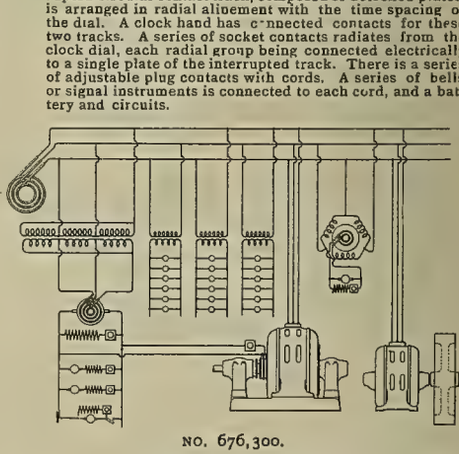
A rotary converter is connected to a direct-current circuit so as to act as a booster. Means responsive to current in the circuit are provided for varying the electromotive force of the rotary converter.

676,344. Regulating Device for Alternating-current Circuits. Elihu Thomson, Swampscott, Mass., assignor to the General Electric company of New York. Application filed January 29, 1900.

This device comprises a constant-current transformer having relatively movable primary and secondary coils, with means provided for preventing relative motion between the coils when the load approaches a maximum.

676,346. Electric-clock Signal. Harry B. Vaughan, Little Rock, Ark. Application filed January 31, 1901.

A clock dial has a continuous circular track. An interrupted circular contact track, composed of detached plates, is arranged in radial alinement with the time spacing of the dial. A clock hand has connected contacts for these two tracks. A series of socket contacts radiates from the clock dial, each radial group being connected electrically to a single plate of the interrupted track. There is a series of adjustable plug contacts with cords. A series of bells or signal instruments is connected to each cord, and a battery and circuits.



NO. 676,300.

676,365. Means for Electrically Lighting Lightships or Other Stationary Vessels. Jürgen H. Junge, Cuxhaven, Germany. Application filed June 28, 1900.

A frame with an outside slit is placed all around the vessel, and a spindle moves freely in an internal groove of the frame by means of sliding rollers. Insulated metal rings are placed around the spindle and are connected in a conducting manner with the branch wires of the current-supply cable. Sliding contact rails are placed and insulated on the inside of the frame.

676,377. Elastic Support for Arc Lamps. Fredrick Wilkie, New York, N. Y., assignor to the Manhattan General Construction company, Newark, N. J. Application filed September 5, 1900.

A continuous yielding rod constitutes the side rods of the lamp. A bend at the lower end of the rod, extends into a button, and is connected therewith by a pin. A spring is secured to the button and is adapted to engage the lower end of the glass bulb of a lamp.

676,378. Safety Trolley Base. Andrew C. Wolfe, Denver, Colo., assignor of two-thirds to Charles K. Wolfe and Frank Dillingham, Denver, Colo., and Joseph F. Hewitt, Allegheny, Pa. Application filed January 22, 1901.

A pivoted trolley pole is combined with sustaining springs, an equalizing lever, equalizing springs, and a retaining pawl for the equalizing lever.

WESTERN ELECTRICIAN

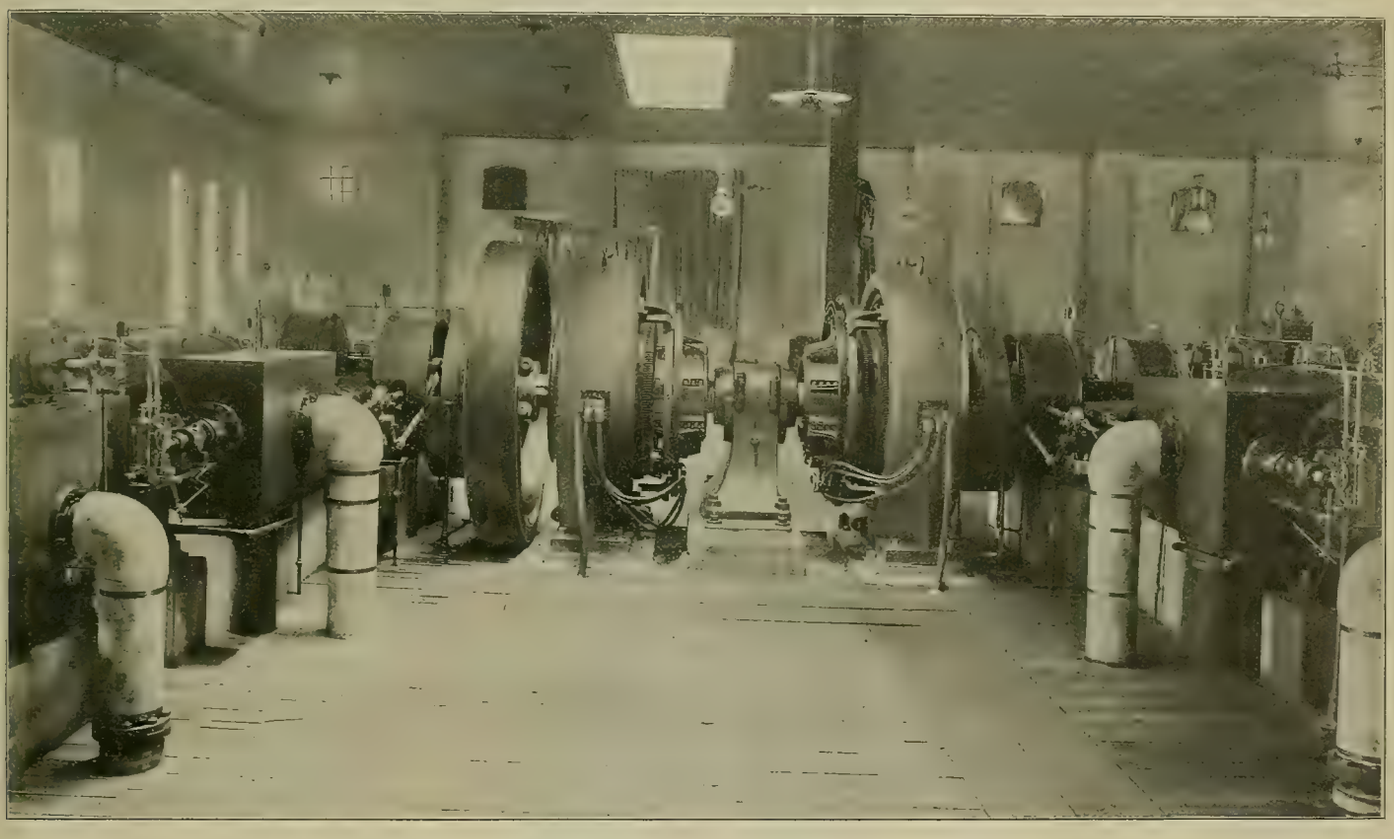
EVERY SATURDAY.

Vol. XXVIII. CHICAGO, JUNE 29, 1901. No. 26

Central-station Improvements in Dayton, Ohio.

At Dayton, Ohio, a city of over 85,000 population and the fifth in size in the state, the Dayton Electric Light company operates one of the largest and most important central stations in the state of Ohio. The company supplies arc service throughout the city and alternating and direct current for commercial lighting. The greater portion of the service is of direct current, the Edison three-wire system being used. In order to accommodate the growth of the company's business there were recently installed the two direct-current generating units shown in the accompanying illustration.

The new machines were built by the Triumph Electric company of Cincinnati, and are of the standard multipolar type. Each of the generators has a capacity of 200 kilowatts at 125 volts, the speed being 200 revolutions a minute. The two generators are both direct-connected on one shaft



CENTRAL-STATION IMPROVEMENTS IN DAYTON, O.—NEW DIRECT-CURRENT UNITS.

back of and between two 300-horsepower, tandem-compound Buckeye engines.

These generators are of the standard eight-pole construction with laminated pole pieces and laminated ironclad armature. Each machine weighs 23,000 pounds and is guaranteed not to have a rise in temperature more than 40 degrees centigrade after a continuous run of 10 hours under full load, and to withstand a temporary overload of 50 per cent. without injury.

Besides the direct-connected installation just mentioned the company has in its power station four 50-kilowatt and four 60-kilowatt bipolar Edison generators which furnish direct current for over 14,000 incandescent lamps and about 100 direct-current arc lamps. Four 150-light Brush arc machines supply current to 510 Adams-Bagnall enclosed-arc lamps, the company having an all night contract for supplying the city street arc lights. An alternating-current service for over 1,000 incandescent lights used by the suburban districts of the city is furnished from a 120-kilowatt Thomson-Houston 1,040-volt alternator.

These additional generators, which have been in use for some time, are belt-driven by a 1,310-horsepower Buckeye engine, steam being supplied by a 750-horsepower installation of Heine boilers. The switchboard, which is of a handsome design, has been recently extended to accommodate the new generators. It is equipped with Weston illuminated-dial instruments and quick-break switches. The cable connections between all the generators and the switchboard are made under the floor of the station.

The Dayton Electric Light company has a capitalization of $600,000, and the following-named officers: President and general manager, Dr. J. E. Lowes; vice-president, R. N. King; secretary, H. C. Kiefaber; treasurer, J. C. Reber; superintendent, Albert Thomas. The directors of the company consist of Dr. J. E. Lowes, T. C. Weakley, H. C. Kiefaber, W. D. McKemy, J. C. Reber, Ezra Bimm, R. N. King and R. M. Nevin.

Pan-American Electrical Exhibitors Organized.

At a meeting of Pan-American electrical exhibitors and representatives of electrical exhibitors held last week in the office of the superintendent of the electrical exhibits, W. Jac Marland stated that the meeting had been called to consider the advisability of organizing for mutual pleasure, protection and better acquaintance during the life of the exposition. S. N. Smith of the Submerged Motor company was elected temporary chairman. He took the chair and called the meeting to order, and asked for nominations for a permanent chairman. Frank Hurlbert of the General Electric company was thereupon elected as permanent chairman, with Mr. Probasco of the Westinghouse Electric and Manufacturing company as vice-president, Mr. Margraff of the Thomas A. Edison exhibit as treasurer, and W. Jac Marland of the collective electric exhibits as secretary.

Chairman Hurlbert, after being conducted to the chair, called for suggestions of a name for the new organization, and after considerable discussion it was moved and carried that the officers and two others, to be appointed by the chairman, decide on a name, and submit it at the next meeting. The chairman appointed S. N. Smith of the Submerged Motor company and P. W. Bossart of the Kellogg Switchboard company to assist the officers in this matter.

Upon motion, the chair was empowered to appoint a committee to draft rules and regulations for the guidance of the organization. The chairman appointed Dr. Waite, S. Sicard and Mr. Henning as this committee.

A committee of three was appointed to thank Professor Sever for the use of his office, and also to secure permanent quarters for further meetings. This committee consists of Paul M. Krahmer, representing the Stromberg-Carlson Telephone Manufacturing company; S. N. Smith, representing the Submerged Motor company, and W. Jac Marland, curator of collective electric exhibits.

A roll-call showed that the following-named gentlemen were present: Frank Hurlbert, General Electric company; W. M. Probasco, Westinghouse Electric and Manufacturing company; W. Jac Marland, collective exhibits; P. J. Hertz, Stromberg-Carlson Telephone Manufacturing company; S. N. Smith, Submerged Motor company; R. B. Hurst, Lea Electric Manufacturing company; M. T. Kuttendrier, Bossert Electric Construction company; L. J. Beloup, Wagner Electric company; R. C. Baker, Automatic Switchboard company; R. B. Hayes, Stanley Instrument company; Paul M. Krahmer, Stromberg-Carlson Telephone Manufacturing company; Walter Gummey, Gould Storage Battery company; E. G. Hunton, O. C. White company; S. Sicard, Mason Monogram company; J. D. Downer, Western Electrician; I. J. Settelle, Peru Electric company; E. L. Elliott, Holophane Glass company; Thomas Henning, Electric Storage Battery company; William Wait, Bettini Phonograph Laboratory company; Oliver F. Conklin, Robbins & Myers company; George W. Pope, Buckeye Electric company and Jandus Electric company; G. D. Adams, Eldridge R. Johnson; Henry E. Waite, M. D., Waite & Bartlett; C. Schimmelfeng, president Eureka Tempered Copper Works; D. C. Gould, Arnold Electric Power Station company; O. A. Estes, National Automatic Telephone company; John F. Fairbairn, National Gramophone corporation; Walter L. Wilhelm, Wilhelm Telephone Manufacturing company; L. A. Hawkins, Stanley Electric Manufacturing company; Ray H. Manson, Kellogg Switchboard and Supply company; S. J. Bear, American Telephone company; W. M. Haen, National Carbon company; S. S. Culver, Northern Electric Manufacturing company; James R. Cravath, McGraw Publishing company; E. F. McCleskey, Akouphone company; A. E. Hall and W. C. Bujan, American Clock company; E. W. Dolliver, Incandescent Light Manipulator company; Milton V. Baslou and Harry S. Williams.

The Development of the Ferranti Rectifier.[1]

By W. E. Warrilow.

The fact that an alternating current per se was unsuitable for efficient arc lighting caused the introduction of a piece of apparatus which changed the nature of the current so that for arc lighting it gave results equal to those produced by a direct current.

The current induced in the armature of an alternator changes its direction of flow a certain number of times per second, varying from 40 to 100, according to the design of the machine. From zero the current rises to a maximum in one direction, falls to zero and rises to a maximum in the opposite direction, falling again to zero, and so on, the cycle or alternation being diagrammatically represented by Fig. 1. If, however, a commutator in circuit with the armature is fixed on the alternator shaft, and so arranged that at the moment of current reversal in the armature the commutator moves forward, the alternating current will become a unidirectional, but interrupted, current. Such an arrangement was adopted on the earliest alternators which supplied current to arc lamps in lighthouses on the coast of France. Subsequently the principle was embodied in a separate apparatus, receiving current from the alternator bus-bars. The commutator was actuated by a motor turning in exact synchronism with the alternator, and the same result was obtained as when the commutator was fixed to the shaft of the generator. A diagram representing the resultant current is shown in Fig. 2, where it will be clear, on comparison with Fig. 1, that the current rises and falls on one side of the zero line only. It will be seen that the feeding of arc lamps from one generating plant of the alternating-current type has been gradually arrived at by patient experiments, and the various difficulties encountered have been described.

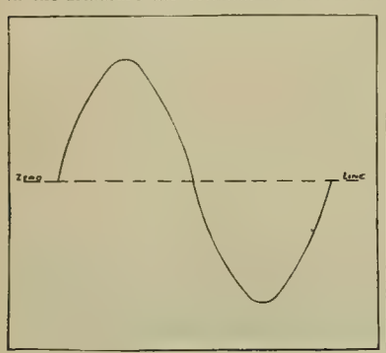


Fig. 1. Alternating-current Curve.

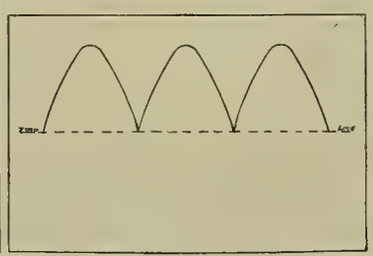


Fig. 2. Rectified-current Curve.

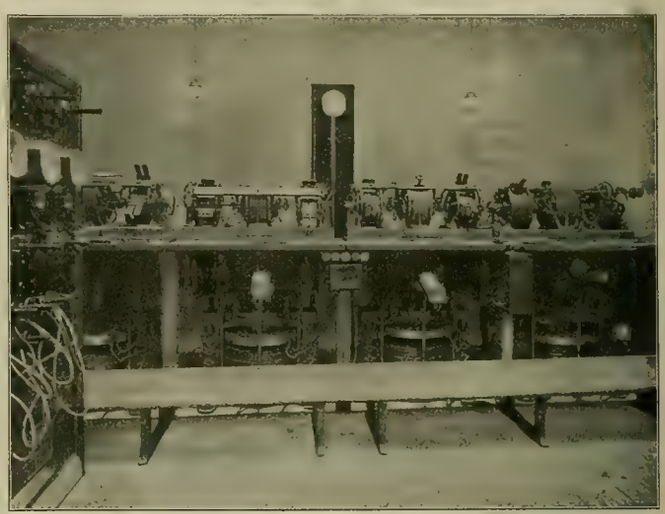


Fig. 3. Installation at Portsmouth.

DEVELOPMENT OF THE FERRANTI RECTIFIER.

An account of the development of the rectifier may now be entered into. The introduction and the manufacture of this plant have been in the hands of one firm only, Messrs. S. Z. de Ferranti, Limited, and though the field has been quite free from competition, the necessities for improvements have been recognized and have resulted in the production of a most efficient piece of apparatus. The first installment of rectifiers was at the Portsmouth corporation electricity works in 1894, when four units with their attendant switch gear were laid down. Fig. 3 is a photograph of the machines and a portion of the switchboard, which may be seen at the left hand of the illustration. Each rectifier consisted of a synchronous motor having two commutators, and a constant-current transformer. This latter, which may be seen underneath the motor table, consisted of fixed primary coils, and secondary coils capable of adjustment by means of a link motion terminating in a lever provided with a sliding weight. When under current, the coils tended to move apart by repulsion, and their distance could be regulated by the adjustment of the weight on the lever. The arrangement could thus supply a constant current at a varying voltage to the series of arc circuits.

The motor, driven by a low-pressure current, turned two single-break commutators, one at each end of the shaft. The secondary coils of the constant-current transformer were connected each to a commutator, which was coupled in series with its fellow commutator. Brushes, set at 90 degrees, and carried on a frame actuated by a handle, conveyed the current to and from the commutators. The right-hand rectifier is shown with grinding gear attached. This consisted of an emery wheel driven by the motor for the purpose of facing up the commutator when it has become worn.

The switchboard is fitted with ammeters, indicators for showing the direction of the current, reversing switches, and plug cords for placing any rectifier on any circuit.

The space occupied by these first machines necessitated the introduction of a more compact unit, and Fig. 4 illustrates the next stage in the development, in which the apparatus is practically self-contained. The constant-current transformer has its coils arranged vertically, and the core is fixed to the standards which form the legs of the motor base-plate. The motor is provided with a double-break, high-tension commutator at one end of the shaft, while the other end is fitted with a commutator of similar break for the motor circuit. The transformer to the right of the rectifier body supplies the motor with low-pressure currents, the voltage of these being regulated by switches cutting in or out certain of the transformer windings. On the left of the rectifier may be seen the water-break switch for closing the arc circuits gradually. The two contacts of the switch, one of which is mounted in an insulator at the top of the water holder, and the other at the bottom of the latter, beneath the water, are connected together with a brass rod insulated with a heavy ebonite handle and washer. The gradual insertion of the arcs enabled the spark at the brushes to be more easily regulated besides preventing undue strain on the arc-lighting cables, by the steady increase of the pressure. The coils of the constant-current transformer are swung on knife edges, and by suitable links and weights their regulation may be easily effected. A dash-pot also tends to check any sudden movement of the coils.

A further modification is shown by Fig. 5, where the coils of the constant-current transformer are operated by a rack motion, provided with adjustable weights and a dash-pot. The high-tension brush rocker has been strengthened with a view to steadiness, and an ammeter is inserted on the motor side for regulating the motor current. The high-tension coils, (B) the primary coils, and (M) the motor transformer.

The motor connections are shown by Fig. 8. The armature or stator (A) is fixed, i. e., does not rotate, though it can be adjusted slightly, the fields (B) forming the moving portion of the motor; (C) is a two-way switch, (D) a 10-ohm resistance, and (E) a four-part commutator, while (F) is the regulating switch for varying the field voltage. When starting the field is placed across the transformer secondary, in circuit with the 10-ohm resistance and in parallel with the armature. When synchronism is attained, the brushes in the meantime having been moved forward about 90 degrees, the two-way switch is put over, cutting out the 10-ohm resistance and placing the field, excited by a unidirectional current, in parallel with part of the armature. The most suitable voltage for running may be obtained by the regulating switch.

Fig. 9 illustrates a complete rectifier of the last pattern, with its switch gear for three rectifiers and three circuits. Surmounting the whole switchboard is the high-tension voltmeter, protected by oil-break fuses and fitted with a plug which may be inserted in the sockets of any circuit for the reading of its pressure. The upper part of the body of the main board is fitted with slate panels, which hinge forward on their lower edges to render the back connections accessible. Each panel is provided with plug and cord (kept in tension by a porcelain weight), plug sockets, pole indicator and ammeter. The plugs and cords are connected to the ends of the circuit cables, the sockets being coupled to the rectified currents from the rectifier in such a way that, by the insertion of a short-circuiting plug, two circuits can be put in series with one another and fed from one rectifier. The hinged panel deals with the rectified currents only, the alternating currents to the primary of the constant-current transformer being passed through an oil-break fuse from one of two bus-bars fixed below the hinged slates. Two of these fuses may be seen on the floor to the left of the rectifier. The currents supplying the above-mentioned bars are carried from the main switchboard through switch, ammeter and fuse, so that all arc circuits can be controlled from the central distributing board. After considerable experimenting, the rectifier has arrived at the standard type shown in Fig. 10, and comparison with previous makes will at once make the chief points of difference evident. The modifications have been effected with a view to greater safety and reliability. The chief alteration is the fixing of the high-tension brushes and the shielding of the commutator with a

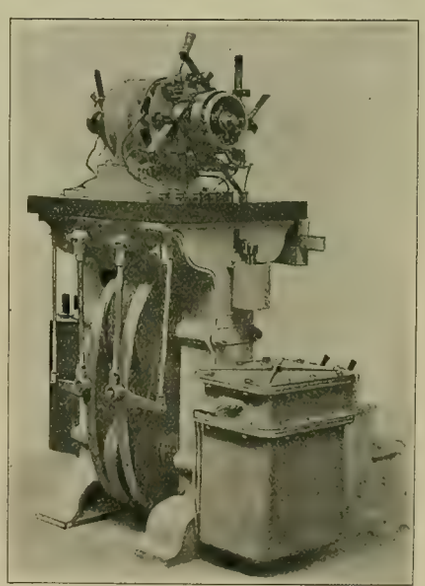


FIG. 4. DEVELOPMENT OF THE FERRANTI RECTIFIER.—SELF-CONTAINED FORM.

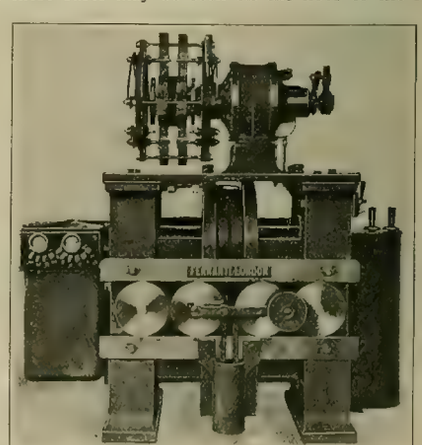


FIG. 5. DEVELOPMENT OF THE FERRANTI RECTIFIER.—MODIFIED FORM.

commutator, which is similar to the previous type, can here be plainly seen. It consists of two inner and two outer rings. The former are divided into four parts in this case (though eight parts are made for high periodicities), two opposite segments being joined together, the other two being connected to the outer rings. The breaks between the segments of the inner rings are shown by Fig. 6, in which the principle will be made clear. By the adoption of this break the spark which is occasioned by the interruption of the circuit is broken up. The connections of a rectifier are shown by Fig. 7, where (A) shows the current passing in one direction to the brushes and (B) illustrates the passing of the current in the opposite direction, while both (A) and (B) make it clear that a unidirectional current flows to the lamps. The brushes, one on each of the inner rings, are in turn short-circuited by a segment, and open-circuited to feed the outer rings by the following segment, at each quarter-turn of the commutator. This shows that whatever the direction of the current on the transformer side of the commutator, a current of one direction only will pass to the lamps as long as the motor is turning. Referring to Fig. 7, (C) is the commutator, (W) the water-break switch, (A, A) the secondary

1. From Feilden's Magazine, London. Mr. Warrilow is a young man associated in Mr. Ferranti's work.

plate-glass guard. The adjustment of the spark effected by the rocking of the brushes in previous types is brought about by rotating the motor armature. The improvement in the appearance of the rectifier alone is a great feature of this change, which has also added considerably to the easy manipulation of the apparatus. The reliability of the synchronous motor is much increased by the lengthening of the motor bearings and the duplication of the brushes on the low-tension commutator.

The constant-current transformer has its coils mounted in frames which run on steel balls, the frames being linked to a dash-pot filled with a certain weight of shot. Regulation is thus carried out quite independent of adjustable weights, and friction of the moving parts is no greater when the coils are wide open than when they are close together. The motor-transformer coils are "sandwiched" between the two fixed primary coils, thus dispensing with an external transformer, and minimizing the space occupied by each rectifying unit. The water-break switch is made double-pole and double-break, and its insulation is such that it is impossible to receive a shock by coming into accidental contact with it. The water holder, moreover, is made free from leakage by a special construction, which has given great satisfaction.

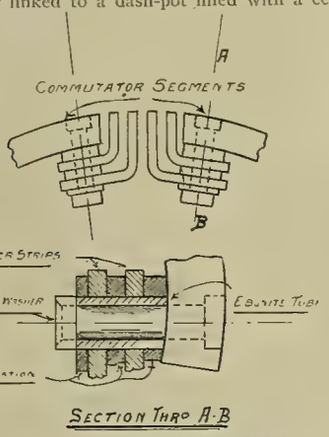


FIG. 6. DEVELOPMENT OF THE FERRANTI RECTIFIER.—SECTION OF COMMUTATOR SHOWING BREAKS BETWEEN SEGMENTS.

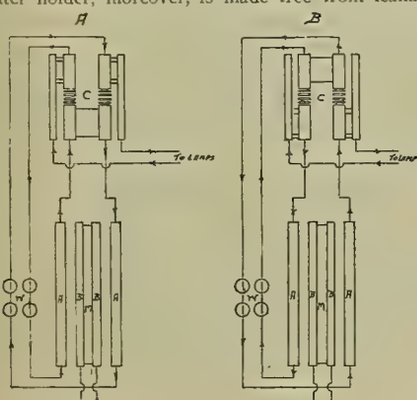


FIG 7. DEVELOPMENT OF THE FERRANTI RECTIFIER.—DIAGRAM OF CONNECTIONS.

The development of the rectifier having been considered, a few remarks on its advantages may now be made. First and foremost, the apparatus enables the alternating-current engineer to compete with, if not excel, the direct-current system in supplying arc lamps from one generating plant, and the economies effected thereby are very marked when compared with the old plan of having two types of generators to supply arcs. With a Brush arc lighter (30 kilowatts) driven by its own engine, the mean efficiency was found to be about 50 per cent. This figure has been exceeded in America with large units, but such instances are rare.

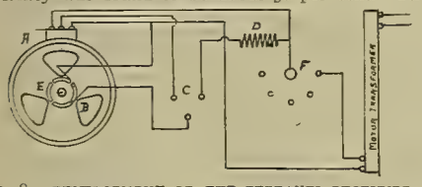


FIG. 8. DEVELOPMENT OF THE FERRANTI RECTIFIER.—DIAGRAM OF MOTOR CONNECTIONS.

For a modern steam alternator, an average efficiency of 89 per cent. may be taken as not unusually high, and for a rectifier an average of 90 per cent. will be a fair figure, so that the combined efficiency of alternator and rectifier will be about 80 per cent., as compared with 50 per cent. for separate arc lighting plant. The comparison, however, does not end here. A 30-kilowatt arc lighter, rope-driven from a horizontal engine, will occupy 500 square feet of floor space; this leaves two feet around the plant for attendance. A similar plant when direct-driven would occupy only 220 square feet, so for each case a floor space of 16 and 7 square feet per kilowatt, respectively, is taken up.

A modern 300-kilowatt alternator will occupy about 500 square feet or 1.6 square feet per kilowatt, and if this alternator supplied 300 kilowatts of rectifiers an additional 200 square feet must be added to the above figure, making the total floor space occupied 2.3 square feet per kilowatt. Comparing this with the 30 kilowatts of plant for rope or direct driving a Brush arc lighter, the balance in favor of the rectifier is very great, and its importance cannot be too clearly marked. The light given by a rectified-current arc is practically equivalent to that supplied by a continous current, as in each case the carbons are of different sizes, and a crater or reflector is formed in the top carbon.

Another point which is worth mentioning here is the possibility which the rectifier affords of increasing the flexibility of a lighting system. In a modern direct-current station it is usual to place a certain number of lamps (varying with voltage employed) in series across the mains, the combination being turned on and off from a certain lamp. This arrangement is cheap in its first installation, but it possesses the disadvantage of placing a most important section of the lighting beyond the control of the staff at the works. Moreover, should a breakdown to the plant occur at the station, all lights would be extinguished, by reason of both public and private supply being given from one set of mains. The same applies in the case of a fault on a main feeder. Where separate arc mains are laid, as is necessitated by the use of rectified currents, the two systems may be kept separate during times of heavy load (when mishaps are most likely to occur) by supplying the arc lamps from a separate alternator, which may, however, be run at or near its full output. When the peak of the demand has dropped, the two systems may be again connected together. This arrangement may seem illogical at a casual glance, but when the advantage gained by the independence of the two systems during the most trying hours of the supply are considered, the apparent absurdity of the system will disappear. A certain flexibility is obtained by lighting the two sides of a street by separate mains, but a breakdown of plant (by no means an impossible event) would probably extinguish all lights for a time.

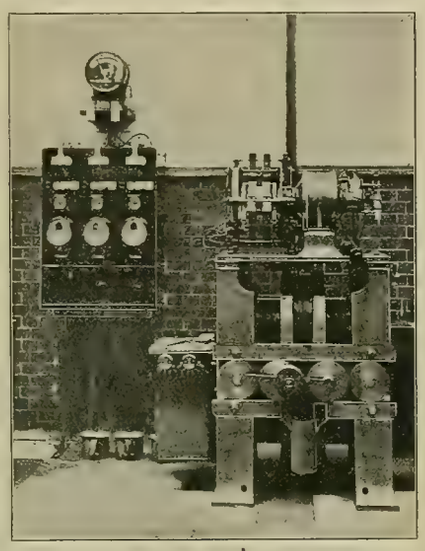


FIG. 9. DEVELOPMENT OF THE FERRANTI RECTIFIER.—LATEST PATTERN OF RECTIFIER.

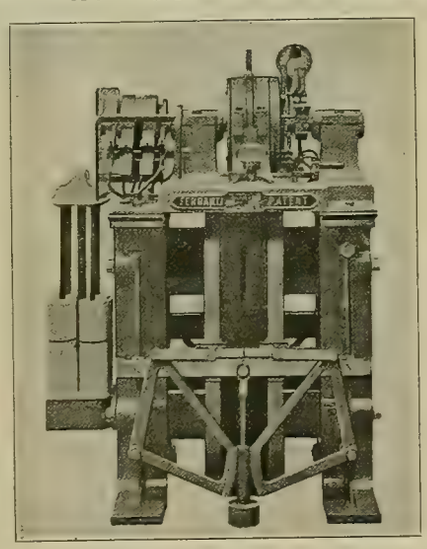


FIG. 10. DEVELOPMENT OF THE FERRANTI RECTIFIER.—STANDARD PATTERN OF RECTIFIER.

That there was some ground for reserve in adopting rectifiers in their earlier stages is true; such grounds, however, are no longer tenable, as the apparatus has stood the best possible test applicable—the test of time.

The rectifier, like any other form of apparatus, will, no doubt, in years to come, be no longer used; but this will not alter the fact that it has met a pressing demand in placing the much-abused system of single-phase alternating current on an equal basis with its rival, the direct current, in the matter of street lighting. Improvements in the alternating-current lamp, either of the enclosed or open type, will be chiefly instrumental in dispensing with the services of rectifiers; but, until such changes are effected, the system may be reckoned upon to hold its own against all comers.

Canadian Electrical Association.

Ottawa, Ont., June 22.—The eleventh convention of the Canadian Electrical association opened on Wednesday morning, June 19th, in the Russell House, Ottawa, Ont., with President A. A. Dion, superintendent of the Ottawa Electric company, in the chair. The other officers present were: First Vice-president E. E. Cary, with the Citizens' Light and Power company, Montreal; Second Vice-president P. G. Gossler, superintendent of the Royal Electric company, Montreal, and Secretary-treasurer C. H. Mortimer of the Electrical News, Toronto, with the following-named members of the executive committee: J. J. Wright, manager of the Toronto Electric Light company; Ormond Higman, chief of Electrical Inspection Department, Ottawa; A. B. Smith, superintendent of the Great Northwestern Telegraph company, Toronto; D. R. Street, secretary-treasurer of the Ottawa Electric company, Ottawa; B. F. Reesor, manager of the Electric Light and Power company, Lindsay; W. H. Browne, manager Royal Electric company, Montreal; John Yule, manager of the Guelph Light, Heat and Power company, Guelph. John Murphy, the chairman, and William Ahearn, Jr., the secretary, of the local committee, were also in attendance.

The attendance was large and much beyond the usual number, all sections of the Dominion being well represented. The papers discussed were practical, and much valuable information was imparted to the members by the interchange of ideas necessarily resulting from such discussions. The president and local committee did all in their power to make the convention a success, and their expectations were fully realized.

At the opening session Mayor Morris of Ottawa delivered an address of welcome, followed by Aldermen Deering and DesJardines, members of the local committee. President Dion said, in opening the convention, that he would depart from the usual custom of delivering an annual address, which usually dealt with the progress of electrical science and industries throughout Canada, as these subjects had been fully dealt with by the lay and technical press, and any review he might make would only be a repetition of something they had already seen or heard, and he would simply say he was pleased to have the honor of welcoming so many old and new faces to Ottawa, which had originally been selected as the place for holding the convention of last year, but in which they had been disappointed by the great devastation by fire during last summer.

An able paper, by K. B. Thornton of Montreal, on "Notes on Construction and Protection of Aerial Transmission Lines," brought forth a spirited discussion as to the respective merits of barb wire and the air-gap arrester as a protection against lightning, the majority being in favor of barb wire. The chief objection raised was in reference to the quality of the material found in the ordinary barb wire, but it was conceded that this difficulty could be overcome by the use of steel or copper.

The committee on legislation presented a report covering its work during the last year. Since what is known as the "scrap-iron decision" there had been constant agitation on the part of various municipalities to introduce an act to repeal the assessment law, the result being that the Ontario provincial government appointed a commission on the whole question of assessment, before which the Canadian Electrical association was represented. The commission recommended that companies having franchises or quasi franchises from municipalities be taxed, first, on the value of the land and then on the value of the buildings or works thereon, on a basis of the cost of their reproduction, all wires, poles, gas mains or other property of the companies being included. The committee thought this unreasonable, and that it would be a great hardship to small companies, but it recommended that no reasonable objection be taken to a taxation based on gross revenue or on the value of plant and works in the same proportion as other manufacturing plants in the same municipality. However, as yet, no action had been taken by the government on the question. The committee deplored the lack of support it was receiving from the companies, who were receiving all the benefits of the committee's work.

O. Higman reported, on behalf of the committee on the rating of arc lamps, that the act had been amended at the last session of the Legislature, giving power to fix a standard rating, and the committee would now be in a position to arrive at something definite.

The secretary-treasurer, C. H. Mortimer, reported a steady growth in membership and a widening in-

terest in the association by members, individuals and corporations interested in electrical matters outside. As a means of adding still more rapidly to the membership, he suggested for the association's consideration the advisability of admitting to membership electrical students in scientific schools at a nominal fee; the association might also offer a yearly prize to the third-year students in such schools. He stated the membership now numbered 267, composed of 235 active and 32 associate members, a gain since his last report of 23.

O. Higman's paper on "Dominion Electrical Standards," after some discussion, resulted in the appointment of a committee to consider the advisability of asking the government to establish a bureau wherein all instruments used for the measurement of current and electromotive force could not only be compared, but tested and calibrated, great difficulty at present being experienced in the shipment and reshipment of these instruments to the makers in the United States.

On Thursday papers were read by J. R. Robertson of Montreal, on "The Influence of the Load Factor on the Design and Operation of a Lighting and Power System;" by L. Denis of Quebec City on "Balancing a Three-wire Alternating Secondary System," and by Professor R. B. Owens of McGill University, Montreal, on "Transformation from Constant-potential Alternating to Constant-current Alternating."

Mr. Robertson's paper was a very exhaustive and practical one. J. J. Wright thought it would be very desirable to have meters at a varying speed, such as were referred to in the paper, but doubted whether they could be made to comply with the regulations of the Department of Inland Revenue. The president asked whether the self-winding clock meters referred to, when found accurate at full speed, could be depended upon to change at the proper time, so that the actual total reading would be correctly given. Mr. Robertson replied that this was a trouble experienced with the instruments now in the market. In reply to Mr. Wright's objection, he said he personally would not want a meter that would run fast or slow, but one that would read on two dials, and the entire registration of the day would then be the sum total of the two dials. The other papers brought forth considerable discussion.

The report of the committee on nomination of standing committees was adopted as follows: Committee on statistics, A. A. Wright, K. B. Thornton and J. F. H. Wyse; committee to confer with underwriters, P. G. Gossler, Edward Slade, A. A. Dion, Alderman Sadler, A. Sangster and J. J. Wright; committee on arc-light rating, O. Higman, P. G. Gossler, Fred Thomson, John Yule, Professor Owens, J. R. Robertson and Mr. Lambe; committee on legislation, John Yule, B. F. Reesor, A. A. Wright, C. B. Hunt, W. H. Browne, A. A. Dion, W. H. Briethaupt, R. O. McCullough and J. J. Wright, with power to add to their number; committee on standardization of accounts, same committee continued, consisting of D. R. Street, Mr. Henshaw and A. A. Wright.

The suggestions submitted in the secretary-treasurer's report were taken up and a committee appointed to put in form amendments to the constitution providing for the division of members under three heads, namely, active, associate and student, and stating the respective privileges of each. In discussing this question, some of the members felt strongly that the executive officers of the association should be composed wholly of men actively engaged in or connected with operating companies; and it was thought by some to be a menace to the future well-being of the association to have men representing manufacturing, supply and other commercial companies eligible to office in the association.

Topical discussions were conducted upon "The Best Practice in Cleaning, Trimming and Inspection of "Enclosed-arc Lamps" and "The Different Systems of Charging for and Measuring Power Consumed by Induction Motors with Varying Power Factors."

The social features of the convention consisted in a carriage drive around the city, tendered by the citizens of Ottawa; a band concert at Brittania-on-the-Bay, through the courtesy of the Ottawa Electric Railway company; an exhibition of the Ottawa Fire Department at Hotel Cecil, followed by a trip by special cars to Rockliffe Park and Rifle Ranges; a visit to power houses and other points of interest at the Chaudiere; a trip to Queen's Park, Aylmer, through the courtesy of the Hull Electric company, stopping at Deschenes Rapids, to visit the power houses of the Hull Electric company and the Capitol Power company.

On Friday morning the election of officers for the incoming year took place and resulted as follows: President, P. G. Gossler, Montreal, Que.; First Vice-president, B. F. Reesor, Lindsay, Ont.; second vice-president, Edward Slade, Quebec City; secretary-treasurer, C. H. Mortimer, Toronto; executive committee, J. J. Wright of Toronto, John Yule of Guelph, A. B. Smith of Toronto, W. H. Browne of Montreal, O. Higman of Ottawa, A. A. Dion of Ottawa, J. Murphy of Ottawa, A. Sangster of Sherbrooke, Que., W. G. Holman of Quebec City and K. B. Thornton of Montreal.

A constitutional point arising on the question of the adoption of the report of the committee on the drafting of amendments to the constitution on membership, a special meeting was held on Saturday morning, June 22d. This concluded the work of the convention, and the members dispersed, to meet in the City of Quebec in 1902. G. A.

Chicago, Kenosha and Milwaukee Electric Railway.

Articles of incorporation have been issued to the Chicago, Kenosha and Milwaukee Electric Railway company. The incorporators are James Cavanagh, John C. Slater and Michael Harkins, all of Kenosha, Wis. The charter is for the construction and operation of an electric railway from the Wisconsin state line to Milwaukee. The officers are: President, Alexander Clark of Evanston, Ill.; vice-president, George S. Rhodes of Evanston, Ill.; secretary, James Cavanagh of Kenosha, Wis., and treasurer, George Rhodes of Evanston, Ill.

It is the purpose of this company to construct an electric railway between Waukegan and Kenosha, thus closing the gap existing in an electric-traction route between Chicago and Milwaukee. The company will enter into traffic arrangements to operate over the road of the Chicago and Milwaukee Electric Railway company, now operating between Evanston and Waukegan and over the lines of the Milwaukee, Racine and Kenosha Electric Railway company, between Kenosha and Milwaukee. In Kenosha the Kenosha Street Railway company is now constructing a road under a franchise owned by B. J. Arnold of Chicago, and traffic arrangements have been entered into with the new company by which it will operate its cars over the Kenosha company's tracks. Later it is hoped that arrangements will be made so that the Northwestern elevated railroad of Chicago will operate over the tracks of the Chicago, Milwaukee and St. Paul Railroad company from Wilson avenue to Evanston, where connection will be made with the Milwaukee electric line.

The new company plans to have its road in operation by January 1st next. It is expected that the trip from Chicago to Milwaukee will be made in two hours and 30 minutes.

Classification of Chatterton's Compound.

On May 16, 1900, G. W. Sheldon & Co. imported for the Central Electric company of Chicago, and via that port, an importation of merchandise, consisting of what is known as "Chatterton's Compound." The collector of the port of Chicago assessed duty at the rate of 35 per centum ad valorem, under the provisions of paragraph 450, of the present tariff, as a manufacture of guttapercha, or of which that material is a component of chief value, and not otherwise specially provided for in the tariff. Protest was entered with the Board of General Appraisers, on the claim that it should have been more correctly dutiable at 25 per centum ad valorem, under paragraph 3, of the same act, as a chemical compound, not specially provided for. As every electrician knows, Chatterton's compound is used for the purpose of uniting the different coatings of guttapercha cores; also for the purpose of cementing guttapercha to wood, and it is especially valuable in electrical operations on account of the fact that it is possessed of such excellent insulating qualities, one of its most important uses being that of splicing submarine cables. The finding of the board was to the effect that the compound is one in which guttapercha is the component material of chief value, and the board further held that the compound was correctly classified by the collector of the port.

A High-frequency Alternator.[1]

By Henri F. Chadwick.

A high-frequency alternator is a very useful machine, and, in fact, is necessary in every well-equipped electrical laboratory. Its principal use was demonstrated by Professor Hughes in 1886, when his experiments on the self-induction of metallic wires called the attention of the electrical world to the nature of the propagation of high-frequency currents through metallic conductors. Although Maxwell, Rayleigh, Heaviside and others had solved the problem theoretically before Hughes performed his experiments, the experimental results appealed to many to whom the mathematical results were either unknown or very vague. It is often thus in laboratory work.

To review briefly the work of Maxwell, Hertz, Hughes and others, it is found that as we increase the periodicity of alternating currents, the real resistance is increased. By this we do not mean that the impedance $\sqrt{R^2 + \omega^2 L^2}$ is greater than the resistance R, but that there is a real increase in the dissipation of energy per unit of current. As the energy loss is proportional to C^2R, with a given current, C, a greater energy loss would mean a greater resistance. This is actually the case as the periodicity is increased.

The old idea that a current of electricity is started in a wire by a kind of push similar to the way in which water is started flowing in a tube has been abandoned, and all modern investigations show that the current starts its flow on the outside, the electrical energy being absorbed from the surrounding dielectric. With high periodicities, the current is confined to the very outermost layers of the wire, and the inner portions might as well be taken away. A solid conductor, therefore, does no more than a hollow tube would do, and this has been verified experimentally. With conductors from one half inch to three-fourths inch in diameter the resistance is the same as that of rather thin tubes of the same diameter, when a periodicity of about 1,000 per second is used. Professor J. J. Thompson has made same interesting calculations along this line. He has found that in the case of a copper conductor exposed to an electromotive force making 100 alternations per second, at one centimeter from the surface the maximum current would only be 0.208 times that at the surface; at a distance of two centimeters only 0.043, and at a distance of four centimeters less than 0.002 of the value at the surface. If the electromotive force makes a million alternations per second, the current at a depth of one millimeter is less than one six-millionth part of its surface value.

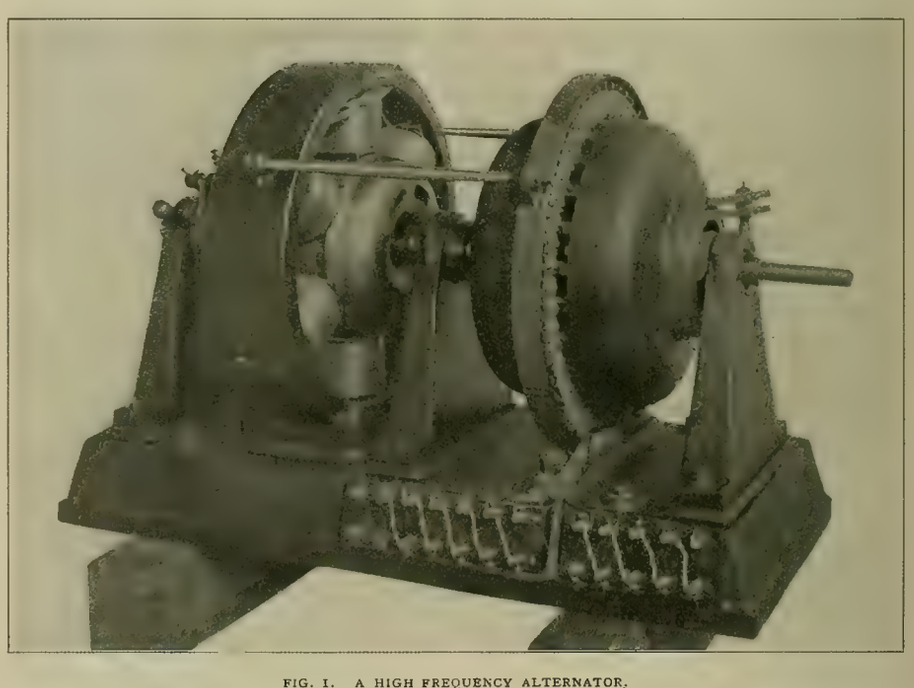


FIG. 1. A HIGH FREQUENCY ALTERNATOR.

Hertz, in one of his papers, said: "Mathematical investigation points to the conclusion that the electric force which determines the current is in nowise propagated in the wire itself, but under all circumstances enters the wire from without and spreads itself in the metal comparatively slowly and according to laws similar to those governing the changes of temperature in a conductor of heat. If the forces in the neighborhood of the wire are continually altering in direction, the effect of these forces will only enter to a small depth into the metal; the more slowly the changes take place, so much deeper will the effect penetrate; and if, finally, the changes follow one another infinitely slowly, the force has time to fill the whole interior of the wire with uniform intensity."

Another way of explaining this skin effect is by the phenomena of self-induction. The counter-electromotive force of self-induction is greater at the axis than at the surface. Therefore the current is

1. From The Tufts Engineer.

driven to the outer layers. The endeavor seems to be to make the self-induction a minimum irrespective of resistance, and thus the behavior of currents for rapid alternations is determined by inductances rather than resistances.

The rate at which the equalization of current goes on in a conductor depends, of course, on the magnetic permeability of the material, and by using rods of different materials we get a very interesting series of experiments for the high-frequency machine.

Besides the observation of the increased resistance of conductors at high periodicities, we use the machine for observing the effect of high periodicities on capacity. The reactance due to capacity is known to be $\frac{1}{C\omega}$ where C is capacity and ω the periodicity. Thus from the triangle of forces impedance $= \sqrt{R^2 + \frac{1}{(C\omega)^2}}$. As ω increases, the value of the fraction $\frac{1}{C\omega}$ grows less, and consequently the value of the impedance is less, and a larger current is obtained.

A photograph of the high-frequency alternator in use at Tufts College, for experimental purposes, is reproduced in Fig. 1. A drawing of the machine, showing all the details of construction, is given in Fig. 2. This motor-driven Mordey alternator was designed and constructed by the electrical-engineering students of the classes of 1898 and 1899. The design, as a whole, is due to Professor W. L. Hooper, but all details of design and construction were worked out by the students mentioned above during these, their senior, years.

The motor is run from a direct-current source of supply at 100 volts. The armature (A) is 10 inches

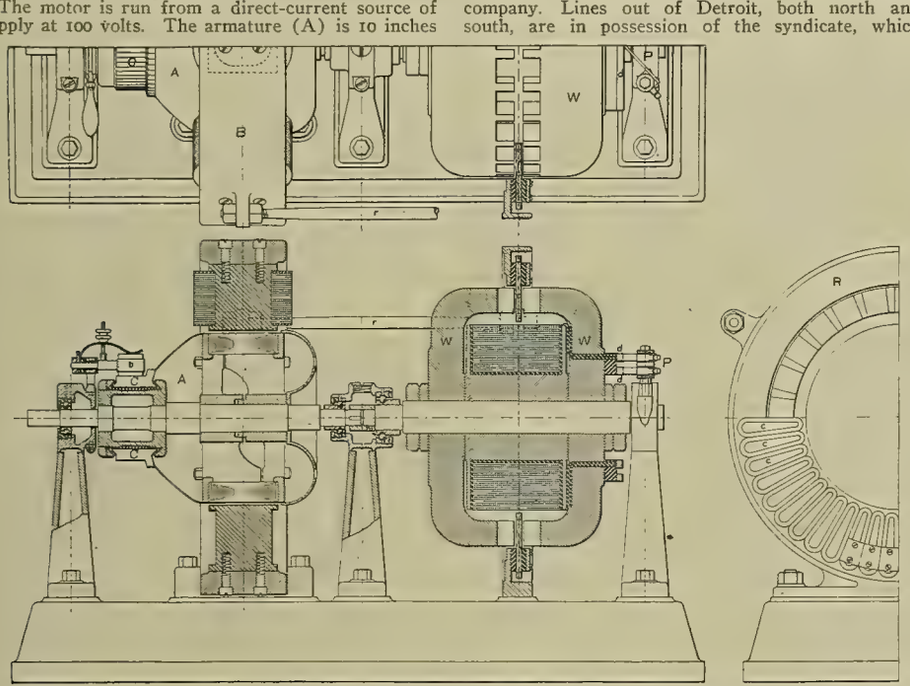


FIG. 2. A HIGH-FREQUENCY ALTERNATOR.

in diameter, and the coils are in series connection. The commutator is shown at (C) and the two brushes (b, b) are 60 degrees apart. The motor yoke (B), which is circular in shape, is made of cast-iron, while the pole pieces and field cores are of cast-steel.

The alternator is the interesting part of the unit. It is of the Mordey type, and thus very convenient for experimental work, as it admits of a great variety of arrangements of the coils. There are 12 sets of coils, each of four in series. As will be seen in the picture of the machine, each set of coils has its terminals, and the coils can be arranged in series, in multiple, or in any combination of multiple series. With all the coils in series we get 100 volts and from seven to 10 amperes; with all in multiple we obtain about eight volts and 100 amperes. Different arrangements of multiple series give values between these two extremes. These armature coils (c, c, c) are wound with copper ribbon, one-fourth inch wide and 0.01 inch thick, and are securely bolted to a composition ring (R), which is firmly held by means of two rods (r, r) fastened to the motor field.

The Mordey field is 16 inches in diameter and consists of two cast-iron crown wheels (w, w), with teeth milled out of the solid metal. The collecting rings (d, d) are mounted on one face of the field, and the brushes are set horizontally, as shown at (P).

One of the features of this unit is that it is mounted on ball bearings. From a casual glance at the machine or at the photograph, one would say that there were only three bearings. What appears to be a single bearing in the center, between the motor and the generator, is really a double bearing with a clutch between. This construction will be apparent from an inspection of the drawing.

With these four ball bearings we get a very easy running combination; in fact, from full speed it requires nearly 10 minutes to come to rest with all circuits open. It must be admitted, however, that the reduction of friction obtained by these ball bearings is somewhat offset by the noise, which is considerable, when the machine is running at full speed.

The alternator is intended to run at a speed of 2,500, with a periodicity of 1,000. At this rather high periodicity we get very nearly a sine wave as the characteristic of the machine.

Recent Ohio Electric-railway Consolidations.

Last week saw the consummation of deals that brought to the Everett-Moore syndicate properties that practically complete its through line from Cleveland to Port Huron, Mich. Now the Mahoning Valley system has been taken over, according to the latest reports, and with the completion of 30 miles of road, Cleveland and Pittsburg will be connected. There are about 20 miles of road on the west of Cleveland to be completed, and then there will be a through line from Pittsburg to Port Huron, Mich., one of the longest electric railroads in the world.

The terminus of the Mahoning Valley road is at Greencastle, Pa., and rights-of-way are owned into Pittsburg. Hon. Myron T. Herrick and James Parmelee owns the greater part of the road. The extension of the Cleveland, Chagrin Falls and Eastern railway will connect with the Mahoning Valley. The syndicate's lines running west from Cleveland will soon connect with the Toledo, Fremont and Norwalk, which was purchased recently. Through Toledo the cars will pass over the Toledo Traction company's lines and will go north into Michigan over the shore line, which is also owned by the company. Lines out of Detroit, both north and south, are in possession of the syndicate, which will form the connection to Detroit, and from there to Port Huron. In fact, there are few roads in that portion of the state that are not now in possession of the syndicate.

It is said that the Cleveland, Pittsburg and Detroit Traction company will be the name under which the long line will be operated. To the consolidation thus formed will be added other roads, the purchase of which is now contemplated. The system will have feeders from almost every direction, and it is claimed that it will be within reach of 2,000,000 people or more.

It is reported that Albion E. Lang, president of the Toledo Traction company, will become the manager of the Everett-Moore roads in Ohio, at a salary of $30,000 per year.

Luxurious Trolley Car for Mr. Everett.

Henry A. Everett of the Everett-Moore syndicate, which is buying up many of the electric-railway properties in the vicinity of Cleveland, Toledo and Detroit, is said to have had plans drawn for a magnificent trolley car to be used in making long-distance trips. The car will be nearly twice as long as the ordinary suburban trolley car and will entail an expenditure of about $15,000. It will contain a parlor, library, office, workroom, dining room and kitchen, and it will also be fitted with three sleeping berths. The latter will be invisible during the day, because they will be stored beneath the floor of the car, not above, as is usual in most sleeping cars. At either end of the car there will be an electric searchlight. The one at the rear of the car, being red, will turn on automatically whenever the car stops. The interior and furnishings will be of mahogany, and the whole will be finished up in sumptuous style.

British Telegraph and Telephone Systems.

The Ottawa (Ont.) Board of Trade has made a practical departure that must bring the question of British governmental cable, telegraph and telephone services to the attention of business men in all parts of the British empire. A circular letter has been drafted and will be forwarded to boards of trade and chambers of commerce throughout the United Kingdom and the colonies, urging the importance of the establishment of state-owned cables connecting the mother country with other parts of the empire. The proposal requires that not only the connecting transmarine cables shall be under government control, but that land telegraphs in the several British possessions shall be state owned. This system is already established in the United Kingdom, and also in Australia, New Zealand, India and South Africa, the services being operated by the various postal departments. Canada is the only important part of the empire in which the telegraph service is in private hands, and the circular alludes to the report that the transfer of the Canadian telegraph lines to the Postoffice Department and the laying of a state-owned cable across the Atlantic are now under consideration of the Dominion government. With these projects carried out, and the Pacific cable successfully established, there will be an all-British telegraph system, under government control, girdling two-thirds of the globe.

The imperial cable scheme includes a line from Perth in western Australia, via Cocas Island and Mauritius, to South Africa, with branches to India and Singapore, the length of the system being 9,100 miles. It also includes a system of 6,600 miles, running from South Africa, via Ascension and Barbadoes, to Bermuda, thence to Canada and the United Kingdom. The length of these two systems will be 15,700 miles, about the same as the trans-Canadian system outlined by the Ottawa Board of Trade. The memorial points out that it was mainly through the influence of chambers of commerce in the United Kingdom that the postal telegraph service was inaugurated, and calls on all concerned in the imperial movement to take such action as will tend most speedily to nationalize the telegraph system, by land and sea, of the whole British empire.

The question of establishing the telephone service under the same management will soon come up for consideration by the government, as it is felt that the only satisfactory way to meet the telephone situation, as it exists in Canada to-day, is to have the business taken over by the government and administered as an adjunct of the postoffice. Great as has been the increase in the telephone business in Canada during the last 10 years, the industry is still believed to be in its infancy, as far as that country is concerned. A few million dollars would purchase all the telephone exchanges in the Dominion. It is claimed that it would be far cheaper to nationalize the telephone than the telegraph, and the benefits resulting from government ownership would be as great in the one case as in the other.

Abraham E. Smith, United States consul at Victoria, B. C., states in a recent consular report that a surveying party has located the landing site of the British Pacific telegraph cable (which is to connect the Dominion of Canada with the Australian Confederation) on Kelp Bay, near Banfield Creek, seven miles from the entrance to Barclay Sound and something over 100 miles from Victoria. The location is described as admirably adapted for the purpose—a good harbor, 12 fathoms of water close to the shore, so that vessels of 10,000 tons can find safe anchorage. The harbor is landlocked, and has a bottom of ooze that it is said will furnish good protection for the wire.

Work has already begun in England on the cable. It is to be 5,834.5 miles in length, the longest yet constructed, and will be transported and laid in one ship, which is now being specially built for the purpose. The cable will run from Vancouver Island to Fanning Island, a distance of 3,337 miles, before a landing is effected, thence to the Fiji Islands, thence to Norfolk Island and thence to Queensland. The first installment of cable, including the sections from Queensland to Norfolk, Fiji and Fanning islands, is expected to leave England in January, 1902. The second and longest portion is to leave in August, 1902, come direct to Vancouver Island, and be laid from Barclay Sound to Fanning Island. According to the contract, the whole cable is to be laid and working by January 1, 1903. Unforeseen disaster excepted, those engaged in the work believe this great enterprise, which will cost $10,000,000, will be completed at the date promised.

Three-cent Fares in Lorain, Ohio.

It is said that the three-cent-fare system will be given a trial by the Lorain Street Railway company of Lorain, Ohio. This company is supposed to be controlled by Hon. Tom L. Johnson. The road runs to Elyria, and the fares have been arranged as follows: In Lorain proper, three cents; from the corporation line to the corporation line of Elyria, three cents; in Elyria, three cents. If one wishes to go from the business portion of one town to the other, the fare will be nine cents, and to the steel plant, midway between, the fare either way will be six cents, instead of 10, as formerly.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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CONVENTIONS AND EXPOSITIONS.

United Electrical Contractors' association of New York State, Builders' Exchange building, Buffalo, N. Y., July 17th.

American Institute of Electrical Engineers (general meeting), Temple of Music, Buffalo, N. Y., August 20th to 24th.

Ohio Electric Light association, Put-in-Bay, Ohio, August 20th to 22d.

Pennsylvania State Street Railway association, York, Pa., September 4th.

International Association of Municipal Electricians, Niagara Falls, N. Y., September 2d, 3d and 4th.

New York State Street Railway association, Rochester, N. Y., September.

Association of Edison Illuminating Companies, Buffalo, N. Y., September 10th.

Roentgen Society of the United States, University of Buffalo, Buffalo, N. Y., September 10th and 11th.

Old Time Telegraphers' association and United States Military Telegraph Corps, Windsor Hotel, Montreal, Que., September 11th, 12th and 13th.

American Street Railway association, Madison Square Garden, New York, N. Y., October 9th to 11th.

South Carolina Interstate and West Indian Exposition, Charleston, S. C., December 1, 1901, to June 1, 1902.

Visitors to the Pan-American Exposition will find the Western Electrician's space in Section F 2 in the Electricity building, where they will be cordially welcomed.

Some time ago, as mentioned in this journal, the Association des Industrielles of France offered a prize for the best rubber insulating gloves for electrical workers. The chief objections to the rubber gloves used in France were that they were too difficult to get on and off and inconvenient in wear; they were easily cut in the handling of the tools, and torn by the rough surface of the metallic wires, and when a cut or tear was made the gloves were really worse than useless, as they gave the wearer an idea of false security. The competition was an international one. After three examinations, the committee selected six gloves for practical trial. They were first of all submitted to an electrical laboratory in Paris, and severe tests for electrical resistance were imposed, with varying results. The gloves were then used in practical work, so as to find their resistance to wear and tear, and after many trials the committee came to the conclusion that of all the gloves submitted to the association those of Mr. Franz Clouth of Cologne, Germany, were the only ones that fulfill in a satisfactory way the object of the competition; and it, therefore, recommended the directors to award to Mr. Franz Clouth of Cologne the prize of 1,000 francs, which was accordingly done. We are not informed whether any but European manufacturers took part in the competition, but it is probable that the United States was not represented. It is important, of course, that linemen should have the best protective devices it is possible to obtain, although it is only too often the case that in the hurry of actual work needful precautions are neglected by workmen having that contempt of danger that familiarity with high-tension circuits sometimes brings.

Probably no more candid statement of lack of success was ever made by the president of a Bell telephone company than that of John I. Sabin, as president of the Central Union Telephone company, in his recent letter addressed to the stockholders of the company, in which he pleaded for five millions of additional capital. "You are not satisfying the public because your system does not reach far enough," says Mr. Sabin; but "there is no use crying over spilled milk. * * * * What you want done must be done now. Later on, and a little later on at that, it will be too late." The situation is a very peculiar one. The majority stockholder of the Central Union is the parent Bell company, the American Telephone and Telegraph company. Thus Mr. Sabin is in reality censuring the fountain head of Bell telephone operation in this country. But the fact is that the parent company, with its long-distance service, is in no insignificant sense a competitor of the Central Union in the extensive territory which the latter essays to serve. Thus a false situation is created, and the minority stockholders assert, with apparent justice, that, as the parent company is at once the majority stockholder and competitor of the Central Union, the outside stockholders should be relieved of the embarrassments of their position, created by no fault of their own, by being allowed to exchange their Central Union holdings, on some equitable basis, for stock in the American Telephone and Telegraph company. Then, having done the fair thing by the "outsiders," the "insiders," with ample capital, could manage affairs to suit themselves.

But, whatever the outcome of the present financial dilemma in which the Central Union finds itself, the situation is most significant of the strength of the Independent telephone movement in the Middle West. The vast importance of the telephone opposition in the states of Ohio, Indiana and Illinois is now indisputable, for it is publicly acknowledged by the Bell people themselves. One cannot fail to recall a paragraph in Mr. S. P. Sheerin's interesting paper read at the recent Independent telephone convention in Buffalo. Mr. Sheerin is a man of national reputation and, as president of the New Long-distance Telephone company of Indianapolis, he knows what he is talking about. This is what he said: "After a 'war expenditure' of seven and a quarter million dollars, begun upon the Independent movement when there were less than 3,000 Independent telephones in the state [of Indiana] the Central Union now has, for its expenditure, 22,000 telephones, and the Independent movement has 52,469." These are surely significant figures. The whole text of Mr. Sheerin's paper, with discussion by Mr. J. B. Ware of Detroit, was given in the Western Electrician last week. It may be added that Ohio is another state in which the actual number of Independent telephones exceeds that of the Bell. Truly, the Independent telephone "infant" is advancing toward lusty manhood with vigorous strides.

It is evident that it will be some time before Chicago has an Independent telephone system covering the entire city. The United Telegraph, Telephone and Electric company has for several years operated an exchange serving the three wards constituting the old town of Hyde Park, but it is badly handicapped by the lack of a franchise enabling it to give downtown connections. It is seeking to extend its service over the whole city, and an ordinance giving the desired franchise is pending in the City Council. The Independent company offers rates much lower than those existing, but the aldermen are evidently in no hurry to give the desired permission, and the application seems to have been laid over until fall and perhaps indefinitely postponed. The Chicago Telephone company, under the new and active management of President Sabin, announces frankly that it does not propose to reduce rates as a competitive measure but rather to improve its service. In the meantime nothing is heard from the Illinois Telephone and Telegraph company, which has a franchise for the construction of a telephone system in the streets of Chicago, one condition being that it shall have an exchange of 2,000 subscribers in operation by the spring of 1904, five years from the date of the passage of its ordinance. This company has made a beginning on an elaborate tunnel system, but the scope of its present plans and operations is not well known to the public. Last fall President Wheeler of the Illinois company said that 11 miles of the tunnel system under the business district of Chicago would be completed by July 1st of this year. It is perhaps doubtful whether this assertion has been made good, as the company has shown few signs of activity. Altogether, the prospect of energetic opposition in the telephone business in the city of Chicago seems still to reside some distance in the future.

The electric-railway activity in Great Britain continues unabated. Perhaps the most interesting project of all is the Behr high-speed "monorail" system to connect Manchester and Liverpool. The parliamentary hearing on this interesting proposal was editorially mentioned in the Western Electrician of June 1st, at which time some of the engineering features of this proposed 110-mile-an-hour road were outlined. Since then it appears that the select committee of the House of Lords, which has been considering Mr. Behr's second application, has decided to allow the bill to proceed, subject to the insertion of a clause providing that the center of gravity of the cars when fully loaded shall be at least 12 inches below the top of the rail. There seems to be a prospect, therefore, that this long-talked-of experiment may be carried out, and further developments will be awaited with interest on both sides of the Atlantic.

From London comes a dispatch dated June 25th stating that the County Council "has decided to spend over £2,000,000 on new electric-traction routes in various parts of London and on the necessary widening of streets required by the new enterprises." This looks like the overhead trolley on an extensive scale, although, like many newspaper dispatches, the statement is indefinite. On the date mentioned a parliamentary committee discussed the bill to authorize the introduction of electricity as the motive power for the Metropolitan underground road—a project in which Mr. Yerkes is now said to be interested, in addition to his own tunnel road. The correspondent says that Mr. Yerkes was examined before the committee and said that he was ready to carry out his agreements if he did not meet too much opposition. Mr. Yerkes did not condemn the Ganz polyphase system of traction, but, according to the report, said he would not put a dollar into any concern using that system.

It is evident that England has at last begun to realize that electric railroading means something tangible in national advancement.

Northwestern Electrical Association's Convention at Sheboygan, Wis.

Those who attended the summer convention of the Northwestern Electrical association at Sheboygan, Wis., had a delightful time. At this writing it is impossible to give a full list of the visitors, but on the Chicago train were the following-named: John W. Brooks, Francis Raymond, G. C. Gunn, J. V. S. Church, W. Forman Collins, F. L. Perry, James Wolff, Edward Jenkins, C. K. Thomas, Thomas G. Grier, Walter S. Goll, Thomas R. Mercein, Charles S. Mercein, George J. Cadwell, Frank McMasters, R. H. Watson, C. W. Bacon, Harry Byrne and J. R. Cravath.

President Debell met the party at the train and distributed badges. The convention was held at Lake View Beach Hotel, about a mile south of Sheboygan, on the shore of Lake Michigan.

President Debell called the convention to order on Wednesday morning, June 26th, and gave a cordial welcome to all. James Wolff, T. G. Grier and J. W. Brooks were appointed a membership committee. Through S. B. Livermore, chairman, the special committee on gasoline lighting presented the following report:

The committee on gasoline lighting must offer an apology to the convention for presenting an incomplete report, but the delay in answering our list of questions on the part of one-half of the stations in the territory covered is responsible for the greater part of it. We covered the states of Michigan, Wisconsin, Iowa, Minnesota, North Dakota and South Dakota by sending out the following list of questions to every plant in these states:

First—How many customers have you lost by reason of gasoline lamps?

Second—What kind of gasoline lamp is most used in your city?

Third—How many street lamps use gasoline?

Fourth—Have lamps caused any accidents?

Fifth—What kind of customers use most gasoline lamps?

Sixth—Do you consider their competition serious?

Seventh—Do your local insurance people make any objection to them?

Out of 370 inquiries sent out, only 160 replies had been received in time to figure up the report. The results are as follows:

The number of plants reporting customers lost is 75, running from two or three each up to 50. Council Bluffs, Iowa, reports 25 lost; Missouri Valley, Iowa, 25; Lead, S. D., 10; Grinnell, Iowa, 12; Clarinda, Iowa, 12; Nevada, Iowa, 10; Mankato, Minn., 20; Marinette, Wis., 15; Tipton, Iowa, 13; Corning, Iowa, 12; Creston, Iowa, 50. Many other towns report five to 10. Many report that customers come back after trying gasoline, so the net loss of actual customers in the district covered is remarkably small.

Second—As to kind of lamps. Reports show all kinds, some towns having eight to 10 different kinds of gasoline lamps. The most common are the hanging lamps, gravity burning, and the air-pressure lamps, tanks or generators in basements.

The underwriters lay great stress on the danger of all these lamps and caution the public about the danger of using gasoline, yet pass 40 different kinds of lamps as safe. The moral is apparent.

Third—Street lamps. Only five cities report use of gasoline street lamps, as follows: Minneapolis, Minn., 1,500; St. Paul, Minn., 3,000; Dubuque, Iowa, 100; Des Moines, Iowa, 100; Winona, Minn., 70. The lamps do not seem to be used at all in the small towns and cities for street lighting, according to our reports. Dubuque reports city just discarding last 100 gasoline street lights.

Fourth—Accidents. There is hardly a report that does not mention one or more accidents resulting from leaks or explosions of gasoline lamps. A pamphlet of the Illuminating Publishing company of Cincinnati, Ohio, entitled, "Is the Use of Gasoline and Acetylene Dangerous to Human Life?" has just been published, and contains a ghastly record of lives lost, terrible injuries and great loss of property. The committee advises each manager or superintendent to buy a few copies of this pamphlet and send one to each gasoline user in town. If he continues to use the dangerous fluid after reading that work he is beyond salvation.

Fifth—What class of customers use most gasoline lamps? The users of the lamps seem to be mostly small merchants, barbers and grocers, saloons, restaurants and drug stores, and from the reports we gather that many of these people are rather undesirable customers, and are always looking for something for nothing. However, there seems to be a class of long-hour burners, such as saloons, drug stores and restaurants, who keep open late at night, and, on the usual method of charging, no doubt feel that they must economize. Then, they listen to the gasoline man, and he has what they want—cheap light. It would seem to the committee that a proper discount to long-hour users would retain many of these who look to gasoline to keep down expenses. The larger stores usually put in pressure-tank plants, and from the reports they are very short lived, caused by poor regulation, heavy cost of mantels and glassware.

Sixth—Do you consider their competition serious? The cities of Oelwein, Iowa, Lead, S. D., Marengo, Iowa, Corning, Iowa, Owatonna, Minn., Creston, Iowa, What Cheer, Iowa, Spencer, Iowa, Tipton, Iowa, Tecumseh, Mich., Montevideo, Minn., St. Paul, Minn., Monroe, Wis., all report that the competition is serious. The balance, or 90 per cent., of the towns heard from do not consider the competition serious. They think that the people that use them do not get satisfaction, and that they are not a success. A certain percentage of people are always trying new things, and, of course, there will always be many lamps and machines that will perhaps look as though they would give the electric and gas plants a run for their money, but the general result seems to be that where good service, in gas or electricity, is to be had at reasonable prices, the gasoline lamp will only be used by the few kickers and cheap people that we all come into contact with. In no case does the report indicate that this competition caused a lowering of rates. Many places report that nearly all their customers who experimented with gasoline have given it up, or, where they have made a large investment in a plant, keep it and use electricity also.

Seventh—Do the local insurance people make any objection? A very few places report that the insurance rates are raised on people using gasoline lamps. Most of the reports would indicate that there is no objection at all. The proper excess charge is 25 per cent. of usual premiums, but the competition among the insurance companies is so fierce that in rare cases do they make any raise in the rates. If one agent does, another stands ready to take his risks at the old rate. The opinion of the committee is that they, being recognized as very unsafe and dangerous, should be rigidly prohibited, not because of the competition they give us in some cases, but because they are unsafe, dangerous to an extreme, and a source of danger to people on each side of them, or above them, who do not use them.

In conclusion, it would seem from these reports that each town has lost from a few to a large number of customers by reason of gasoline competition, but that most of these people have returned to the use of electricity, showing that while it may be a very cheap light, there must be great drawbacks to its general use. There are in every town lots of people looking for something for nothing, and the gasoline idea is a smooth one and catches their fancy. They do not know the origin of the fluid, its quick evaporation on exposure to the air and its consequent danger, and it is only by actual experiment that they become convinced that it is no good, and usually after paying $150 or more for an outfit that cost about $25. Of course, it won't do to lose sight of this fact, that where many minds and much money are concentrated on one object, it is more than likely that some day a perfect gasoline lamp will be invented, and we must be on our guard and hold our customers by giving good service and good rates. But at present it is evident that it does not seriously threaten our interests.

At the Wednesday afternoon session two papers were presented—one by Guy V. Williams on "Incandescent-lamp Economy" and the other by Professor B. V. Swenson on "Trades Training for Non-Technically Educated Men."

In the afternoon there was a baseball match in which the "Benedicts" beat the "Bachelors" in a five-inning game by a score of 23 to 6.

The dance on Wednesday evening was a delightful social function. Quite a large party of Sheboygan ladies, with their escorts, came out in carriages and by trolley from the city to entertain the visitors. The reception committee was composed of Mr. and Mrs. Gustav Schrage, Mr. and Mrs. E. L. Debell, Misses Arlisle, Seaman and Elizabeth Morris, Mr. Herman Roenitz and Lieutenant Louis Wolf. Vocal solos were sung during the intermission between dances by Mrs. E. C. Francis, Miss Melaine, Miss Lohmann, and a whistling solo was delightfully rendered by Mrs. Carrol Quimby. It was evident that the elite of Sheboygan were vieing with one another to help Mr. and Mrs. Debell impress upon the delegates a lasting remembrance of Sheboygan's hospitality.

At the Thursday morning session an invitation was read from Charles G. Armstrong, on behalf of the Milwaukee Exposition company, inviting the Northwestern Electrical association to attend the exposition in September. Professor D. C. Jackson of Madison, Wis., was elected an honorary member of the association. Budd Frankenfield read the only paper that was presented at this session, his subject being "Shunt Motors." Two new associate members were admitted, and the session adjourned.

On Thursday afternoon there were held a trap-shooting contest and Olympian games, while in the evening the members and delegates attended a theatrical performance given in the theater on the hotel grounds by a local stock company.

A number of additional central-station men and others arrived on the second day of the convention.

The Beaumont (Texas) Telephone company has been incorporated, with a capital stock of $60,000, for the purpose of constructing, operating and maintaining a telephone exchange. The incorporators are W. H. Aldridge, S. H. Van Wormer and J. K. Duffy.

Philadelphia Street-railway Situation.

Following the ignoring of his offer to pay the city of Philadelphia $2,500,000 for the street-railway franchises which were recently given to Congressman Robert Foederer and his associates, John Wanamaker, on June 21st, sent letters to Mayor Ashbridge and Mr. Foederer, renewing his offer and adding $500,000 to the original offer, as a bonus to the men holding the grants and privileges. Mr. Foederer is alleged to have said that Mr. Wanamaker's offer was not sincere, and this Mr. Wanamaker denies in his letter. In part Mr. Wanamaker says: "I therefore renew the offer which I made to the mayor, to pay, as therein stated, to the city of Philadelphia $2,500,000 and a bonus to yourself and your associates personally for the conveyance of the grants and corporate privileges you now possess. When you and your associates assign to me the capital stock, ownership, and control of the corporations you now possess, with the engineers' plans, I will pay to you the sum of $500,000, and I will pay to the city of Philadelphia the $2,500,000 under the conditions stated in my letter to the mayor. One million and a half dollars of this amount, I should stipulate, should be used for the deepening of the Delaware River channel, and $1,000,000 be applied to the building of public schools and for the purposes of public education.

"In addition to this, I will agree on the surface roads covered by your charters and the ordinances that three-cent fares only shall be charged between the hours of 5 and 8 a. m. and 5 and 7 p. m., and not over five cents for the other hours; and I will further agree that any time within 10 years the city of Philadelphia may resume the franchises upon the payment of the actual money expended and invested in the various enterprises covered by the charters and ordinances, with six per cent. interest."

Chicago Traction Franchises.

Hostilities over franchise extensions were begun between the Chicago Union Traction company interests and the city of Chicago on June 25th by William L. Elkins filing bills in the federal court to restrain the city officials from interfering with the alleged rights of the traction company under the so-called 99-year act and to restrain the officers of the Union Traction company from attempting to renew franchises on the city's claim of expiration in 1903. In the application for restraining orders the assertion is made that the franchises were extended by the 99-year act of the Legislature in 1865, and the court is asked to decide the validity of that act.

It has been expected that the Union Traction company would stand on the 99-year act and that no renewal of franchises would be asked for at the expiration two years hence. The action begun on June 25th by Mr. Elkins is thought to be of as much force as if it had been brought by the traction company itself, as Mr. Elkins represents the interests which now control the company

The Machinists' Strike.

The employers seem to be winning in the contest arising from the strike of the machinists that has been on for several weeks. Advices from Cincinnati, Milwaukee, Minneapolis, New York city, Cleveland and other cities state that shops are being opened and that many of the strikers are yielding. The situation in Chicago remains about as it has been for some time. In Milwaukee the strikers have been held in check by injunctions issued by some of the manufacturers, restraining them from interfering with the men at work in the shops or from doing anything that will in any way damage the companies issuing the injunctions or their employes. A similar action has been taken by a Detroit engine firm. These measures are directed against each and every member of the International Association of Machinists, and are really being brought by the National Metal Trades association. Labor leaders say that the injunctions will be bitterly contested.

BOOK TABLE.

CENTRAL STATION EXPERIENCES. New York: Power Publishing company. 1901. Pp., 106, 5¾ by 9 inches, with 40 diagrams and illustrations. Price, paper, 75 cents; cloth, $1.

This little volume, comprising a series of articles reprinted from Power, has a striking colored cover and, as its title partly implies, gives the experiences of a steam engineer while learning to run an electric-light and power station. The book is composed of a series of narratives related in a familiar, colloquial style. Simple arithmetic only is employed, and the stories are written in a way to make easy reading for one unfamiliar with technical terms. The diagrams are instructive and the illustrations interesting. Many problems which come up to perplex the practical but inexperienced man who is put in charge of electric power machinery are solved. The book is neatly printed and will undoubtedly prove of value for those for whom it is intended.

DEVELOPMENT OF THE TELEPHONE FIELD.

Proposed Telephone Competition in Chicago.

The question of granting a franchise to the United Telegraph, Telephone and Electric company to operate a telephone system in Chicago was discussed by the City Council committee on gas, oil and electric light on June 21st. The committee invited the Chicago Telephone company to send representatives to hear the arguments of the men who are petitioning for a franchise, and President Sabin, Attorney A. D. Wheeler and General Manager A. S. Hibbard responded.

It was expected that the Chicago Telephone company would offer a liberal compensation and a further reduction in the telephone rates to keep the other company out of the field, but Mr. Sabin declared that no opposition, however formidable, would cause his company to reduce its rates, but he laid stress on the fact that substantial reductions were being made all the time without outside pressure. He said that the company will continue to make reductions as speedily as the business warrants it and it can do so without injury to itself and its customers.

President Block, of the petitioning company, said that the double system in a city greatly benefited the community, and that where Independent companies had secured franchises in cities the rates have been invariably lowered and better service provided. Mr. Block offered to supply telephones at about 50 per cent. of the rate now charged, and promised the city 50 trunk lines free for its own use, and telephones in all the engine houses at a nominal cost. The company would agree to pay the city three, five and seven per cent. of its gross receipts during the life of the 20-year franchise. Mr. Block asked the committee to remember that there were manufacturing concerns in Chicago with $25,000,000 in capital, employing thousands of men, that made telephones and apparatus for the Independent companies, and were unable to sell a dollar's worth of it to the Chicago Telephone company, which was supplied throughout with Bell instruments and apparatus.

President S. P. Sheerin of the New Long Distance Telephone company of Indianapolis spoke in favor of the proposed ordinance. He said that if the council passed the ordinance it would allow his company to obtain an entrance to Chicago. Being an opposition concern, his company could not make any arrangement with the Chicago Telephone company, and was unable to get any nearer Chicago than Lafayette, Ind.

Further consideration of the subject was postponed, and it is generally believed that the committee will not take it up again until next fall.

Wisconsin Valley Plan of Mutual Telephone Systems.

What is known as the "Wisconsin Valley Plan" of mutual telephone companies organizing and doing business is spreading to other states. This plan is strictly co-operative. Stock can be bought only by persons that rent telephones, and such persons can buy as many shares of stock as they rent instruments, and no more. Whenever the stockholder ceases to rent as many telephones as he has shares, the company has the right to cancel his excess stock and refund to him its par value. The company binds itself to furnish stock to every renter of its service. It must also regulate its monthly charges so as to be able to pay a dividend of one per cent. a month on $50 shares, to be credited to the monthly rental. As an example, where a rental of $2.25 a month for business houses and $1 for residences is charged, and a monthly dividend of 1½ per cent. (75 cents) is credited on the rental account of each stockholder, the stockholder actually gets his business telephone for $1.50 and his dwelling-house service for 25 cents a month.

Telephone Operator Sues for Damages.

According to the Chicago Record-Herald, Miss Mary Schultz, a former operator for the Chicago Telephone company at the South exchange, has brought suit against the company for $30,000 as compensation for injuries received while performing her duties as operator for the company. Miss Schultz alleges that she had a receiver adjusted to her ear and was busy answering calls, when she received a shock that injured some of the bones on the left side of her head, and which will permanently disable her. Mr. A. S. Hibbard, general manager of the Chicago Telephone company, says that he has no knowledge of any suit being brought against the company for damages. He describes Miss Schultz's injury as being of the same nature as the cramp a telegrapher experiences in his hand after long service.

Central Union Assessment Objected To.

President Sabin's assessment scheme to finance the Central Union Telephone company is being resisted by a number of the minority stockholders of the company. These stockholders allege that a considerable part of money which the company has spent in the last few years was expended more for the furtherance of the interests of the Bell Telephone company than for those of the Central Union company.

The assessment scheme planned by President Sabin, and which was explained in his circular letter to the stockholders of the company, called for an immediate assessment of $20 a share and also for two other assessments, one of $20 a share before December 31, 1901, and another of $20 a share during 1902. This plan the minority stockholders are said to oppose strongly.

One of the leading minority stockholders—a gentleman who opposes the assessment plan—suggests that a compromise by which the stockholders would be able to exchange their stock on a reasonable basis, say, two shares of Central Union stock for one share of American Telephone and Telegraph stock, would be acceptable. The American Telephone and Telegraph company now controls the majority of the stock of the Central Union Telephone company, and as the two companies are operating practically in the same field, they have, to a certain extent, adverse interests, and as long as that remains the case it will be impossible for the Central Union to prove successful.

The stock of the Central Union company, immediately after the issuance of President Sabin's letter, dropped from about 50 to 34, but it has recovered somewhat, and is now quoted around 40.

The stockholders say that they have received no dividends for the last five or six years and that the surplus each year has been used in developing the company, constructing new lines, etc., without any appreciable results.

It is expected that a meeting by the minority stockholders will be held soon to decide upon a course of action. It has been reported that the "insiders" will offer to take the stock of the objectors. It is asserted that all the stock put on the exchange for sale has been taken by the "insiders."

Wisconsin Independent Telephone Association.

[Special dispatch to the Western Electrician.]

La Crosse, Wis., June 25.—The summer meeting of the Independent Telephone Association of Wisconsin was begun here to-day. The convention was called to order in the city hall this morning by President Hutchinson. Mayor Boschert of La Crosse gave the delegates a hearty welcome and President Hutchinson responded. Captain Moulton of La Crosse spoke of the national convention, which he had attended, and pointed out the important work that that association was doing. A general discussion on toll lines followed.

After the morning session the delegates visited the local exchange of the La Crosse company and reconvened at 2 p. m. The president spoke of the importance of the co-operation of Independent companies and the necessity of putting in the best construction and adopting uniform standard of toll-line construction. Mr. Abbott of Roebling's Sons company gave a paper treating on tolls and toll lines, comparing the lines and systems of Michigan with those of Wisconsin. This was a good paper, and was ordered placed on file. There was a general discussion of the paper. The delegates then took a trolley-car ride around the city. At 7 p. m. they took a steamboat excursion on the Mississippi River and at nine had a banquet at Hotel La Crosse. Forty companies were represented. W.

Full Opinion in Berliner Case.

[Special dispatch to the Western Electrician.]

Boston, June 24.—Judge Brown, in the United States Circuit Court, to-day, sent down his opinion in the case of the American Bell Telephone company against the National Telephone Manufacturing company and the Century Telephone company—the well-known proceeding involving the validity of the Berliner patent. When Judge Brown decided against the Bell company in February last he sent down a brief statement of the reasons for his decision. The decision to-day is more elaborate, consisting of 113 printed pages, but there are no new points. Appeal will be taken by the Bell company to the Circuit Court of Appeals.

Telephone News from the Northwest.

The Mountain Lake (Minn.) Telephone company will build a line to Comfrey, Minn.

Baldwin & Meredith contemplate building a line between Casselton and Litchville, N. D.

The Cannon Valley Telephone company has been granted a franchise at Le Sueur Center, Minn., for a local exchange.

Recent wind and electrical storms in the Twin Cities have played havoc with the telephone system. The Northwestern Telephone Exchange company figures that 500 instruments were burned out in houses during a week.

Linemen of the Zenith Telephone company and the Duluth Telephone company of Duluth recently went on a strike for an eight-hour day with wages the same as they now are getting for 10 hours.

Martin Olson has been granted a franchise for a local exchange at Atwater, Minn.

J. C. Kelsey has been transferred from Minneapolis to the management of the Douglass County Telephone company, Superior, Wis.

The United Telephone and Telegraph company has filed articles of incorporation in Minneapolis, and proposes to build to Duluth. The incorporators are A. T. Averill, W. H. Durin, Glen W. Averill of Cedar Rapids, Iowa, Charles Webster and G. W. Potter of Waucoma, Iowa. The company has considerable property in Southern Minnesota and Northern Iowa and proposes to extend northward.

A telephone line is projected between Easton and Barber, Minn.

The council of Barnesville, Minn., has concluded to grant no franchises for telephones, but will install a municipal system.

The Iron Range Telephone company has recently absorbed the toll line between Crookston and Fosston, Minn. It is understood the line will be extended east from Fosston, as far as Bemidji, this season.

A local exchange is being installed for Dawson, Minn.

H. H. Strunk & Son have been granted a franchise by the council of Shakopee, Minn.

The Plattsmouth Long-distance Telephone company will extend its lines from Plattsmouth, Neb., to Havelock.

A farmers' telephone line is projected from Clarence to Olin, Iowa.

Bayard, Iowa, will vote on July 1st on granting a franchise to the Guthrie Center and Northwestern Telephone company.

The Rocky Mountain Bell Telephone company is said to be after the line of the Red Lodge and Wyoming Telephone company. The Bell was refused a franchise at Billings, and if it can secure the Red Lodge and Wyoming line it will fall heir to that company's Billings franchise.

A stock company has been formed by citizens of Stanhope, Jewell and that vicinity and proposes to build a line between Stanhope and Jewell, Iowa.

The Marengo Telephone company has been formed at Marengo, Iowa, with a capital stock of $7,500. There are over 100 subscribers secured, and work will be pushed on the exchange.

A telephone line is projected between Ralston and Scranton, Iowa.

The Iowa Telephone company, at Burlington, has arranged to connect with the Oakville private line, which will give considerable rural connections.

The Mississippi Valley Telephone company of Keokuk, Iowa, has increased its capital stock from $10,000 to $20,000.

The Nebraska Telephone company is about to introduce the nickel-in-the-slot service for Lincoln.

The Iowa Telephone company is building a new switchboard for its exchange at Clinton, Iowa. It will have a capacity for 2,400 connections.

The Fort Dodge Telephone company of Fort Dodge, Iowa, has increased its capital stock from $25,000 to $50,000, and will proceed to extend its system. There will be 700 feet of new cable strung at once.

The Creston Mutual Telephone company of Creston, Iowa, is extending its lines to connect with the Hawkeye system at Greenfield, which will give additional connection with 350 towns in Northern and Central Iowa.

The Iowa Telephone company offers to expend $100,000 in improvements and an underground system at Cedar Rapids if the city will grant a new franchise.

A telephone line is projected from Hartwick to Belle Plaine, Iowa.

The Iowa Telephone company has about completed a copper line between Des Moines and Fort Dodge. From the latter place it will be continued on to Sioux City. A line will be built from Fort Dodge to Livermore also. At Livermore connection with the Western Electric Telephone company will cover Northern Iowa and South Dakota.

The Twin City Telephone company will expend about $500,000 in improvements and extensions to its system in Minneapolis and about $400,000 in St. Paul. R.

Indiana Telephone Items.

The Farmers' Mutual Telephone company of Shirley, Ind., has been incorporated, with a capital of $2,000, and will operate exchanges in Hancock, Henry and Madison counties, maintaining headquar-

ters at Shirley, in Hancock County. The Millville Telephone company, capital stock, $3,000; the Waveland Telephone company, capital stock, $1,000, and the Shannondale Co-operative Telephone company, capital stock, $1,600, were also incorporated, with a view of constructing lines and operating exchanges in their respective communities.

A local telephone company is now constructing the first telephone exchange the town of Nashville has ever had. Until a few days ago Nashville was entirely shut off from communication with the outside world, but the new telephone line has placed the people in connection with several points in the state.

The farmers in the neighborhood of West Newton and Valley Mills, Marion County, have constructed private telephone lines to their homes, and are now preparing to connect them with an exchange that is almost completed, at West Newton, by the New Telephone company of Indianapolis. The subscribers own their wires and poles and pay the company 50 cents a month each for the connection. The plan is to establish the service on farms all over the country.

The Peru Home Telephone company has filed articles of incorporation with the secretary of state. The company has a capital of $30,000, and will install a substantial home plant. The directors are C. J. S. Kumler, Joseph M. Bergeman, Jerome Herff, E. H. Griswold, John E. Yorling, Joseph Andres and L. B. Fulwider.

There is a movement on foot to organize a home telephone company at Logansport to compete with the Central Union Telephone company, which has just announced a graded schedule of rates to become effective July 1st. The schedule is a substantial increase, and, therefore, unsatisfactory. The Central Union has solicitors at work seeking subscribers to the party-line and "kitchen" service. Patrons say they will not pay the increased prices, but will order their telephones taken out. It is understood that the New Telephone company of Indianapolis was asked to go to the relief of Logansport, but it regarded the prevailing rates as too low.

A co-operative telephone system will be inaugurated at Rossville. It is proposed to have a local exchange, with lines reaching out into the country, to be operated on the co-operative plan. It is aimed to cover a radius of 10 miles and connect with long-distance telephones.

Severe wind and electric storms have seriously impaired the telephone service throughout many portions of the state. Newspapers and other news gatherers, more than ever, realize the convenience and value of the telephone—now that they have been forced to do without it for a few hours. During a severe electrical storm at Indianapolis the manager of the New telephone exchange ordered all the attendants down and away from the board. At Shelbyville and other towns the exchange connections were burned out, compelling the attendants to abandon their posts.

The New Telephone company of Indianapolis will be compelled to take up its conduit system and change it to other streets because of the building of a new federal building.

The Indiana state tax commissioners will meet in annual session next week. Among other corporate industries, the sessions will be devoted to the hearing of statements regarding the property of telegraph and telephone companies.

The Indiana Supreme Court has refused to order the transfer of the case of the Rushville Co-operative Telephone company against Arthur B. Irwin, decided recently by the Appellate Court. This is the case in which Irwin refused to pay a bill for telephone service on the ground that the company was indebted to him for a similar amount. The company shut off the telephone service from him and he brought suit to compel it to reconnect his telephone. The Appellate Court decided against him and he sought to have it transferred and passed on by the Supreme Court on the ground that the appeal presented a new question of law, as follows: Can a telephone company arbitrarily discontinue the telephone service of one of its patrons, or refuse to grant him service after said discontinuance, on the ground that he is indebted to it for a preceding month's telephone service, and can it require him first to pay its bill for service and then resort to an action at law to recover what the company owes him? The Supreme Court decided that the new law is not retroactive, and refused to order the case transferred.

F.

Ohio Telephone Notes.

It is reported that the Bell interests in Toledo have taken up the old tactics of cutting rates as soon as there are prospects for an Independent plant. The fact that the Home Telephone company has made application to the Probate Court for a franchise and that it is very likely to get it has caused the Bell people to wake up a little. The new company is making contracts rapidly at about half of the old Bell rates. The officers of the new company say they will meet no rates, and that they have fixed their figures so that telephone users will save about $7,500 per year by using their system, and they feel that that is enough.

There are rumors in this state that the Independent interests will soon be combined, but they have as yet had no confirmation. It is said that the fact that Judge J. M. Thomas has been offered the presidency of the Telephone, Telegraph and Cable company is significant, but whether it is or not, nothing has been done as yet to indicate as much. Up to the end of last week Judge Thomas had not accepted the position, and telephone men in position to know say they cannot tell what course he is considering.

The striking linemen on the Central Union company's work at Mansfield will likely lose their positions, as their places are being filled by other men as rapidly as possible. The company acceded to their demand for increased salary, but they refuse to work with one or two non-union men, and this is prolonging the trouble.

General J. Warren Keifer, D. O. Fox, D. G. Jeffries, W. S. Meredith and J. Ward Frey of Springfield have incorporated the Springfield Independent Telephone company, with a capital stock of $25,000. This company desires a franchise and proposes to furnish business telephones at $30 a year and residence service at $18 a year. It also agrees to sell its plant to the city any time it may wish to purchase. At the present time the Home Telephone company and the Citizens' Telephone company, both recently incorporated, have applications before the council, and are urging immediate action.

For some time the Home Telephone company of Findlay has been annoyed by someone taking wire from its poles and wareroom. A few days ago a boy, 11 years of age, was apprehended. He would climb the poles, twist the wire off, and then go to another pole and do the same thing, pulling the wire down after him.

It is reported from Fairmont, W. Va., that there is being formed in that state a telephone company with a capital of $7,000,000, to acquire the plants at Fairmont, Mannington and other places in that part of the state.

The Citizens' Telephone company of Washington Court House has increased its capital stock from $50,000 to $100,000.

The Martel Telephone company, Martel, Marion County, with a capital stock of $10,000, has been incorporated, to operate lines in Marion, Crawford, Morrow, Richland and Knox counties. John Jones, Thadd Cressinger, J. E. Cyphers, M. J. McCabes, E. C. Gallagher and E. C. Moody are the incorporators.

O. M. C.

Mississippi Happenings.

The Alabama, Mississippi and Tennessee Telephone company has completed a line from Toccapola to Lafayette, Miss. This company will build a line from Pontotoc, Miss., to Oxford, Miss., a distance of 17 miles, where it will make connection with the Oxford exchange; from there it will be extended to Memphis, Tenn., by way of Holly Springs.

The city of Oxford, Miss., has recently refused to grant a franchise to the Cumberland Telephone company.

A. W. Kearley, owner of the Boonville (Miss.) telephone exchange, says he has 200 subscribers and has about 100 applications for telephones. The Cumberland Telephone company put in an exchange at Boonville and has only 20 subscribers, and 13 of these have connection with Mr. Kearley's exchange.

The Cumberland Telephone company has again been summoned to appear before the Railroad Commission at Jackson, Miss., to answer charges of discriminations in rates and for alleged violations of the commission's order defining what these rates shall be. The general superintendent of the Cumberland Telephone company was notified to be present at the commission meeting. A complaint has been filed by citizens of Kosciusko, where there is a rival company, to the effect that the Cumberland is putting in telephones there free of charge in order to run out its competitor. It seems that the schedule of rates of the two concerns is about the same, and the trouble arises over the free installation of the telephones. Some friction between the Cumberland and another company is also reported from Yazoo City, which th commission will very probably inquire into.

MANUFACTURERS AND DEALERS.

The Electric Appliance company, Chicago, is manufacturer of the Eaco visual-signal switchboard, which, it claims, has all of the advantages of the flashlight board without the aggravations caused by the burning out of the signal lamps.

The Eureka Electric company of Chicago is now distributing what is known as its special Telephone Supply Construction Material Catalogue. This catalogue is one of the most complete ever put out by any concern in the Independent field. The company has also a regular telephone catalogue, which is one of the largest issued, embracing a large line of guaranteed apparatus. The Eureka company says that it will be pleased to send to any person or company interested in the Independent field, with its compliments, one of its special transmitters made up as a neat little watch-charm.

Among the many contracts for telephone plants recently closed by the American Electric Telephone company of Chicago may be mentioned the following: Mansfield, Ohio, common-battery, 1,200 capacity, installed with provision for 3,000; Reading, Pa., common-battery, 1,500 lines, with 5,000 ultimate capacity; Zanesville, Ohio, common-battery, 1,200 connected with 3,000 ultimately; Huntington, Ind., 800 at present, to increase to 1,500; Austin, Texas, with 1,200 for immediate connection, 3,000 ultimately; Temple, Texas, and Tyler, Texas, 600 ready to connect, will provide for increase to 1,500; Xenia, Ohio, 600 in operation, provision for 2,000, and Oklahoma City, O. T., 750 subscribers on 1,200-line switchboard.

GENERAL TELEPHONE NEWS.

The Monmouth (Ill.) Telephone company has increased its capital stock from $35,000 to $50,000.

New York city is said to have the largest of the world's city telephone systems, having at present 60,000 telephone stations.

Amended articles of incorporation have been filed with the secretary of state by the Northern Iowa Telephone company, increasing its capital stock from $20,000 to $40,000.

The Bell Telephone company was a heavy loser during a disastrous storm that swept over Booneville, Mo., recently. The whole exchange was almost entirely destroyed.

The Wharton Valley Telephone company has been incorporated at South Edmeston, N. Y., with $3,000 capital stock, by B. F. Bishop, Van Ness D. Robinson and Frank Harrington.

Dispatches from New York state that Samuel P. Levenberg, an 18-year-old boy in the employment of the New York Telephone company, claims to have discovered a practical method of wireless telephony. It is stated that his experiments have been very successful to a distance of five blocks.

The Marengo (Iowa) Telephone company has been incorporated, with an authorized capital stock of $7,500. The officers of the company are: President, J. H. Branch; vice-president, Henry Gode; secretary, H. N. Havner; treasurer, John Keil, Jr.

The Rollin (Mich.) Telephone company, composed of farmers of that township, has completed arrangements to extend its line to Hudson, Mich. The line will then connect with Geneva, Manitou Beach and Addison. There are 70 men in the company, and an effort is being made to extend the system all over Southern Michigan.

The Spencer, Millbury and Fitchburg (Mass.) lines of the Consolidated Street Railway company are to be equipped with telephones, for which the New England Telephone company is stringing the wires. After waiting a certain time on a turnout, conductors can telephone for instructions, and cars can be saved many annoying delays.

A dispatch from St. Petersburg, Russia, states that the authorities of that city have decided to send an engineer to the United States to make a comprehensive study of American telephone systems. He has been instructed to familiarize himself with the manufacture of telephonic apparatus and the operation of the large city exchanges in the United States.

At their meeting on June 20th the directors of the New England Telephone and Telegraph company voted to issue new stock amounting to $2,577,000. Stockholders will have the right to take one share of the new stock for every six shares now held, payments to be made August 16th and November 16th. Part of the proceeds will be used for the construction already done this year and will provide for the needs of the company for the remainder of this year and part of next year. The company has about 80,000 subscribers and is obtaining about 1,000 new ones every month.

NEW COMPANIES.

A company has been organized at Strawberry Plains, Tenn., to establish a telephone system.

A charter has been granted to the Galt Telephone company at Galt, Mo. The company has a capital of $2,400.

The Gourdin Telephone company has been chartered at Gourdin, S. C., for the construction of a telephone system.

S. S. Royster, D. B. McBrayer and J. H. Johnson have incorporated the Lattimore Telephone company at Lattimore, N. C.

The Sharpsburg (Ky.) Telephone company has been incorporated, with a capital stock of $3,500, by B. T. Wright and R. A. Atkinson.

The Tyler Telephone company, Tyler, Texas, has been incorporated, with a capital stock of $4,000. M. D. Shaw is president of the company.

The Crab Orchard Telephone company has been incorporated at Corinth, Ill., with a capital stock of $2,000, by George O. Mitchell, J. L. Dorris and J. L. Roberts.

John W. Ferrell, R. H. Fitzhugh, G. D. Clement and others have incorporated the Jackson County Telephone company at Newport, Ark., with a capital stock of $2,000.

The Texas Telegraph and Telephone company, Kemp, Texas, has been incorporated, with $20,000 capital stock, by George Mason, A. J. Still, Jr., J. W. Young and others.

The Stel-Rockingham and Norborne Telephone company has been incorporated at Jefferson City, Mo., with a capital stock of $50,000. B. F. Clemens, John B. Early, J. H. Bryan and others are the incorporators.

The Hudson and Middlesex Telephone and Telegraph company has been incorporated in New Jersey, with a capital stock of $15,000. The incorporators are Bryan S. Klotz, Sylvester M. Cooley and Walter P. Lindsley.

Electrical Prospects in the Moros Country of the Philippines.

During the last year and a half there has been good progress made in the so-called Moros section of the Philippine Islands, and to-day there are several electrical power plants in operation, with the prospects of others getting under way before long. The Moros section is that part of the Philippine archipelago at the extreme southern end, and includes the large island of Mindanao, which island is rich in mineral deposits. Gold, silver, lead, copper, coal and other minerals have been located on the island, and a number of foreign capitalists are establishing extensive mining plants. There is good waterpower in the islands, and the commercial activity is improving. Both the mining engineers and the business men of the islands are concerned in the electrical development of the country.

A correspondent of the Western Electrician conversed with the municipal authorities in a number of the leading cities and towns and discovered that arrangements had been made in many places for the investment of capital in stock companies for establishing either electric lights, electric railways, power systems or telegraph and telephone lines. In nearly all of the larger places in the Moros section there are at the present time a number of Europeans who are engaged in the lumber, machine, dry-goods, sugar, rice, or mining business, and these men are concerned in the new electrical concerns, many of them purchasing stock. The native mine owners, planters and business men also greatly favor the introduction of electrical devices and freely purchase stocks in substantial companies. Up in the interior of the Moros country, where the American soldiers have not as yet been to any extent, the natives are wild and unreliable. But in all of the garrisoned cities and towns, and all along the seacoasts, where the natives have come into contact with the trading vessels, the natives are quiet and intelligent. Many of them are wealthy, owning large mining properties or plantations.

Electric Railways.

Electric roads are wanted in the Moros section for the purpose of handling the ores of the mines which are being opened by foreign capital. One of the chief detriments to the mining interests of the country at the present time is the lack of effective transportation. The miners are obliged to move the ores on the backs of animals. In some cases water buffalo and bamboo drag sleds are employed. At some of the mines packs are carried on bamboo poles, suspended on the shoulders of two natives. These means of transportation are costly and inadequate, and the mining companies are planning for the building of electric roads which shall traverse the mining sections. The discovery of coal in the Moros country has greatly encouraged the building of electric roads for transportation purposes. The writer spoke with some of the newly elected alcaldes of the country, elected under authority of the United States government, and these men informed him that they could easily raise enough capital in their respective territories for the building of electric roads. All through the highways of the Moros country there are long lines of pack trains carrying mining outputs, cocoanut products, bananas, lumber and general merchandise. The two-wheeled carts of the country are very poor vehicles in which to carry goods, and the native bulls used in the shafts have a hard time transporting even light loads.

The country is suitable for electric roads. There would not have to be very much grading done, for the present roads mostly follow the level of the river beds, and in course of the many years in which they have been in use, the Spanish and the natives have built them into pretty fair shape. There is an abundance of lumber along the lines for ties. Fuel is plenty. There is no doubt about a road paying good dividends from the very start, for the present methods of transportation are very poor and costly. There are a number of mines which are idle at present because of lack of proper means for getting the ores to the seaports. Several of the richest mining companies informed the writer that they would purchase liberally in electric-railroad stock, providing that the road tapped the mining districts.

Electric Lighting.

It may appear strange that the Filipinos should desire electric lights at this stage, when for many years they have had only the commonest types of candle or oil lights. No gas lights have ever been in service in the Moros section. Some of the better classes of Filipinos have traveled in other countries lately, and some of them have observed the success of the electric-lighting system at Manila and other places in the Philippines, with the result that there are several combinations already organized with a view of establishing electric-light plants in Mindanao. There are a number of large cities and towns in the island, and since the municipal elections in these places some definite steps have been taken toward the development of the electric-light interests.

The correspondent was told by some of the commanding officers of the garrisoned towns that all that was needed was representatives of electric-lighting concerns to come with the proper papers and plans, and the necessary money for the putting in of the plant would be forthcoming. It is not the lack of funds that hinders, but the lack of plans, apparatus, and someone to superintend the works. Electricity is new to the Filipinos, and the native machinists are not capable of handling any of the dynamos or motors. When the first electrical machinery was sent to the islands the native machinists greatly feared to have anything to do with it. But this fear has worn off, so that now one may see Filipino and Chinese machinists in the Philippine shops working at the mechanism of the electrical devices. The natives are gradually getting a better understanding of the machinery, and some of them are competent to adjust the parts and care for the machines.

Lights are in particularly good request in the Moros section, for the reason that the present form of lights is not only costly, but very inferior. Nearly all of the streets of the cities and towns are dark on all nights when there is no moon, although the regulations require that there be a light suspended in front of each house. Illuminating oils are high in price in these islands, as most of the oil is shipped from Russia. The cost of kerosene oil is several times greater here than in American markets. One may see native housewives purchasing a little bottle of the oil, which they treasure highly, and so arrange all lights that the oil will be consumed in the least quantity. Many of the house and street lights are reduced so small in size to save oil that they reflect hardly any light at all. There is good waterpower for power purposes in the vicinity of nearly all of the commercial centers. Labor is as cheap in the Moros section as up in the Bisayan and Tagalog countries. Good workmen can be hired for 10 to 12 cents a day. The writer met with machinists who were working for five cents a day, but they seemed to bungle a great deal. One fellow devoted fully an hour to boring a hole which an American machinist would drill in five minutes. American machinists are in demand and receive $3 to $5 gold a day, and in most instances, when hired, are put in charge of gangs of native machinists with instructions to train the latter.

The Telegraph.

The telegraph has been in vogue in the Moros country for over a year. The Signal Corps of the United States service has been stringing wires between garrisoned cities and towns since the beginning of American occupation. At the present writing there are hundreds of miles of wires in the section, and more lines are being added daily. As soon as a new district is opened, the linemen are sent there with native helpers, and the latter dig the holes for the poles, cut the poles from the forests, and in a very short time the wires are put up and the instruments installed. A great many new Signal Corps men have come over from the United States during the last six months and the offices of the telegraph lines are well furnished with trained men.

The telegraph was not used by the Spanish, except in the immediate vicinity of Manila. There are now nearly 1,000 military telegraph offices in the Philippine archipelago, and new ones are being opened constantly. The telegraph lines and poles were at first cut and torn down very often in the Moros section, as in the islands of Luzon and Panay, but the death penalty was administered in a few cases to the Filipino ladrones and rebels who did these things, with the result that the lines are now very seldom molested. In some of the worst places it was necessary for the guards to shoot at all natives who were acting suspiciously about the lines, but usually the shooting was in the air, for the purpose of terrifying the natives. This scheme succeeded well, and nowadays it is seldom that the lines are cut or the poles torn down.

The telegraph is used considerably in the Moros section by the mining corporations and the Filipino business houses. The government established the lines for military purposes, but the private concerns can use the wires upon showing that the business is legitimate and upon paying the proper price which the government has established for private messages. Many of the messages go over the lines in the native languages and some of the American operators are often puzzled over the inscriptions. Some of the mining concerns have lately combined with the proprietors of the cocoanut lands and sugar-plantation owners for the purpose of putting in private telegraph lines. There is a very good demand for fittings, such as wire, instruments and all the necessary furnishings for telegraph lines, and American companies carrying these goods should supply circulars and prices to the military commanding officers or the alcaldes of the leading cities and towns of the Moros country. These cities and towns number about 40, and can be located by securing a Spanish map of the island of Mindanao, such a map being obtainable from the engineering corps at Manila.

The Telephone.

When the first telephones were introduced in the island of Panay the Western Electrician correspondent was present when the Filipinos experienced the sensation of conversing with one another at distances of a dozen or more miles over the wires. There had been a small telephone line in service at Manila and some of the better-educated classes of natives had heard about it. But very few had seen or used a telephone. Therefore when the first were introduced for service between military stations, many of the Filipinos secured permission to try the wonderful devices. The fame of the telephone spread throughout the archipelago, and at the present writing there are a number of effective telephone lines in operation by private concerns in the Moros country. The mining engineers have found it necessary to have telephone lines in some of the districts, and there are also lines tapping the lumber works, which are now so active in the hardwood forests, getting out lumber for house-building purposes. The military commands of the Moros section also utilize the telephone lines in many places where telegraph systems are not practicable.

The lack of supplies of telephone devices is what is preventing the proper development of the business. The writer knows of numerous manufacturing concerns that would like to install telephone systems in their works to extend to important points, but are unable to do so for lack of apparatus. There are several places in Manila where one can purchase limited supplies of telephone equipments, but none can be bought elsewhere, and as many of the Moros people never go to Manila, they are not aware that telephone outfits can be procured in the islands. Many of the Moros people have sent to Spain and other countries for telephone outfits, and in some instances the results have been disappointing.

The custom of sending toy devices to the Philippines is not as yet quite broken up. Complete toy outfits of telephone lines have been sent here for practical service and the bill for the same has not been small either. One telephone device which arrived in Mindanao consisted chiefly of rosined strings connected between tin cylinders. There was no instrument at all. The Filipino buyer saw the thing advertised in some periodical and he sent for it, supposing that he was going to get a telephone out for practical service between his sugar works in the country and town office at a seaport.

The average Filipino has little or no idea of the practical side of the telephone, and he should not be trusted with setting up new devices. The writer knows of cases in which really good instruments have been received and set up by the natives and ruined before once used. The natives do not understand the loading of the battery and are not familiar with the acids employed. They do not know how to connect up the wires properly, and make a botch of the whole affair.

Fans and Fittings.

There is a very excellent opening for an electrical fan and general electrical fitting establishment in the island of Mindanao. The heat is extreme at this point, which is so near the equator, and thousands of the richer classes of natives, as well as many of the foreigners, are constantly studying how to keep cool. A great many native boys find employment, at from five to eight cents a day, swaying a fan over one's head to keep the air in circulation. A few electrical fans have been put into some of the residences of the rich natives and foreigners, while quite a number have been set to going in offices and public buildings, all with very satisfactory results, so that the demand for the electric-fan outfit is increasing. Exceedingly high prices have been obtained for such fans as it has been possible to purchase. The supply is very limited, and, in fact, one can hardly find a fan for sale. There are stores in Manila which carry a line of electrical fans with other electrical goods and there is no doubt that the sale of fans is very lively. The draft resulting from the use of an electrically driven fan is very suitable to the climatic conditions, and the natives, as well as the foreigners, in the islands favor it.

An agent for these electrical fans could do a thriving business in the leading cities and towns of the Moros section, where the proper power is obtainable. Very good profits would be secured, for the prices rule high.

As to general electrical fittings, the electric bell may be mentioned as coming into service in some of the newly erected houses, which are being built with sawed lumber instead of bamboo, and on American plans, under the direction of American carpenters. Quite a number of such houses are going up for the richer classes of people. Some of these houses are finished in mahogany, rosewood and other hardwoods. No expense is spared by many of the sugar-mill people and rice-land owners, for these persons appear to have an abundance of wealth. They have heard of or seen the electric bells in use somewhere, and they want to have them in their houses, even though they do not use them. The future for electrical apparatus and small fittings in the Moros section is very bright. In course of time there will undoubtedly be electrical furnishing stores established at important points, which will tend to help in the introduction of electrical machinery, lights, railways, lights and general fittings for the house, the shop, the mill, the mine and the public building.

Lightning Strikes the Niagara Falls Transmission Line.

According to press dispatches, lightning struck the transmission line that supplies the electric power for Buffalo and the Pan-American Exposition on Saturday night, June 22d. The bolt came during a violent electrical storm and struck the line between Niagara Falls and Tonawanda. Some of the fuses on the transmission line were burned out, and it is said that for a short time Buffalo and the exposition were in darkness and street cars were stopped.

COMMUNICATIONS.

Photometric Value of Arc Lamps.

To the Editor of the Western Electrician:

In my preliminary report to the National Electric Light association committee, the power measurements on the series alternating lamp were erroneously given. The corrected values are:

Electromotive force	70 volts
Current	6 6 amperes
Apparent power	462 watts
Power	397 watts
Power factor	.86
Watts per mean hemispherical candle	1.26

C. P. MATTHEWS.

Purdue University, Lafayette, Ind., June 17, 1901.

[An abstract of this report was given in the Western Electrician of May 25th on pages 352 and 353. —Ed.]

Electrical Disturbances on Telephone Lines.

To the Editor of the Western Electrician:

At the Congress of Electrical Engineers, held in Chicago during the World's Fair, Mr. Preece of London gave a very pretty description of his experiments along the coast of Scotland, with a view to making possible a telegraphic communication by induction between the mainland and a small island some few miles distant. To accomplish this, he built a line along the coast, and parallel with this he built another line along the island, connecting both ends of these lines to the ground, making of each a complete electrical circuit. He then introduced a generator and a suitable circuit-breaking key into one of these circuits and a telephone receiver into the other. With this apparatus, Mr. Preece discovered, upon starting his generator and making and breaking the circuit with the key, that these interruptions were noticeable in the telephone receiver of the other circuit, providing the distance separating the two circuits was not greater than the length of either circuit. When these circuits were shortened, so that the distance between the two was greater than the length of either, the receiver refused to respond, and no sound was noticeable.

Taking the result of these experiments as a basis, I have found this theory to be of great value in telephone work, and especially so in the placing of telephone leads entering a building, where it is necessary to run close to an electric-light or power lead. There seems to be a prevailing idea among installers and linemen who come in contact with such conditions that it is only necessary to place their wires a reasonable distance away from such disturbing elements, and nine times out of 10, when this mental calculation is used, there is found to be quite a little noise on the telephone wire, the cause of which they cannot locate. There may be a vague idea that the trouble is caused at this point, but if this theory, so ably shown in the experiments of Mr. Preece, is followed out, and the parallel kept shorter than the distance of separation, we may feel positive that the trouble does not originate at this point. Of course, in a great many cases, in small cities or towns, it is impossible to follow this rule in regard to the main lead, but if this theory is followed as carefully as possible, the result will be surprising, as very often there is more noise picked up where telephone wires enter a building than in the main lead. FRANK D. PEARNE.

Chicago, June 13, 1901.

Pacific Coast Electric Transmission Association.

The fifth annual convention of the Pacific Coast Electric Transmission association was held at the Hotel Vendome, San Jose, Cal., on June 18th and 19th. The attendance of prominent electricians, power men and promoters of electrical companies was large. Among the papers read and discussed was one by R. M. Masson and another by J. A. Lighthipe of San Francisco. Each treated on high-tension switches. The delegates inspected the Standard Electric company's sub-station and the Electric Improvement company's works. Experiments were made with the long-distance power-transmission lines of the Standard Electric company. These circuits extend to San Jose from the North Yuba River, more than 184 miles distant. The delegates were the guests of the Electric Improvement company at a banquet served at Alum Rock Park. Speeches were made by J. O. Hayes, Judge H. G. Bond, Alfred Holman, A. T. Herrmann, George Center, J. E. Richards, C. C. Poole, Prince Poniatowski, E. J. de Sabla and George P. Low.

Chicago Lighting Competition Considered.

Representatives of the Chicago Edison company recently appeared before the council committee on gas, oil and electric light to dissuade the committee from granting a franchise to the A. J. Sidder company, permitting it to operate an electric-lighting system on North avenue, for one mile, between North Clark street and the river. Action on the Sidder ordinance was deferred for the insertion of an amendment stipulating that the company shall never charge more than 10 cents a kilowatt-hour.

Increase of Chicago Edison Stock.

At the annual meeting of the stockholders of the Chicago Edison company on June 10th it was decided to increase the capital stock of the company from $6,000,000 to $10,000,000, only $900,000 to be issued at present. The board of directors on the following day adopted this resolution:

"Resolved, That certificates of the increase of the capital stock of this company to $10,000,000 be forthwith filed in the office of the recorder of deeds of Cook County and in the office of the secretary of state of Illinois; that 9,000 shares, each of the par value of $100, of new or additional stock be issued August 1st, and be offered for subscription at par to the stockholders of the company as they shall appear of record on the company's books at the close of business on July 25th, in proportion to their record holdings of stock at that time; that stockholders of record on the books of the company at the close of business on July 25th shall be entitled to subscribe for such new stock to the extent of 15 per cent. of their then record holdings of existing stock, that is to say, to subscribe for one share of the new stock for every 6 2-3 shares of existing stock then held by them of record; that subscriptions for the new shares, with payment in full, be receivable at the office of the secretary and treasurer of the company, 139 Adams street, Chicago, until the close of business at five o'clock p. m., August 1, 1901; that the right of a stockholder to subscribe for new stock shall be considered as waived, and shall be lost, in every case where the stockholder's written subscription, with such payment in full, shall not be received at said office before the close of business at five o'clock p. m., of Thursday, August 1, 1901; that the transfer books of the company be closed from the close of business at five o'clock p. m., July 25th, until the opening of business at 10 o'clock a. m., August 2d; that all shares respecting which the right to subscribe may be lost shall go into the treasury of the company, and that subscriptions for fractional parts of one share shall, when paid, be represented by fractional subscription receipts, carrying no participation in dividends, nor in voting power, but exchangeable in amounts equal to whole shares for regular stock certificates."

Miss Bence's Successful Promotion of Electric-lighting Boards.

In its issues of November 24, 1900, and May 4, 1901, the Western Electrician described the unique "electric-lighting board" for sign and decorative work recently brought out in England. At the latter date it was stated that a company was being organized in New York to exploit the invention in this country; and a recent issue of the Electrical Review of London gives some additional information on this point of rather unusual interest: "We are informed that in the course of a meeting of the shareholders held at their offices, No. 7 Pall Mall, it was announced that the American rights of the 'E. L. B.' system have been disposed of for a very considerable sum, the first cash payment, which was recently cabled, alone amounting to £15,000. As Admiral Sir Henry Nicholson, K. C. B., the chairman of the company, remarked, the purchase has a far wider interest than the mere financial side, seeing that Americans are particularly chary of electrical inventions hailing from Europe, and it speaks well for the system to have successfully passed all the electrical patent and insurance ordeals to which such inventions are subjected in the states. The negotiations for the sale, by the bye, were conducted entirely by Miss Amy Ashton Bence, the secretary of the company, who visited New York, and the estimation in which her services are held by the shareholders may be gauged by the substantial check which was handed her in connection with a vote of thanks proposed by Sir James Weeks Szlumper, M. Inst. C. E. (mayor of Richmond), seconded by Mr. Passmore, M. I. M. E. (late manager of the New Zealand government railways), and by the presentation of a set of plate to her on the part of the directors, in their personal capacity. Miss Bence was formerly the right hand of the late Sir Augustus Harris. The prospects of the company appear to be excellent, business already having commenced in several foreign countries, as well as in England, and the directors have already declared an interim dividend, at the rate of 20 per cent., on its first year's working. A demonstration of recent improvements and developments of the system will shortly take place."

General Electric Company's Foreign Interests.

It is officially announced that the General Electric company has purchased the German and French shareholdings in the British Thomson-Houston company, Limited, of London, England, thereby giving the General Electric company the controlling interest. C. A. Coffin, president, Eugene Griffin, first vice-president, and W. J. Clark, general manager, of the foreign department of the General Electric company, will be members of the British Thomson-Houston board, and the closest co-operation will exist between the General Electric and British Thomson-Houston companies. The British Thomson-Houston company has been operating under patents of the General Electric company, but as an independent concern.

CORRESPONDENCE.

New York Notes.

New York, June 22.—Compressed air will be used to some extent by the Brooklyn Rapid Transit company in the operation of several of its lines. A compressed-air plant will be established by the company near the Brooklyn terminal of the big bridge, and compressed air will be supplied to some of the cars on the Brooklyn elevated roads.

President Greatsinger of the Brooklyn Rapid Transit company is reported as saying that since March 20th, $3,200,000 has been expended by the company for new cars, generators, sub-stations and other improvements, all of which are now in the hands of the contractors.

A union of surface-railroad men, under the auspices of the American Federation of Labor, has been started in Brooklyn. It is said the surface street-railway men will be organized thoroughly in both Brooklyn and New York. The union is not antagonistic to employers. A number of the men on the Broadway and Seventh avenue branch of the Metropolitan street-railway system said that the men on that branch do not see the necessity of joining a labor union at present.

A few of the motormen and conductors on the Broadway and Columbus avenue lines of the Metropolitan Street Railway company have complained that their work hours are longer since the electric motive power was introduced than when the cable system was in operation.

More trouble has broken out in the rapid-transit tunnel, and indications point to a renewal of the strike. The rock drillers and tool sharpeners blame the contractors for a total disregard of the agreement made by them at the close of the last strike.

A motor car in the Brooklyn Bridge Railroad service was wrecked during the early morning rush on Saturday, June 15th. The axle of the forward wheel of the right-hand truck broke, and as the car left the track the truck struck the third rail and sent a shower of sparks into the roadway, thereby causing a stampede of horses and a scurrying of passengers. The three cars following the motor stayed on the track, as the coupling connecting them with the motor car broke. Three hours were spent in clearing the track, and many thousands walked over the bridge.

The rotating part of one of the large dynamos in the electric-lighting plant of the Edison Electric Illuminating company, in Duane street, burst on the evening of June 20th. The wheel weighed more than five tons and was 12 feet in diameter. The report led people in the neighborhood to believe that a disastrous explosion had occurred in the works. One man, Henry Kramer, an assistant engineer, was injured. He was standing within a few feet of the machine and was hit by several of the flying fragments, sustaining such severe injuries that he will probably die.

Articles of incorporation have been filed by the Long Island Extension Railroad company, with a capital stock of $1,000,000. The company proposes to build and operate by electricity or other motive power an underground-tunnel railroad four miles long, from a connection with the Long Island railroad in the neighborhood of Long Island City, under the East River, and Manhattan, to a point south of Fiftieth street and west of Broadway. The most significant feature of the new project is that from the route chosen it is evidently the intention to make a connection with the rapid-transit tunnel near the middle of Manhattan Island.

Bids for the construction of the 100 new motor cars for the Manhattan elevated railroad were all due this week, and the award will probably be made during the next few days. Specifications for the first 800 trucks required for the electric service will be sent out soon and bids are due July 8th.

Cars for the transportation of baggage and express will be put into operation on the Metropolitan street railway on June 26th. Just how many cars and on what lines they will operate has not been decided by the Metropolitan Express company. Stations will be established for the handling of baggage and express at different points in the districts traversed. From them electric baggage and express wagons will distribute and collect the matter. M. L. G.

New England News.

Boston, June 21.—The removal of a number of the surface lines and the consequent necessity of transferring to the elevated, with the crowded condition of the elevated cars, has led to many complaints in all sections covered by the lines of the Boston Elevated company. President Bancroft says that the changes are yet new and that the public is not accustomed to them, and adds that it is possible that some changes may be found to be advantageous.

The contracts for the building of the interstate trolley line between Danbury, Conn., and Golden's Bridge, N. Y., have been awarded, and construction will soon be begun. The road, which is to be completed by September 1st, will be owned and operated by the Danbury and Golden's Bridge Street Railway company, which was chartered in 1897.

The Postoffice Department has authorized the establishment of an electric-car postal service between Boston and Malden, Mass. Four trips will be made every holiday and Sunday and nine trips on every other day. The service will be begun July 1st and the

Boston Elevated Railway company will receive $416.08 per year, for 34,684 miles. The cars will be divided into postal and passenger sections.

Governor Crane vetoed the Washington street subway bill and on June 19th the House of Representatives refused to pass it over his veto by a vote of 98 to 135. As the Legislature adjourned sine die on the same day, the Washington street subway is still in the indefinite future. In his veto message, Governor Crane asserts that by the provisions of the bill the Boston Elevated Railway company can be compelled to contribute only $6,000,000 to the work of building the subway, and if the cost exceeds that sum the city of Boston must pay the excess without any reimbursement.

Ex-Senator W. A. Butler has resigned the position of attorney for the Boston Elevated Railway company.

For a consideration of $13,500 the Lynn and Boston Street Railroad company has obtained the title to the property of the North Woburn Street Railway company.

Mayor O'Connell of Worcester, Mass., has vetoed the bill granting a franchise to the Worcester Electric Light company and has approved the franchise of the Consolidated Street Railway company. B.

Canadian Intelligence.

Ottawa, Ont., June 22.—So far, no standard for arc lighting has been devised by the Canadian inland-revenue department. A test system had been about completed, when a change was made from the open to the enclosed-arc system now in use. When a standard has been agreed upon, inspection will probably be made by means of a recording instrument attached, for the purpose of the test, at each lamp.

Another big electric company is anxious to obtain authority to use the streets of Montreal. At a recent meeting of the City Council, a long petition was read from the Shawinigan Water and Power company, setting forth that the company was ready to expend large sums of money in the development of electrical power; that a transmission line was shortly to be constructed from Shawinigan Falls to Montreal, and that the company was anxious to get an entrance into the city. In order to distribute power and light in Montreal, it was necessary that the petitioners have the right to enter the city with their pole lines and wires.

A new electric company has been organized in the province of Quebec to develop waterpowers and to manufacture and supply electricity for the purposes of light, heat and power; and, moreover, to be vested with all the powers conferred upon the Canadian Electric Light company, viz., the power to furnish electric light, motive power and heat and other advantages to be derived from electricity to the cities, towns and municipalities in Quebec province, lying west of and including the city of Three Rivers. The new company will operate under the name of the Provincial Light, Heat and Power company, with a capital stock of $500,000.

The Electric Street Railway company of Kingston, Ont., has refused the demand of its employes, who are members of a union, for an increase in their wages. The company claims that the road is not a paying concern, and if the men go on strike, the company will try to replace them with other men, and, failing that, will run its cars into the barn and sell them and the whole plant by public auction.

The Cataract Power company of Hamilton, Ont., has concluded negotiations with the Dundas Electric Light company, and will take over the business and rights of that company.

A proposal is made to transmit electric power from Nottawasaga River to the town of Stayner, Ont., six miles distant. The scheme would give enough power to induce manufactories to locate in that vicinity.

It is reported that power from Niagara Falls will soon be delivered in the city of Toronto under the auspices of the Toronto Railway company, the Toronto Electric Light company, and possibly the gas company. The Toronto street railway will take 10,000 horsepower per year, and the Toronto Electric Light company, for itself and customers, about 5,000 horsepower. The rate for this power, delivered at the borders of the city, will be $25 per horsepower per annum. This rate is for power for an entire day of 24 hours. The lowest rate now charged by the Electric Light company is said to be $60 per year and upward for a 10-hour-a-day horsepower.

A big project is well advanced toward supplying the city of Montreal with pure water, cheaper power and light and a large cold-storage plant. The concern is to be capitalized at $5,000,000. Several New York capitalists are interested in the scheme, and James E. Wilder of Montreal is a prominent promoter. The waterpower at the Lachine Rapids will be used. It is the intention of the company to install an immense electric and compressed-air plant, part of the compressed air to be utilized in purifying the water and to elevate it on the spot to a height above the present reservoir, which will enable the company to supply the whole island of Montreal, and to transmit electric power and compressed-air power through the city. A. V. W.

Southern Developments.

Charlotte, N. C., June 22.—The North Augusta Electric and Improvement company has applied for a charter to improve property on the South Carolina side, near Augusta. It is proposed to build an electric railway from Hamburg to Aiken.

The Greensboro (N. C.) Electric company has been chartered by the secretary of state, with an authorized capital of $250,000. M. D. Barr, F. A. Barr, John Karr and Z. V. Taylor are interested. A power plant will likely be erected.

A $100,000 company, to be known as the Gainesville Light and Power company, is projected at Gainesville, Ga. It proposes to develop waterpower from the Chattahoochee River at that point. Samuel F. Dunlap of Gainesville and F. S. Murray of Chicago are the principal promoters.

It is stated that arbitration will be necessary to settle the tax difficulty between the state of Georgia and the Atlanta Railway and Power company. The company's valuation is about $500,000 less than the comptroller's.

The City Council of Culpepper, Va., has granted a 10-year franchise to J. M. Spotts of Staunton, Va., to erect an electric-light plant in the city, to furnish light to the town and citizens.

After several months of contention a new era has been established in street-railway traffic in Richmond, Va., the Passenger and Power company and the Traction company now having arranged to operate on each other's tracks on certain streets of the city.

An electric line is again being discussed between Atlanta and Marietta, Ga.

The Lincoln Park company has been chartered, to purchase land in Elizabeth City, Va., and also to erect street-car lines, electric-light lines, etc. The capital stock is $50,000. W. B. Hoover of Newport News is president of the company.

George J. Baldwin of Savannah, Ga., and others have purchased a controlling interest in the Columbus (Ga.) Railway company, including the electric and dummy lines of Columbus. The deal involves $225,000.

An automobile line is being talked of, to run between Winston, High Point and Greensboro, N. C. Mr. Dulaney Whiting of New York city is interested. It is expected that the line will begin operations about August 1st.

An injunction having been refused by the courts to enjoin the erection of a new railway between Manchester and Petersburg, Va., a large force of men has been employed, working night and day, to complete the electric line between the two cities. L.

Notes from Old Mexico.

Austin, Texas, June 21.—An increased demand for electrical machinery in Mexico is reported. The bulk of orders are placed with United States manufacturers. In addition to the installation of electric-lighting and power plants in many of the smaller towns of the republic, many of the mines are putting in electric power plants.

The town of Rio Verde, which is the terminus of the new railroad built from San Luis Potosi, is to have an electric-light plant. The machinery has already been ordered. The plant will be located near a waterfall, the electricity being generated by waterpower.

The new electric-light plant at Orizaba in the state of Vera Cruz, which was recently started, is giving good satisfaction.

A new electric-light plant has just been installed in the town of Tlalnepantla.

The Rey del Oro Mining company, which owns a number of gold mines in the state of Sonora, is erecting an electric power plant on the Multos River. The power derived from this plant will be used to drive the machinery in the mines and reduction works.

A new street-railway line is being constructed in the city of Guadalajara by La Compania de Tranvias.

The Legislature of the state of Coahuila has granted to Reginald H. F. Drummond, an American, a concession for the establishment of electric-light plants in the towns of Musquiz, Cuatro Cienegas, San Buenaventura and Monclova, all in that state.

The report of the board of directors of the Mexico Electric Tramways, Limited, which owns and operates the street-railway system in the City of Mexico, has just been issued for the year 1900. It shows that there were carried during the year 26,670,060 passengers, earning $1,019,390, gold, as against 22,425,527 passengers, earning $951,735, during 1899. The report says: "In order to acquire a more direct control of the tramways, and to simplify negotiations with the Mexican government and the municipality, the directors have obtained a lease from the Compania de Ferrocarriles del Distrito Federal de Mexico, under which an annual return of 3½ per cent. is guaranteed to the shareholders of that company, as the result of which it is hoped that the whole system will be operated with greater efficiency and economy. In terms of this lease, therefore, the tramway system in the City of Mexico (as from the first of January, 1901) was worked as the Mexico Electric Tramways, Limited. The last year's results have been materially prejudiced by the dislocation of traffic, due to the reconstruction of the system, and by the congestion caused by the introduction of an entirely new drainage system throughout the city. In the face of these and other disadvantages, it is stated, the result of the operations covering the period under review may be regarded as satisfactory. The drainage system is now nearing completion, and, with the extension of the electric service, the directors expect better results during the current year."

A fire recently occurred in the street-car stables in the City of Mexico, destroying a number of cars belonging to the system. W. D. H.

From the Buckeye State.

Columbus, Ohio, June 22.—The Marysville council has granted a franchise to the Union Electric Railway company, which is represented by T. N. Kerr of Columbus.

The Trumbull Electric Railway company has been granted a franchise for an extension of its line on West Market street, in Warren, but the right is reserved to grant any competing company a franchise on that street, so in reality the purpose of the franchise is said to have been annulled.

The Mohawk Valley company of Cleveland has been incorporated for the purpose of buying, selling and dealing in franchises, rights-of-way and privileges of urban and interurban electric railways. The capital stock is $10,000, and the incorporators are Clement McMahon, Sam B. Newman, S. G. Morris, F. A. Fallin and Charles E. McKisson. The same gentlemen are the incorporators of the Manhattan Construction company of Cleveland, with a capital stock of $10,000. The laws of this state are to the effect that an incorporation shall have but one general purpose, and where several gentlemen desire to do more than one branch of business it is necessary to incorporate two companies.

The Dayton and Germantown Traction company has given notice of a modification of its purpose, changing the terminal at Germantown to Hamilton. The company is now authorized to build its line from Dayton to Hamilton.

The Western Ohio Railway company of Lima has amended its charter so that it will be allowed to build branches from Lima to Toledo and from Minster to Dayton.

The heirs of Robert Simpson have sold the Cincinnati and Northwestern road to Judge C. D. Robertson. The road is seven miles long and extends from College Hill Junction, Cincinnati, to Mount Healthy. It is believed that the road will eventually be secured by one of the numerous companies now seeking entrance to Cincinnati.

The Cleveland and Eastern Electric Railway company has been granted a 25-year franchise in Trumbull County, from Leavittsburg to the Portage county line.

The application of Messrs. Coe and Carpenter for a franchise for the use of the streets in Galion has been granted. They propose to build a line from Cleveland south.

It is said the running time on the Columbus, London and Springfield road, between Columbus and Springfield, a distance of about 45 miles, will be 75 minutes.

The Consolidated Gas and Light company has purchased the properties of Kerlin Bros., the Tiffin Light and Fuel company and the Tiffin Electric Light and Gas company at Tiffin.

The stockholders of the Cincinnati Traction company held a meeting a few days ago, and all the old directors and officers were re-elected. Reports show the company to be in a very satisfactory condition.

The Springfield Railway company has been granted a franchise to extend its line to Ferncliff Cemetery, a distance of almost one mile.

The commissioners of Jefferson County have been asked to grant a franchise to the Steubenville and Wheeling Electric Railway company.

The Sandusky and Interurban Electric Railway company has filed notice with the secretary of state that it has amended its charter so as to allow the construction of a branch from Ceylon to Norwalk.

The Cincinnati Oxford and Western Railroad company of Cincinnati has been incorporated, with a capital stock of $10,000. It is not stated whether steam or electricity will be used.

The Sharon and Newcastle Railway company of Youngstown has been incorporated, with a capital stock of $380,000. The company proposes to build a line from a point near Hubbard, on the road operated by the Youngstown and Sharon Street Railway company, to the Pennsylvania state line, at the crossing of the Hubbard and New Bedford roads. The incorporators are R. Montgomery, S. D. L. Jackson, George E. Rose, James Kennedy and Thomas E. Connell.

George K. Browning has been granted a franchise along the National pike, from the Muskingum county line to Hebron, in Licking County, where he expects to build a road to connect with the Columbus, Buckeye Lake and Newark road.

The Big Consolidated road of Cleveland is to have a belt line that will reach all the depots and at the same time form a crosstown line which will connect with nearly all the other roads in Cleveland. It is said that Mayor Johnson is willing for the execution of the plans as they stand.

The organization of the Toledo and Indiana Railway company of Toledo has been completed by the election of the following-named directors: C. P. Griffin, A. K. Detwiler, L. W. Brown, C. H. Masters, Frank Yesbera, Dr. James Donnelly, W. P. Delaney, J. Q. Files, L. E. Flory and George G. Metzger. The officers chosen by the directors are as follows: President, Hon. Charles P. Griffin; vice-president, George G. Metzger; secretary, L. W. Brown; counsel, C. H. Masters. It is said the company is well fixed financially, and that the work of grading will begin at once.

The Columbus Electric Light company has agreed

to lease its plant to the city at $15,000 per year for three years, furnishing 1,200 lights, the city to leave the plant in as good condition as it was found. It is difficult to tell at this time what will be done in the matter.

The Tiffin and Port Clinton Railway company is a new company incorporated this week, with a capital stock of $20,000, and headquarters at Fremont. It is proposed to build a line between Tiffin and Marblehead, through Fremont and Port Clinton. The incorporators are W. H. Dore, H. C. DeRan, R. G. Kerlin, E. P. Simon and J. C. Breene.

The City Light and Power company of Sebring has been incorporated, with a capital stock of $25,000. The incorporators are George E. Sebring, O. H. Sebring, F. A. Sebring, E. H. Sebring and C. J. Allbright.

The Consolidated Gas and Light company of Toledo has been incorporated, with a capital stock of $500,000, for the purpose of furnishing gas for fuel and light and furnishing electricity for light and power. J. M. Barr, M. B. Daly, C. F. M. Niles, W. H. Dore and R. W. Kirkley are the incorporators.

The commissioners of Hamilton County have granted the Cincinnati, Milford and Goshen Street Railway company a franchise to build a line along the Columbus and Wooster pike, from the Cincinnati city limits to Terrace Park and beyond.

It has been decided to locate the new power house of the Toledo, Bowling Green and Southern road at Findlay. It will be a large and expensive plant.

O. M. C.

Information from Indiana.

Indianapolis, June 24.—The specifications for the new electric-light contract for Indianapolis are still being much discussed, and litigation is not unlikely. The Indianapolis Light and Power company claims to have a perpetual franchise to furnish private lighting in the city, and this claim will have to be settled. A municipal plant is proposed.

The Tell City Electric Light company has filed articles of incorporation, with a capital stock of $40,000. The company will erect a plant at Tell City.

Portland reports its municipal electric-light plant a success for the first year, ended June 1st.

The last week was one of activity in matters relating to electric lines. The Richmond Interurban Railroad company began the construction of a line from Richmond to Centerville. A proposition to vote a $20,000 subsidy to the Goshen and Northern Indiana Traction company for an electric line from Goshen to Angolia carried by a large majority, and work will begin immediately. Ripley and Jackson townships voted a two per cent. subsidy to the Crawfordsville Traction company, for the construction of an electric road from Crawfordsville to the coal fields. The Hartford City council granted the Fort Wayne, Hartford City and Muncie Electric Railway company a new franchise. Nearly all the right-of-way has been secured, and the work of construction will soon begin.

George F. McCullough, president and general manager of the Union Traction company, has been summoned to Philadelphia to confer with Randall Morgan and other large stockholders of the company, and it is given out that the conference will result in a deal in which the Union Traction company, recently incorporated under the laws of New Jersey for $15,000,000, will secure control of 160 miles of electric railway centering in Anderson.

Articles of incorporation of the Indianapolis, Plainsfield and Western Traction company were filed with the secretary of state, with a capital fixed at $200,000. An interurban line to connect Plainfield with Indianapolis will now be built, work to begin next month.

The prediction is made that the era of electric-road building is just beginning, and that it will be only a matter of a few years until the state is almost covered by a network of tracks. Roughly estimated, plans have been drawn for nearly 1,000 miles of electric railway in this state. The Legislature gave the interurban promoters a great lift by enacting a law giving them the same right of eminent domain that is enjoyed by steam roads. Thus they are able to survey and take a right-of-way, where it would have been almost impossible to have obtained it before. Whether an electric road can condemn a right-of-way alongside of a steam road, which, under the law, is entitled to 50 feet on either side of its track, will be determined by the court. The electric roads contend that they can condemn any part of the 50 feet that is not being used by the railroad. If the court so decides, it will be a victory for the electric roads.

The Tipton Electric Light company filed articles of incorporation, with a capital of $25,000, for the purpose of providing Tipton with electric light and power. The board of directors is headed by C. W. Ramsey.

The General Electric company has filed articles with the secretary of state, in compliance with the new foreign incorporation law of Indiana. The company gave the amount of its capital, represented in Indiana, as $20,000.

F.

Northwestern Notations.

Minneapolis, Minn., June 22.—Thomas Lowry, president of the Twin City Rapid Transit company, says that the third interurban line, which his company will construct between Minneapolis and St. Paul, will be an extension of the Selby Avenue line in St. Paul, out Marshall avenue, to the bridge over the Mississippi River, thence in on Lake street, Minneapolis, to the present Minnehaha Avenue line. The fourth interurban will be a continuation of the Grand Avenue line in St. Paul to the Mississippi River. This line will require a new bridge over the river. Mr. Lowry further says that if the new company, recently formed, establishes a street-car line between Anoka and North Minneapolis, it will be given good connections and everything done to facilitate its operation.

The board of directors of the Des Moines and Eldora Electric Railroad company will take bids at once for the construction of the line from Des Moines to Nevada, Iowa. Next year the road will be completed from Nevada to Eldora.

The Golden Reward company will ask electric-railway franchises of the city councils of Deadwood, Lead and Spearfish, S. D. The company expects to begin work at once after securing the necessary franchises.

W. H. Wheeler of Beloit, Wis., has been granted a franchise at Ripon, Wis., for an electric-lighting and waterworks system.

The Public Service company of St. Cloud, Minn., has completed wiring connection with Sauk Rapids, Minn., and is now furnishing that village with electric lighting.

A movement is on foot at Stewartville, Minn., for the establishment of an electric-light plant.

A bill of sale has been filed at Des Moines, Iowa, by the Thomson-Houston Electric Light company, in favor of the Capital City Lighting company, and by the Capital City in favor of the Des Moines Edison. All the property was ultimately transferred to the Des Moines Edison company. This is the consummation of a deal which was made some months ago.

The Tacoma Railway and Power company of Tacoma, Wash., has completed the extension to Spanaway Lake, and has put it in operation.

The Postal Telegraph-cable company has a line in course of construction from Denver to Salt Lake and Spokane.

The Fremont Canal and Power company has applied to the county board at Fremont, Neb., for a franchise for the construction of electric lines through the county. Lines are contemplated west to the sugar factory at Leavitt and east to the county line and thence to Omaha. The company owns the water right for the Platte River canal.

The council of Creston, Iowa, has granted a franchise to Omaha parties for an electric railway.

The Manitowoc and Northern Traction company has been incorporated at Manitowoc, Wis., to build the proposed line to Two Rivers, Wis. The capital stock is $100.000. The incorporators are H. C. Higgins of Marinette, Thomas Higgins of Neenah and H. I. Weed of Oshkosh.

An electric-light and power system is projected for Thompson, Mont. Jesse Pruden of Missoula, Mont., who has a water right on Prospect Creek, is interested.

The Northwestern Mammoth Granite and Electric Power company has been incorporated at Spokane, Wash., with a capital stock of $100,000. It proposes to build a line from Spokane to the Little Spokane, and there to operate a granite quarry. Power can be developed at the little Spokane sufficient to operate the line and to operate the quarrying machinery.

The waterpower plant on the Platte River, near Fremont, Neb., as proposed by the consolidated electric-light, power and street-railway interests of Omaha, is to be an immense affair. A dam, 2,400 feet long and 154 feet high at the highest point, will be necessary. The cost of the dam alone is placed at $400,000, and of the buildings and machinery, $1,250,000. The canal and other work, with the wires and similar work, will cost about as much more. The time needed to complete it is placed at four years.

R.

PERSONAL.

J. H. Livesey of the Detroit office of the General Electric company was a Chicago visitor early in the week.

W. B. Baker, secretary of the Waupaca (Wis.) Electric Light and Railroad company, called on some of his Chicago friends last week.

William V. B. Van Dyck, instructor in electrical science at Rutgers College, New Brunswick, N. J., has resigned, to take up a position with an electrical company in New York city.

J. R. Giller, formerly general foreman of the Westinghouse Electric and Manufacturing company, has become sales manager of the Ohio Brass company of Mansfield, Ohio.

R. R. Jarvie has been appointed superintendent of transportation for the Metropolitan West Side elevated railway of Chicago. He has been in the company's service for six years, and was a clerk to a former superintendent. He will have 500 employes in his charge.

George Amick of Otsego, Mich., is anxious to learn the whereabouts of his son, Claud Amick, who formerly worked for the Kalamazoo Valley Electric company and later was employed in Chicago as a lineman. The young man was foreman for a construction company and had charge of a crew of linemen when the father heard of him last. Any information concerning the missing man will be gratefully received by the father.

Oliver P. Waymire, vice-president of the Chillicothe and Hillsboro (Ohio) Traction company, dropped dead of heart trouble in Springfield, Ohio, a few days ago. He was tax inquisitor of several counties and was interested in a number of enterprises in Springfield and Troy.

The marriage of Franklin Judson Pope and Miss Mary Ethelwyn Russell took place at Great Barrington, Mass., on June 12th. Mr. Pope is the son of Ralph W. Pope of Elizabeth, N. J., the well-known secretary of the American Institute of Electrical Engineers, and is a member of the staff of the New York Evening Sun.

Thomas Curtis Clarke, consulting engineer and former president of the American Society of Civil Engineers, died at his home in New York city on June 15th, at the age of 72 years. He was well known as a bridge engineer and designer and built over 125 miles of iron and steel bridges, viaducts and elevated railways. He was a member of the Institute of Civil Engineers of London, and also of the American Philosophical Society of Philadelphia.

Jacob Henry Van't Hoff, professor of physical chemistry in the University of Berlin, was the recipient of the degree of LL.D. by the University of Chicago at the recent decennial convocation. This week he was given a similar honorary degree by Harvard University. Professor Van't Hoff is called by scientists the father of modern physical chemistry. He is the founder of the theory explaining the space relations of atoms in molecules—a theory said to be essential to a comprehension of the chemistry of organized and inorganized matter, and also a discoverer in the domain of the modern theory of solutions.

Mr. Cecil B. Smith, member of the Canadian Society of Civil Engineers, assistant engineer of the city engineer's department, Toronto, Canada, and formerly assistant professor of civil engineering in McGill University, Montreal, and Mr. William S. Aldrich, member of the American Institute of Electrical Engineers, member of the American Society of Mechanical Engineers, and professor of electrical engineering in the University of Illinois, have opened an office as consulting engineers in the Mail and Empire building, Toronto, Canada. Professor Aldrich, in particular, is well known to electrical and mechanical engineers in the United States, and he has many friends who will wish him success in his Canadian connection.

ELECTRIC LIGHTING.

An electric-light plant is to be erected at Marion, Ky.

Fire recently destroyed the Delta (Pa.) electric-light plant.

The village of McGraw, N. Y., is to be lighted by electricity.

Sioux Falls, S. D., has decided to erect a municipal electric-light plant.

Lompoc, Cal., contemplates the erection of an electric-light plant.

An electric-light plant is being erected at Utica, Ill., by H. Grove.

Thorold, Ont., has voted $6,000 for extending its electric-light system.

Ipswich, Mass., is to establish an electric-light plant at a cost of $85,000.

S. Bacorn has sold his electric-light system in Rutland, Ill., to J. S. Webber.

The Electric Light company of Somerset, Ky., has been incorporated, with a capital stock of $10,000.

The Pikes Peak Power company has been granted permission to erect an electric-light plant in Victor, Colo.

Pratt City, Ala., has been petitioned for a franchise for the erection of an electric-light and power plant.

Fire completely destroyed the Rockville (Md.) electric-light power house recently, the loss being $8,000.

The San Gabriel (Cal.) Electric company has decided to increase its capital stock from $50,000 to $1,000,000.

The East Jordan (Mich.) Electric Light and Power company has been incorporated, with a capital stock of $10,000.

The Chattanooga Electric company of Chattanooga, Tenn., will issue $375,000 worth of bonds for improvements.

D. T. Bomar, G. W. White and R. I. White have incorporated the Citizens' Light and Power company at Fort Worth, Texas.

J. W. Urlson has purchased the plant of the old water and light company at Arkadelphia, Ark., and will soon install five dynamos.

The Sardis Electric Light and Power company has been organized at Sardis, Miss., for the purpose of erecting an electric-light plant.

J. H. Lawrence, W. Angus, E. P. O'Brien and others have incorporated the Suburban Electric Light

company at Oakland, Cal., with a capital stock of $500,000.

An electric-light plant will soon be erected at Manning, Iowa, by a company which is now being formed, with $10,000 capital stock.

A franchise has been granted to the Fish-Mansfield company of Shelby, Ohio, to build an electric-light plant at Mount Gilead, Ohio.

The Citizens' Electric Light and Power company has been incorporated at Jamestown, N. D., by T. Pettigrew, B. Hanna and J. Knauf.

It is estimated that the power plant now being erected by the Citizens' Light and Power company at Rochester, N. Y., will cost $1,500,000.

The Eager Electric company has been incorporated at Watertown, N. Y., by H. Eager and F. M. Bosworth. The capital stock is $10,000.

The committee on electric lights and waterworks at St. Peter, Minn., has been authorized to advertise for bids for improvements to the power plant.

M. Greene, J. D. Vail and C. E. Sayre have incorporated the Excelsior Lighting company at Marshalltown, Iowa, with a capital stock of $25,000.

The Wichita (Kan.) Gas, Electric Light and Power company has decided to spend $20,000 in improving its plant and installing new machinery.

H. L. Jennings, G. Hutton, J. C. Moore and L. L. Johnson have incorporated the Jupiter Light company at Lemoore, Cal., with $50,000 capital stock.

The Unionville (Conn.) Electric Light and Power company has been incorporated, with a capital stock of $20,000. A power plant will be erected at once.

The Beaver Dam (Wis.) Light and Power company has been incorporated, with $50,000 capital stock, by F. G. Bigelow, R. Nunnemacher and C. Schley.

The Enterprise Heat, Light and Power company has been incorporated at La Salle, Ill., with a capital stock of $25,000, by W. R. Hummer, G. A. Wilson and T. Lucey.

A. S. Grenier of the electric-light plant at Gilman, Ill., plans to furnish electricity for both street and commercial lighting in the towns of Danforth, Ashkum and Clifton.

Bids will be received until July 5th for lighting the streets of Red Wing, Minn., for a term of one, three and five years, respectively. C. E. Harrison may be addressed.

Rockingham, N. C., has voted to issue bonds for the erection of an electric-light plant. The town will install 30 arc and 600 incandescent lights. H. S. Ledbetter may be addressed.

The Atlantic Light and Water company of Norfolk, Va., has been incorporated, with $500,000 capital stock, to construct electric and gas-lighting plants, etc. T. R. Heller is president.

Kansas City, Mo., is contemplating the establishing of a municipal electric-light plant. An ordinance is before the council providing for the issuance of $250,000 worth of bonds for that purpose.

The Arcadia Electric Light, Ice and Telephone company has been incorporated at Arcadia, Fla., to establish and maintain a general electric-light business in that city. The capital stock is $20,000.

The lately incorporated Mexia Lighting company of Mexia, Texas, has remodeled and improved its plant and will increase the capacity by the installation of a direct-current generator of about 40 kilowatts.

The directors of the Electric and Water company at Grand Rapids, Wis., have decided to increase the capacity of their plant by putting in a new engine, a boiler and a dynamo, at a cost of about $12,000.

The Nevada Power, Light and Water company of Nevada City, Cal., has been incorporated, with an authorized capital stock of $400,000. The incorporators are L. A. Gould, F. Blanch and D. O'Connell.

A number of Chicago capitalists, organized as the Little Rock Light, Heat and Power company, have asked the City Council of Memphis, Tenn., for a franchise for 30 years, to operate a commercial electric-lighting plant.

Articles of incorporation have been filed by the Hillsborough County Light and Power company, Manchester, N. H. The incorporators are W. D. Lovell, A. E. McReel and J. F. Springfield, and the capital stock is $50,000.

The Rockford Edison company of Rockford, Ill., is making some improvements to its system, among them being an addition to its plant on the east side of the river. The addition will be 45 by 45 feet in size and will be built of white brick. New machinery is to be installed.

A contract has been made between the city of Muskegon, Mich., and the Muskegon Traction and Lighting company for the lighting of the city for 10 years, beginning June 1, 1901. The contract calls for 175 1,200-candlepower arc lights for $76 each per year and such number of 20-candlepower incandescent street lights as the council may designate, at $12 per annum per light. Incandescents for interior lighting are to be furnished at 15 cents per kilowatt-hour. The company plans to build a $100,000 power house immediately.

The Edison Electric company of Los Angeles, Cal., which controls a large number of light and power companies in Southern California, has recently absorbed the Redlands (Cal.) Electric Light and Power company. The Edison company is planning to spend $500,000 in improvements in and about Redlands.

A representative of Montgomery Ward & Co. appeared before a Chicago council committee recently to ask for a franchise for a private electric-light system to furnish lights in the square bounded by Madison and Washington streets, Wabash and Michigan avenues. The committee decided that a tax of 10 per cent. on the gross revenue of the plant should be paid in consideration of the franchise.

A contract was recently let for the entire equipment of the new central station being built by the Citizens' Electric Light company of Battle Creek, Mich. The installation will consist of one 275 and one 135-kilowatt, two-phase, Stanley inductor alternators, together with station and sub-station switchboards, step-up transformers, etc., and will be supplied by the Northern Electrical Manufacturing company of Madison, Wis. The larger unit will be belted to a waterwheel of about 250 horsepower, and the smaller one will be driven by a Buckeye engine. On account of the limited and uncertain water-power available, it will be necessary to operate these generators in parallel, the smaller unit taking its load automatically in proportion to the power of the waterwheel. This will mean that the water-driven unit will at all times carry the bulk of the load, the engine-driven unit being called upon only when the power of the waterwheel falls below normal. These conditions have been met with satisfactory results in many plants equipped with Stanley apparatus.

ELECTRIC RAILWAYS.

The consolidation of the trolley system centering at Meadville, Pa., with a capital stock of $1,500,000, is rumored.

Surveys have been completed at Beaumont, Texas, for the proposed electric-railway system which will embrace 20 miles of trolley lines.

A franchise has been granted by the Village Council at Bryan, Ohio, to the Southern Michigan Street Railway company, to construct a road from Bryan to Hillsdale, Mich.

The Muncie-Greenfield Electric Railroad company has been organized at Muncie, Ind., with W. H. Wood, president, and E. Elliott, treasurer. The capital stock is $500,000.

The Pottstown (Pa.) Traction company has been incorporated, with $140,000 capital stock, to build a street railway in Pottstown and suburbs. The road will be 21 miles long.

A project for an electric railway at Petersburg, Va., includes the erection of a power plant to cost $1,000,000. L. E. Spencer of the New York Trust company of New York is interested.

The Golden Bridge Electric Railway company, North Salem, N. Y., has been incorporated, with a capital stock of $100,000, to construct an electric railway from North Salem to Ridgebury, Conn.

J. J. Elliott, A. W. Selover, E. E. Fuller and H. G. Selover have incorporated the Minneapolis and Anoka Railway company, with $200,000 capital stock. Work of construction will begin at once.

The Mohawk River Traction company has been incorporated in New York, with a capital stock of $160,000, to operate an electric railway through Nelliston, Fort Plain, Canajoharie and Sharon Springs.

Allan I. McDermott has been appointed receiver for the Washington (D. C.) Traction and Electric company. Application for the receivership was filed by the United States Mortgage and Trust company of New York.

J. R. Scrugham, R. T. Belt, N. Wolf and others have incorporated the Cincinnati and Suburban Traction company at Bethel, Ohio, with a capital of $750,000. An electric railway will be built from Linwood to Bethel.

E. L. McFadden, L. W. Link and J. A. Jenne have incorporated the Granite City and Edwardsville Railroad company at Venice, Ill., with $60,000 capital stock. The company will erect a street-railway and electric-lighting plant.

The Camden Interstate Railway company of Huntington, W. Va., has filed a mortgage for $1,500,000 in favor of the Citizens' Trust and Guaranty company of West Virginia, to cover an issue of bonds. The money is to be used in building extensions and making improvements.

The Warren and Garrettsville Electric Railway company has made application for a 50-year franchise to build an electric railway from Garrettsville, Ohio, to the county line in the northeast corner of Windham.

The Village Council of Illiopolis, Ill., has granted a franchise to Myers and Dempsey, representatives of the new electric railroad between Springfield and Decatur, which gives the railway company the right-of-way through the village.

The Detroit and Monroe Electric Railway company has been incorporated in Michigan, to build an electric line from Monroe to Detroit, with branches to Carleton, Rockwood, Trenton and Wyandotte. The road will be 49 miles long.

The Essex Cross Railway company has been incorporated at Trenton, N. J., with a capital stock of $500,000. A trolley line will be built in Essex County, N. J. The incorporators are J. A. Lawrence, F. M. Eppley and G. A. Smith.

J. B. Ford of Wyandotte, Mich., is planning an electric road to carry coal from the Saginaw Bay district to Southern Michigan towns, including Detroit and Bay City. Coal cars are to be run at night and passenger cars in the daytime.

The Watertown and Carthage Traction company has been incorporated at Watertown, N. Y., with a capital stock of $200,000. The company will build an electric railway to connect Watertown, Black River, Felt's Mills, Great Bend and Carthage. The line will be 20 miles long.

The Des Moines, Nevada and Eldora Railway company has been incorporated at Des Moines, Iowa, with a capital stock of $50,000. An electric road will be built from a connection with the Des Moines interurban road to Eldora in Hardin County, and will extend north and east.

It has been reported that the Connecticut Railway and Lighting company has closed a deal by which it secures control of the entire electric-railroad system of New Haven, Conn. There is over 60 miles of track in the system, and it is said that $3,000,000 was the price paid by the purchasing company.

The Chicago City Railway company has placed its order for 120 new cars for the Wentworth avenue line with the St. Louis Car company. The City Railway company has had great success with the new electric cars it put into service last winter, and the new ones will be of the same pattern.

The Denver and Northwestern Railway company has been incorporated at Denver, Colo., by S. M. Perry, C. J. Hughes, F. Perry and A. Smith. The company proposes to build an electric line from Denver to the mouth of the Platte Canyon and to Boulder, Greeley, Louisville, Littleton and Golden.

The St. Louis, O'Fallon and Lebanon Electric Railroad company, with its principal offices at Lenz Station, Ill., has been incorporated for $25,000 by G. J. Kobusch, St. Louis, J. A. Day, J. M. Bramlette and others. The object of the company is to construct an electric-railway line from East St. Louis to Lebanon, Ill.

The San Bernardino (Cal.) Traction company has been organized, with a capital of $500,000, for the purpose of building and operating an electric street railway. The incorporators are H. Fisher, H. Sinclair, E. D. Graham, A. C. Dehman and J. H. Fisher. The road will have branches to Los Angeles, Riverside and Highlands.

Wallace D. Lovell, who is largely interested in electric street railways in New Hampshire, says that the new roads he is interested in and which will be built this year are the Dover, Somersworth and Rochester, Seabrook and Hampton Beach, Portsmouth and Exeter, Haverhill, Plaistow and Newton, Haverhill and Plaistow, and Manchester and Haverhill railways.

The Youngstown-Sharon Street Railway company will expend about $2,500,000 in Ohio and western Pennsylvania on its new trolley system. The contract has been made for all the steel rails to be used in the construction of the road between Sharon and Newcastle, a distance of 21 miles. The road when completed will connect Sharon and Cleveland, taking in intermediate points.

A syndicate headed by Pierre S. F. Dupont of Lorain, Ohio, has purchased the 40 miles of trackage, equipment, rights and franchises of the Dallas Consolidated Electric Street Railway company and the North Dallas Circuit Railway company of Dallas, Texas. The sale also includes the Twin City Railway company, the interurban line now being constructed between Dallas and Fort Worth.

Atlanta (Ga.) and Mobile (Ala.) capitalists have secured a controlling interest in the Mobile Street Railway company. It is said that J. Howard Wilson of Mobile is interested in the sale. Mr. Wilson is president of the Mobile Light and Railway company, operating a large system in Mobile, and the above sale is said to effect a consolidation of the two companies, representing nearly 30 miles of railroad.

It is reported that the Cincinnati Traction company has secured all the lines operating across the Ohio River, between Cincinnati and Covington, Ky., and Newport, Ky. It is said that the directors of the Cincinnati, Covington and Newport Street Railway company will confirm the sale. This will put all the street railways on both sides of the river at that point under the control of the Widener-Elkins syndicate.

A project to connect Saginaw and Grand Rapids, Mich., by means of an electric railway is being vigorously pushed. A company has been incorporated, with a capital stock of $1,000,000, and the bonds

have been taken by an eastern syndicate. The route will be from Grand Rapids through Greenville, Stanton, Elmore, Lake Odessa, Alma, St. Louis, to Saginaw. The road will be known as the Grand Rapids and Saginaw electric railroad.

According to statistics compiled from American Street Railway Investments, there were in 1900 905 companies in the United States operating electric, cable and horse railways. The mileage of track is given at 20,442, of which 19,314 miles is used by electric companies. The total number of cars is 62,918, and of these 55,084 are operated on electric roads. The aggregate capital stock for 1900 is given at $1,066,196,460, an increase over 1899 of $75,183,698.

An ordinance may soon be introduced in the Chicago City Council providing for the posting of a policeman at the door of every street-car barn, on and after September 1, 1903, for the purpose of preventing the egress of any street car on which a license fee of $200 has not been paid. An alderman who takes a leading part in traction discussions is responsible for the proposed ordinance, and he proposes to introduce his plan at an early date.

The Legislature of Michigan has passed a bill that requires all electric interurban railway companies to provide and carry, at each end of every car in use upon such a line, an ax and saw, to be used only in case of accident, suitable water tanks in each car, and to carry at all times a reasonable supply of wholesome drinking water. The bill also calls upon the companies to maintain, upon each passenger car, a suitable toilet room with proper conveniences for the use of passengers.

The Bituminous Street Railway company of Clearfield was incorporated, with $180,000 capital stock, to build 30 miles of track to connect Clearfield with Dubois, Falls Creek and other districts in Clearfield County, Pa. G. A. Lukehart is president. The directors are W. A. Engleman, J. B. Hess, J. A. Vasbinden. These gentlemen are also interested in the Old Town Street Railway company of Curwensville, which was chartered to build a line seven miles long, with $42,000 capital stock.

Press dispatches from Toronto, Ont., report that a deal having for its object the combining of all Canadian gas, electric-light, street-railway and power concerns within 100 miles of Niagara Falls is about to be closed. The deal was engineered by New York, Toronto and Montreal capitalists, and, it is said, will be a Canadian copy of the International Traction company of Buffalo, Tonawanda and Niagara Falls, and will likely be controlled by the same interests. Power lines will be built from Niagara Falls, and the entire system operated from that point.

A syndicate of Boston capitalists has incorporated the Seattle-Tacoma Interurban Railway company in the state of Washington. The company has a capital stock of $2,000,000. An electric railway will be built between Seattle and Tacoma, a distance of 33 miles, and the construction will be such that it will be possible to maintain a speed of 60 miles an hour. The road will be equipped for both passenger and freight business. Lee, Higginson & Co., Kidder, Peabody & Co. and Stone & Webster are members of the syndicate.

AUTOMOBILES.

On June 17th, Bunker Hill Day, over 50 automobiles participated in the Massachusetts Automobile Club's run from Boston to Massapoag Lake, Sharon, Mass. Other carriages came from Providence, R. I., with the Rhode Island Club. In all, 90 carriages and 210 persons reached Sharon. After dinner there were several informal events in front of the hotel.

PUBLICATIONS.

A June bulletin, sent out by the Sprague Electric company of New York city, describes in detail its line of Lundell motors. Eight different types of machines are illustrated and dimensions of the various sizes are given in tables.

A new catalogue has been recently issued by the New York and Franklin Air Compressor companies illustrating and describing their latest type compressors, designed for the operation of pneumatic tools and machinery in machine shops, boiler shops, shipyards, foundries, etc. The publication also contains much valuable information and data relating to the points to be considered in the selection of air-compressing machinery and its proper installation in the attainment of the highest economical results.

TELEGRAPH.

It is reported that the Russian government, in order to facilitate the telegraphic business between Odessa and Berlin, will construct a direct line between these two cities. Work on the new line will be commenced in the spring.

The Commercial Cable company has recently completed laying a cable between Waterville, Ireland, and Weston-Super-Mare, from which place it will be connected directly to London. The British government has long opposed this plan, and the completion of the work marks the end of the struggle.

The United States cableship Burnside, which has been laying cable in the Sulu Archipelago, has laid practically all the cable it had on board, and reports show that the cable lines are working very successfully. Time is furnished now from the observatory at Manila to all important points throughout the islands, and a press bulletin goes free daily to every garrison.

Communication between Brazil and the United States has been greatly facilitated by the opening of the new line between New York and the Azores Islands, connecting with the line from Brazil, via Lisbon. Messages can now be sent without delay and the cost of transmission has been reduced about 25 per cent.

It is said that a home for railroad employes is to be built in or near Chicago by the Order of Railway Telegraphers. The plans for the home call for an expenditure of between $400,000 and $500,000. The headquarters of the order are in Peoria, Ill., but Chicago is recommended for the home on account of its accessibility from all parts of the country.

The Central African telegraph that connects Brazzaville with Loango on the west coast has been completed. The line from Brazzaville to Stanley Pool, which is being erected to connect with the telegraph system of the Congo state, will ultimately be extended to Lake Tanganyika, where it will form a conjunction with the German East African system.

Experiments, in connection with a new telegraph system, have recently been conducted by the postal engineers between London and Glasgow. The new apparatus is the invention of a French engineer of the name of Mercadier, and it is said that it is possible to send 12 separate messages over one wire at the same time. The system is also capable of being duplexed, making it possible to send 24 separate messages at one time over a single wire.

United States Consul Guenther at Frankfort says that, according to experiments conducted by H. Janssen on Mont Blanc, it is not necessary to erect poles for stringing telephone and telegraph wires in snow-covered countries. If the snow is several inches thick, it serves as a good insulator; the wires can simply be laid down, and be ready for transmission of messages. Similar experiments with equally favorable results were made on Mount Ætna.

The Eastern Telegraph company has finished laying a cable from Falmouth to St. Vincent, Cape Verde Islands. It passes through the office of the Western Telegraph company at Funchal and is worked in connection with the Cape-St. Helena route. The Western Telegraph company has four cables at Funchal—two to Lisbon and two to St. Vincent. One of the Lisbon cables is continued to Brazil and connects that country with Europe. The direct cable route from Funchal to the United States is by way of Lisbon and the Azores. The rate to New York is about 50 cents a word.

Articles of incorporation have been filed at Jersey City, N. J., by the Postal Telegraph Cable company of New Jersey. The object of the company is to construct and operate a telegraph line wholly within the state of New Jersey. The capital stock is $50,000. The incorporators are William H. Baker, Charles P. Bruch and Theodore L. Cuyler, Jr. Mr. Baker, vice-president of the Postal Telegraph company, when questioned, said that the company proposes to operate over all the wires which it has in New Jersey under one head, and that the new arrangement is simply a business proposition.

SPACE TELEGRAPHY.

The French navy officials have decided to equip the flagships Bouvet, Amiral Pothuau and Charles Martel with wireless-telegraphy systems for use in the approaching naval maneuvers.

The Federal Wireless Telephone and Telegraph company of Pierre, S. D., has filed articles of incorporation, with $5,000,000 capital stock. Alfred B. Davis, Seymour Lee and W. A. J. Seals are the incorporators.

A dispatch from Buenos Ayres, Argentine Republic, states that Mr. Ricaldoni, an engineer, has just made experiments with an improved system of wireless telegraphy. The results of the experiment were very satisfactory.

W. L. Mercereau, superintendent of steamships of the Père Marquette Railroad company, is planning to install wireless telegraphy on all the steamers of the line. This system will supplant the carrier-pigeon service, which had been planned for the boats. Land stations on Lake Michigan for the line will be located at Milwaukee, Ludington and Manitowoc.

Professor R. Fessenden, the United States Weather Bureau's wireless-telegraphy expert, has been installing his system of wireless telegraphy on the coast of Virginia. Professor Fessenden is reported as having said that his experiments at Cape Hatteras, Roanoke and thereabouts have resulted satisfactorily and that great progress has been made in the work at those points.

It is said that the recent report of the board of naval officers recommending the adoption of wireless telegraphy and the disuse of homing pigeons in the United States Navy was doubtless based, in part, on the successful operation of the new system between Governor's Island and Fort Wadsworth, which was inspected by the board some time ago. Last summer messages were frequently sent across the water between the two places in an eminently satisfactory manner. The poles used as the initial points in the system are about 150 feet high and about six miles apart.

The Dominion government of Canada has taken up the question of utilizing the Marconi system of wireless telegraphy in all seriousness, and has cabled for two instruments. Upon their receipt, the work of putting them to a practical test will be at once entered upon. A series of experiments with this system will be made by D. H. Keeley, superintendent of government telegraphs, on board the steamer Tyron, which is about to leave Halifax, N. S., with the 22 miles of submarine cable to connect Belle Isle with the shore end of the Gulf telegraph system at Chateau Bay. Upon the result of the test will depend whether the system can be made use of as an alternative to the cables connecting the island of Anticosti, and other important isolated stations in the Gulf of St. Lawrence, with the land lines. Frequently, in winter and early spring, these cables are interrupted. The Montreal shipping men are of the opinion that should the instruments realize all that is claimed for them, the dangers of the St. Lawrence route would be reduced at least 70 per cent.

MISCELLANEOUS.

Plans are being made for the creation of a federal bureau of technics in Germany. Members of the leading chemical and electrical works, the German association for protecting the trades, the Technical Association of Germany, the Association of German Engineers, the Union of German Patent Lawyers and the Central Bureau for Scientific Investigation are on the executive committee, which has charge of the plans.

It is the desire of the United States Civil Service Commission, Washington, D. C., to establish an eligible register for the position of laboratory assistant in physics, National Bureau of Standards, Treasury Department, at $1,200 or $1,400 a year. Persons who desire to compete should apply for application form 304 and special form, which should be executed and, with the material required, filed with the commission prior to the hour of closing business on July 6th.

The Council of the Institution of Electrical Engineers of England is considering the formation of a museum for objects or apparatus not now in commercial use, but which possess interest in connection with electrical science and its application. To prevent the loss to the profession of the many objects of historical interest that are still in existence, the council has invited the members of the Institution and their friends to co-operate with it in the collection of such apparatus as may be available.

TRADE NEWS.

Sipe & Sigler of Cleveland, Ohio, announce that they have been awarded the contract for a battery of 64 cells of 800 ampere-hour capacity, to be installed at the Skuylkill Arsenal, Philadelphia.

Articles of incorporation have been issued to the Spencer Electrical company, New York city. The directors are J. H. Spencer, C. L. Child and Henry Dawson. The company has a capital of $100,000.

The Utica Drop Forge and Tool company and the Smith & Hemenway company of New York city announce that their exhibit can be seen at the Pan-American Exposition, in section S, Electricity building, in Marland's collective exhibit.

The Meriam-Abbott company of Cleveland has recently been incorporated, with a capital stock of $50,000. The purpose of the new company is to manufacture engines, electric motors, generators, storage batteries, charging outfits and other electrical supplies and machinery. The incorporators are Frank E. Abbott, F. P. Root, E. B. Meriam, Joseph B. Meriam and Walter R. Root.

"The officials of the National Automobile and Electric company of Indianapolis," writes the Indiana correspondent of the Western Electrician, "are rejoicing over the fact that they have done so much for Indianapolis in bringing here from Chicago James K. Pumpelly, a chemist and electrician of national reputation. Mr. Pumpelly's specialty is storage batteries. He has taken out more patents in his line of investigation, it is said, than any other man in the country." The Indianapolis company will manufacture under new inventions and improvements of Mr. Pumpelly, who has removed to Indianapolis from Chicago. Mr. Pumpelly has had wide experience in the storage-battery business, having devoted much attention to vehicle batteries. His inventions and services should be of great value to the new Indianapolis company.

BUSINESS.

The Monon Route is arranging a Cincinnati excursion from Chicago. Tickets will be on sale July 5th to 7th, good returning until August 31st by depositing with agent at Cincinnati. The rate is one fare for the round trip. The Chicago city ticket office of the Monon is at 232 Clark street.

The Gould Storage Battery company of New York city has recently broken into the German market.

Gould automobile batteries are said to be more suited to automobile work than the best German product. The Gould 100-ampere hour battery only weighs 29 pounds per cell complete, it is said. It is of the hardy electrochemical formation, not of the pasted type, and long life is a feature.

The Chicago, Burlington and Quincy Railroad company announces that on special days during this summer the rates for round-trip tickets over its route from Chicago, Peoria and St. Louis to Colorado will be more than cut in half and that on other days about half rates will apply. The company is doing everything possible this year to make it convenient and not too expensive for people of moderate means to spend their vacation in the Colorado mountains. Illustrated books on Colorado, with information about hotels, ranches, etc., may be obtained from P. S. Eustis, general passenger agent of the company, at Chicago.

The Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio, through its engineer, C. P. Folsom, has secured a nice order for its Victor high-pressure turbines in Canada. The wheels will be used by the Ouiatchouan Pulp company, Ouiatchouan, Que., and will operate under a 240-foot working head. The pulp mill will have a daily capacity of 30 tons of pulp. The order includes two 1,000-horsepower wheels for driving the grinders, one 500-horsepower wheel for driving the screens and wet machines, and one 100-horsepower wheel for driving an electric plant.

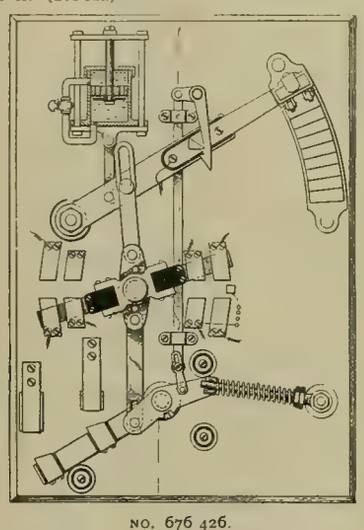
The Central Electric company of Chicago has issued a new wire price-list, dated June 17th, in which are listed I.X.L. weatherproof wire, galvanized telephone wire, annunciator, office and magnet wires and lamp cord. This company will be glad to receive inquiries from those interested in this material and will be pleased to send a copy of the price-list upon request.

ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued June 18, 1901.

676,342. Rheostat Controller. John Dillon, Milwaukee, Wis. Application filed March 22, 1901.

A pivotal rheostat arm is provided with a lateral lug and a bell crank, one arm of which constitutes a latch engageable with the lug. A rod having guides is in connection with the other arm of the bell crank. A main switch bar has a lever constituting part of spring-snap mechanism in conjunction with the switch bar. A link in connection with the lever has loose-play union with the rod. There is a swing plate, and links in connection with the plate have loose-play union with the rheostat arm and lever. (See cut.)



NO. 676 426.

676,436. Telegraphic Instrument. Harry T. Johnson, Jersey City, N. J. Application filed July 5, 1900.

An arm is connected with the key lever and is arranged to engage with and exert an upward pressure on the sounder lever when the key lever is depressed. Means for adjusting the position of the arm without varying the adjustment of the sounder lever are provided.

676,439. Pole Piece for Dynamo-electric Machines. Frank A. Merrick, Johnstown, Pa., assignor to the Lorain Steel company of Pennsylvania. Application filed March 20, 1901.

A plate or lamina for use in the construction of the pole pieces of dynamo-electric machines has a concaved polar edge bounded by a compound curve whose central portion is concentric with the axis of the armature and whose end portions have each a greater radius of curvature.

676,441. Fan-motor Support. Fred P. McBerty, Warren, Ohio. Application filed June 12, 1900.

This device comprises a hollow standard and a yoke having a hollow stem or stud secured thereto. A groove is formed in the stem and has a stop therein. A screw or other securing means are adapted to engage the groove so as to prevent the withdrawal of the stem from the standard and to limit by means of the stop the rotation of the yoke. The opening in the stem and in the hollow standard affords a passage for the leads from the motor to the switch.

676,517. Supervisory Signal for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric company, Chicago, Ill. Application filed August 15, 1898.

Telephone lines having means at their stations for diminishing the resistance in the line in the use of the telephone are combined with a plug and plug circuit for making connection with a line. A supervisory signal associated with the line has two windings. A local circuit closed in switch contacts brought together in making connection with a line includes one of the windings of the supervisory signal. The other winding of the signal is in the circuit of current determined by the diminished resistance of the line in the use of the telephone. The windings of the signal are equal and differentially disposed with respect to the currents in them. The signal is displayed only during connection of the plug with the line, while the telephone of the line is in use.

676,520. Electric Motor. Arthur P. Warner, Milwaukee, Wis., assignor of one-half to the Northern Electrical Manufacturing company, Madison, Wis. Application filed October 22, 1900.

An armature of the motor has a shunt field winding around it. There is a starting resistance in the armature circuit, and an additional field winding is in shunt around a part or all of the starting resistance.

676,524. Electrode for Secondary Batteries. Wilson H. Abbey and Jacob Altmos, Cleveland, Ohio. Application filed August 25, 1900.

A holder for the active material is formed of a corrugated sheet. This sheet is bent parallel with the corrugations to form a series of shelves or partitions, each having a plurality of corrugations extending longitudinally of the shelves and parallel with the sides thereof. The spaces between the shelves are alternately open at opposite sides to the free admission of the battery fluid. Supporting and closing means are provided for the shelves and spaces between the shelves. (See cut.)

676,575. Electric Furnace. Alfred H. Cowles, Cleveland, Ohio, assignor to the Electric Smelting and Aluminum company, Cleveland, Ohio. Original application filed July 6, 1895. Divided and this application filed April 9, 1897.

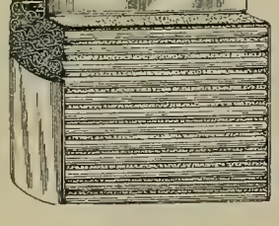
The cooling jacket surrounds the furnace chamber, which has a lining. Gas passages lead from the center of the chamber through the lining and the jacket. A holder for the carbon electrode is composed of material, the coefficient expansion of which is greater than that of the carbon.

676,576. Electrode Connection for Electric Furnaces. Alfred H. Cowles, Cleveland, Ohio, assignor to the Electric Smelting and Aluminum company, Cleveland, Ohio. Original application filed November 24, 1899. Divided and this application filed August 30, 1900.

An electric smelting furnace has a closed top, and an electrode extends from the furnace chamber through the top. These are combined with a gas-tight pipe fitting around and making a close joint with the electrode so as to form a chamber between the top of the electrode and the pipe, and a gas inlet to the chamber discharging upon the top of the electrode to prevent the passage of vapor through the joint. (See cut.)

676,577. Electric Smelting Process of Reducing Sodium Compounds. Alfred H. Cowles, Cleveland, Ohio, assignor to the Electric Smelting and Aluminum company, Cleveland, Ohio. Original application filed July 20, 1895. Divided and this application filed September 27, 1900.

This process consists in forming a mixture of sodic aluminate with carbon and a compound of a non-volatile metal and heating the mixture in a tightly closed carbon-lined chamber by heat from an electric current. The sodium is thereby reduced, volatilized and passed out of the chamber. The oxide of aluminum is reduced and an alloy of the aluminum with the non-volatile metal of the charge is produced, collecting and condensing the sodium vapors, and tapping or removing from the furnace the reduced aluminum alloy.



NO. 676 524

676,583. Electrical Apparatus. Thomas B. Kinraide, Boston, Mass. Application filed August 13, 1900.

A source of intermittent electrical energy has at its opposite terminals electrodes, one of which has a discharge point provided with means for cutting off the receptive area about the discharge point. The other electrode has a large receptive area provided with means for preventing the tendency to discharge. The means resides in presenting a receptive surface without angles or points. The other electrodes co-operate with the terminal electrodes, there being a discharge-point electrode arranged to co-operate with a receptive area electrode, and vice versa.

676,618. Magnetic Separator. Thomas A. Edison, Llewellyn Park, N. J. Application filed July 16, 1897.

A series of bar magnets are arranged in a stack and there are feeding devices for feeding the material by gravity directly against both polar faces of the magnets in succession. Floors are provided for receiving the material rejected by one magnet and for delivering it to the magnet next below. Inclined conduits carry off the concentrate from the several magnets and are provided with lateral passages to permit the rejected material or tailings which fall on top of the conduit to pass through the receiving floor beneath it. (See cut.)

676,704. Method of Protecting Wooden Piles. Samuel L. Shuffleton, Seattle, Wash. Application filed August 13, 1900.

This is a method of treating submerged wooden piles, which consists in passing a current of electricity from the interior of the pile outward through the pores of the wood.

676,738. Electrically Propelled Boat. William R. Edwards, Weybridge, England. Application filed March 2, 1901.

A propeller shaft is adapted to be driven by an electric motor. Reversible propeller blades and propeller-reversing mechanism are carried upon one end of the propeller shaft. There is mechanism for operating the reversing mechanism to operate the blades. Means are carried by the mechanism for controlling the current through the motor, whereby when the reversing mechanism brings the blades to a neutral position the current ceases to flow through the motor.

676,745. Electrohydraulic Brake for Railway or Like Vehicles. André Goldschmidt, Paris, France, assignor to Compagnie Internationale du Frein Electro-Hydraulique Durey, Brussels, Belgium. Application filed February 12, 1901.

This device is a continuous hydraulic electrically operated brake in which the energy necessary for applying the brake is obtained from a compression pump actuated by the momentum of the vehicle.

676,840. Magnetic Separating Apparatus. Thomas A. Edison, Llewellyn Park, N. J. Application filed January 9, 1900.

A magnet comprises two dished members having polar extremities which are arranged adjacent to each other with a relatively narrow gap between them. Non-magnetic rims are rigidly carried by the members and are arranged parallel with the polar extremities. A belt is carried by the rims and the polar extremities and to this the mixed magnetic and non-magnetic materials are fed.

676,841. Magnetic Separating Apparatus. Thomas A. Edison, Llewellyn Park, N. J. Application filed July 2, 1900.

An endless belt is supported at both ends and is caused at one end to travel concentrically with respect to a magnetic field, the linear travel of the belt being substantially parallel to the zone of maximum magnetic attraction. Means are provided for feeding magnetic and non-magnetic material to the belt in an area out of line with such zone, whereby the magnetic particles will be caused to move laterally with respect to the non-magnetic particles while the latter are subjected to centrifugal force.

676,843. Incandescent Lamp. Christian Hoelscher, Warren, Ohio, assignor of one-half to the Wiswell-Pritchard Electric Manufacturing company, Niles, Ohio. Application filed May 25, 1900.

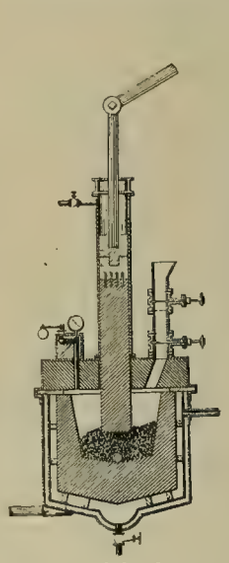
Two metallic contacts are firmly secured within and project beyond the outer end of the mount. The leading-in wires are connected to the contacts. The contacts form the connecting medium for the lamp socket.

676,849. Circuit-breaker Trip. Arthur J. Purinton, Waterbury, Conn. Application filed May 9, 1900.

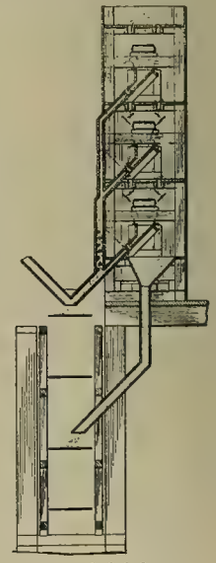
A circuit-breaker catch has a spring for pulling the catch in one direction and a magnet for attracting the catch in the opposite direction. A trip lever engages the circuit-breaker catch, and a spring is adapted to force the trip lever so as to cause the circuit-breaker catch to move against the pull of its spring. A spring is adapted to hold a catch lever in engagement with the trip lever, and an armature is attached to the catch lever, and a magnet embraces the trip lever and is arranged to attract the armature against the pull of the catch-lever spring.

676,853. Electrically Illuminated Cross. Henry J. Schlacks, Chicago, Ill. Application filed April 22, 1899. Renewed May 15, 1901.

This device is a hollow cross, which is provided with slots in its front face, and is adapted to carry lamps to fit within the slots.



NO. 676,576.



NO. 676,618.

676,854. Automatic Telegraph. Harry Shoemaker, Philadelphia, Pa., assignor to Gustave P. Gehring and Marie V. Gehring, Philadelphia, Pa. Application filed February 12, 1901.

A transmitting station has means for feeding an endless strip of paper provided with perforations adapted to be fed by the means. Vibrating plates are provided with points to contact the paper and be raised and lowered to make circuits. An electromagnet is magnetized by one point in one direction and is magnetized in the other direction with the other point. A receiving station prints the transmitted message upon sensitized film or paper. The receiving station comprises an electromagnet and means are operated by the electromagnet to form circuits to help tear down itself. Electromagnets are in circuit with the means and are magnetized one at a time by the means. A printing mechanism is operated by the last-mentioned electromagnets.

1901
WESTERN ELECTRICIAN
TWENTIETH CENTURY
SOUVENIR NUMBER

THE STORY OF THE MAGNET

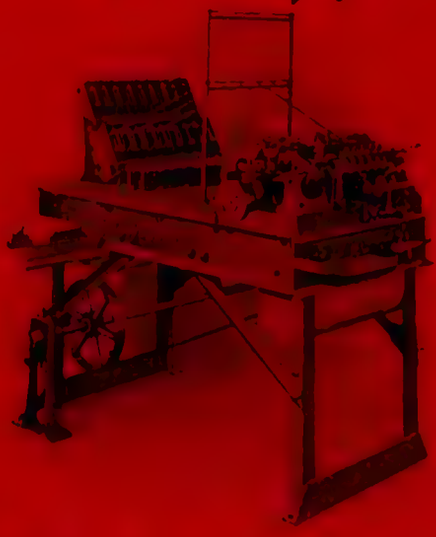
THE ELECTRO-MAGNET
AT THE BEGINNING
OF THE
19TH CENTURY

AN ELECTRO-MAGNET

is a core of iron around which are wrapped a number of turns of **bare** copper wire. It is essential that the turns be separated one from another.

It has been customary for the past seventy years to separate turns one from another by wrapping silk **around** the wire. The Varley Duplex Magnet Company have special automatic machinery which separates these turns one from another by laying a silk thread **alongside** of the wire, separating turn from turn, and a sheet of paper is automatically inserted at the end of each layer, separating the layers one from another.

THE 20TH CENTURY MAGNET



MULTIPLE AUTOMATIC MAGNET WINDING MACHINE

THE "VARLEY" MAGNET

examined under a glass discloses a most perfect winding, and it will be seen upon close inspection that each turn of wire when wound in this manner, compared with ordinary winding, occupies much less space and consequently permits of many more turns being obtained in the limited winding space, or with a desired number of turns these turns can be **crowded** or wound much **nearer to the core** than is the case with the ordinary wound magnet. They are now universally adopted by nearly all Telephone, Telegraph and Instrument Makers, and they are **cheaper** than an equivalent amount of single silk covered wire.

THE VARLEY DUPLEX MAGNET CO.

Jersey City, N. J. Chicago, Illinois

Western Electrician

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SIMPLEX INSULATED WIRES AND CABLES.

RUBBER COVERED, WEATHERPROOF, UNDERGROUND AND SUBMARINE.

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CARBONS

SPECIALTIES A SPECIALTY. ELECTROLYTIC. ALTERNATING. DIRECT. ENCLOSED. OPEN.

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TRADE MARK

1889—Paris Exposition, Medal for Rubber Insulation.
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THE STANDARD FOR RUBBER INSULATION.

Sole Manufacturers of

Okonite Wires, Okonite Tape, Manson Tape, Candee Weather-proof Wires.

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"PHONO-ELECTRIC" WIRE "IT'S TOUGH"

WILL GIVE A SECURITY AND PERMANENCE TO YOUR TROLLEY, TELEPHONE and TELEGRAPH LINES that can be obtained by the use of no other wire.

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MANUFACTURERS OF

Paranite Rubber Covered Wires and Cables,

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All Wires are tested at Factory. JONESBORO, IND.

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2,000 IN USE.

Bipolar and Multipolar Motors from ⅓ to 50 horse power. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio.

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ALL METAL RECEIVER EXCEPTIONALLY STRONG. NEEDS NO ADJUSTING.

IT IS THE BEST. WHY NOT HAVE IT?

SWEDISH RECEIVER

ERICSSON TELEPHONE CO. 296 B'WAY, N.Y.

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Sterling Extra Black Finishing Varnish,
Sterling Black Air Drying Varnish,
Sterling Black Core Plate Varnish.

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Suitable for all purposes where Storage Batteries are applicable.

No buckling of plates. No spilling of acid. No sulphating or corroding.

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We have fine facilities for light manufacturing, and solicit correspondence. Estimates given on quantity or small lots. PUNCH PRESS AND SCREW MACHINE WORK.

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MANUFACTURERS OF

VITRIFIED SALT GLAZED UNDERGROUND AND INTERIOR CONDUITS.

Contractors for Complete Installation of Conduit Systems.

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Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils.

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Catalogue showing new types for season of 1901 will soon be issued. You should see the new Emerson line before buying. Write for catalogue.

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For Porcelain or Clay Insulating Specialties, such as Bushings, Knobs or Cleats, Address,

THE AKRON SMOKING PIPE CO., MOGADORE, OHIO.

I-T-E CIRCUIT BREAKERS

CUTTER ELECTRICAL CO., PHILADELPHIA

THE BEST ON EARTH

TIPLESS LAMPS THE SHELBY ELECTRIC Co. SHELBY, OHIO.

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Weston Standard Portable Direct Reading Voltmeters, Millivoltmeters, Voltammeters, Ammeters, Milliammeters, Ground Detectors and Circuit Testers, Ohmmeters, Portable Galvanometers.

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Our Portable Instruments are recognized as The Standard the world over. The Semi-Portable Laboratory Standards are still better.

Our Station Voltmeters and Ammeters are unsurpassed in point of extreme accuracy and lowest consumption of energy.

Mention the WESTERN ELECTRICIAN when writing for catalogues.

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STANLEY A. C. WATTMETERS. Permanent Accuracy Guaranteed.

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The Largest and Oldest Manufacturers of Rheostats in the World.

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Compound Prism Globes and Shades

FOR ALL KINDS OF LIGHTING.

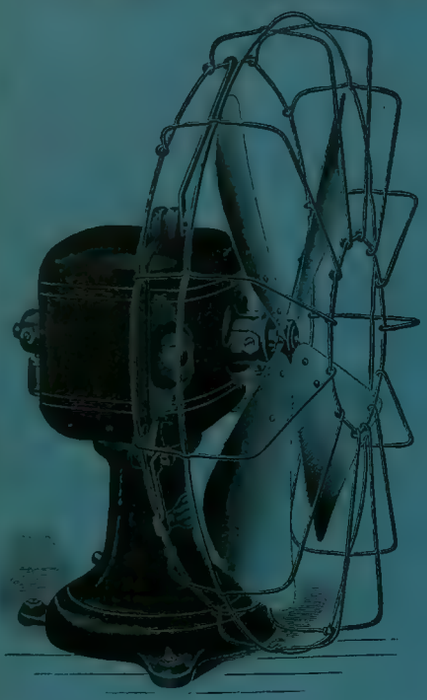
TWO GOLD ONE SILVER Medals

Awarded at Paris Exposition.

WRITE FOR CATALOGUE.

DIEHL DIEHL

OUR CEILING AND ELECTROLIER FAN



PATENTS

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U. S. COURT'S

DECISION

MARCH 8th AND DEC. 5th, 1900.

Our fans appeal to users whose electricity is measured by meter, and the central station managers who furnish electricity at a fixed monthly rate.

A special feature in the design is that the two field cores are cast integral with one frame, making an unbroken magnetic circuit. The armature is built up of thin, soft iron, with slots in the periphery, cut accurately, for the reception and protection of the wire, which has double silk insulation. The commutator is made of hard drawn copper bars with mica insulation. The commutator bushing is secured to the steel shaft by a lock nut. The self-aligning bronze bearings are also self-oiling, having an improved self-feeding wick oil cup. The brush holders are unique in design, no wires are shown, and the carbon brushes are easily removed by unscrewing the fibre cap. The frame and supporting base have a smooth finish of enamel with suitable decoration. The blades, guards and trimmings are furnished in japan, nickel or brass, as ordered. Our Desk Fans are also made with universal joint by means of which the current of air can be directed as desired. When it is found desirable to permanently secure the fan it can be fastened by means of screws through the holes in the base.

A special feature of the Diehl Electrolier Ceiling Fan is the detachable basket which may be unscrewed from the fan without disturbing any of the wires, and by screwing on the basket makes connection with the lights automatically.

The Electrolier Fans are also run successfully with the motors on arc circuits and the lights on alternating system, as the two currents are kept entirely separate throughout and are thoroughly insulated.

The 5-light Electrolier Fan is furnished with etched shades, complete as shown, without lamps.

DIEHL MANUFACTURING CO.

SHOW ROOMS { NEW YORK, 561-563 Broadway. CHICAGO, 192-194 Van Buren St. BOSTON, 128-132 Essex St. PHILADELPHIA, W. Irwin Cheyney & Co.

MAIN OFFICE AND WORKS: ELIZABETHPORT, N. J.

DIEHL DIEHL

Roads Having Lines Extending

considerable distances beyond their power stations will do well to investigate the merits of *Storage Battery Sub-Stations.*

A Chloride Accumulator Sub-Station

is a "reservoir" located on a line—absorbing energy when the local consumption is light—giving forth this energy to the sections fed by it, at times when the service demand is above normal.

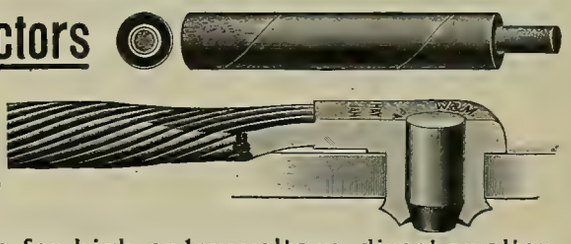
Many such Chloride Accumulator installations have been made. We will be pleased to advise you of results attained and saving effected and of the probability of our being able to assist your situation similarly.

THE ELECTRIC STORAGE BATTERY COMPANY,

19th Street and Allegheny Avenue, Philadelphia, Pa.

SALES OFFICES: NEW YORK: 100 Broadway; BOSTON: 60 State Street; BALTIMORE: Equitable Bldg.; CHICAGO: Marquette Bldg.; DETROIT: Michigan Electric Co.

"CROWN" Insulated Conductors AND Rail Bonds



"Crown" wires are the perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

"Crown" bonds are the perfection of simplicity and economy in rail bonding, together with perfection of contact.

In "CROWN" WIRES or "CROWN" BONDS you secure the best attainable results, electrically and mechanically.

Solid or stranded bare copper conductors; also lead-encased and armored for aerial, underground and submarine work.

American Steel and Wire Co., Chicago, Ill.

NEW YORK, WORCESTER, DENVER, SAN FRANCISCO; LONDON, ENG.

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

THREE IMPORTANT POINTS:

SIMPLICITY, DURABILITY, REFINEMENT OF DESIGN

are the first points considered by prospective arc lamp buyers. **The Belden Arc Lamp** excels, not only in the above points but in many others. Users pronounce it the most satisfactory lamp on the market.

It burns a minimum of 250 hours.
No alignment necessary.
Trims easier than an open arc lamp.
Allows easy access to every part of lamp.
Gives absolutely steady light.

Our bulletins give further reasons why **The Belden** should receive your careful consideration before placing your next order.

BELDEN-LARWILL ELECTRIC & MFG. CO.,
FORT WAYNE, IND.

AGENTS: M. B. Austin & Co., 58 W. Van Buren St., Chicago. C. E. Wilson, 1000 Betz Bldg., Philadelphia, Pa. R. N. Stewart & Co., Denver, Colo.
We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.

TRY A 1901

KINSMAN DESK LAMP.

ALWAYS IMPROVING. **ALWAYS LEADING.**

SEND FOR DESCRIPTIVE MATTER.

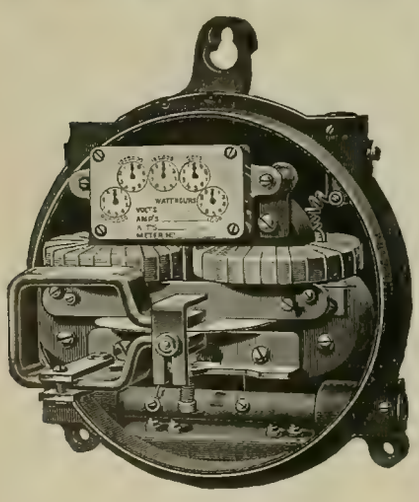
Beware of Spurious Imitations.

McLEOD, WARD & CO.,
27 Thames St., New York.

ELECTRO GALVANIZED CONDUIT

INTERIOR AND UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

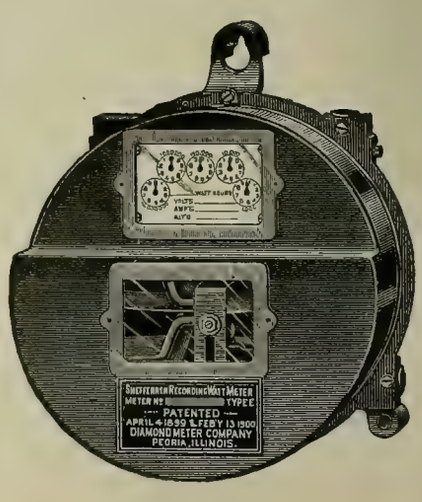


Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.

DIAMOND METER CO.
PEORIA, ILL., U. S. A.



OUR TRADE FOLLOWS THE FLAG.

With the close of the year 1900, our business expansion kept pace with the country's commercial progress, and we enter upon the Twentieth Century with the confidence gained by the experience of the past, and with enlarged plans and a determined purpose to meet all the demands, which we expect will be greater than ever, on our sources of supply.

In entering on the New Year and New Century we continue to offer Okonite insulation, the standard of all insulations, which has been tried on land and sea, in the mine and in the air, and never has been found deficient. It never disappoints. The claims made for its superior and lasting qualities, if made for any other insulation, would be extravagant. It has no equal; there is no other insulation nearly "just as good," and it is the only safe insulation that should be used in a permanent installation, as it improves with age, as Lord Kelvin testifies in his report on tests made covering a period of years.

Okonite does not crack when exposed to the severest changes in temperature; it will not deteriorate when placed in lime or mortar; it is not affected when immersed in sulphuric acid; it will stand a greater amount of kinking and torsion without injury to the insulation than any other insulation.

There is more of it used than ever before. It is used in the operation of the telegraph, telephone, electric light, street railways, mines and automobiles, also in laboratory work. In submarine service it is pre-eminent.

Its familiar trade mark OKONITE TRADE MARK is known wherever the electric current flows.

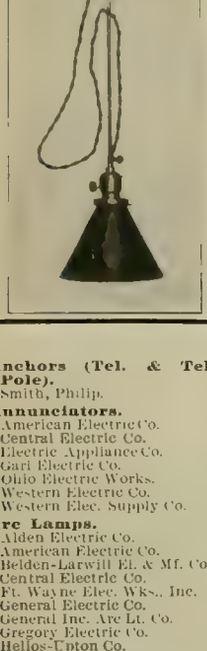
SHIPMENTS FROM STOCK.

CENTRAL ELECTRIC COMPANY,

264-266-268-270 FIFTH AVENUE,

CHICAGO.

SOMETHING NEW FOR THE 20th CENTURY.



Smith's Incandescent Lamp Adjusting and Controlling Devices.

Patented October 16, 1900.

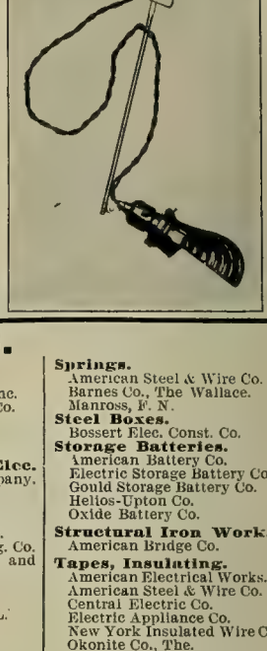
NOW READY FOR THE TRADE.

Simplest, neatest and handiest device for controlling lamp on end drop cord ever invented. It enables you to throw the light just where you want it. Adjusts your lamp up or down or throws reflection to side of room or at any angle. Weighs less than five ounces. Will hold on any size cord. Can be used where others would be impracticable. Made in various styles. Finished in brass, bronze, nickel, copper or black.

Price of Adjuster Like Cut, 75 Cents.

Mailed on Receipt of Price. Agents Wanted Everywhere. Send Sample Order

IT'S JUST WHAT YOU HAVE BEEN LOOKING FOR.



THEO. SMITH, Mfr., 151 Throop St., Chicago, Ill.

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STEAM RAILWAY CARS

By Electricity Generated from the Car Axle.

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STORAGE BATTERIES
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THE COST
OF MAINTENANCE IS
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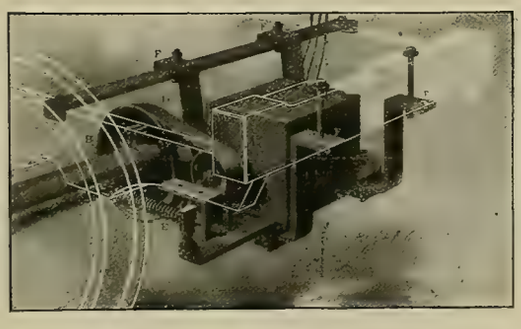

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AND
ELECTRIC FANS
WITHOUT
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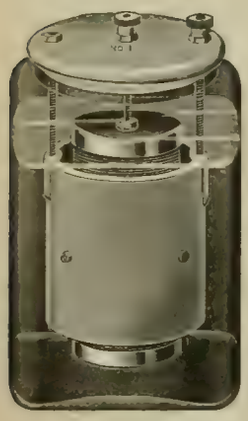

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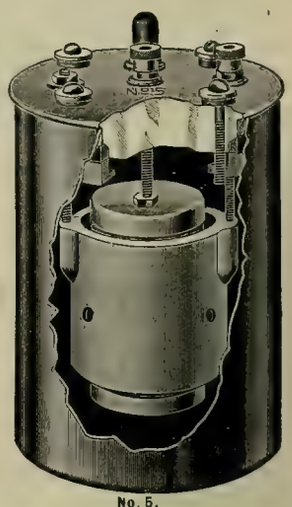

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Manufactured in ten different styles.

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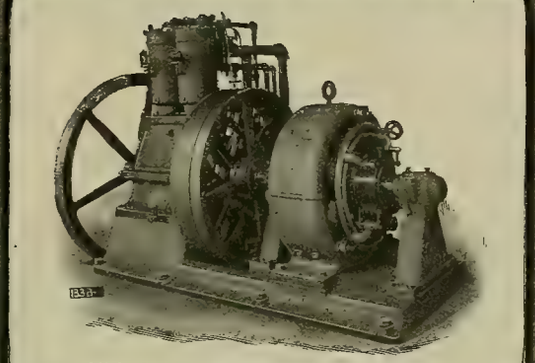

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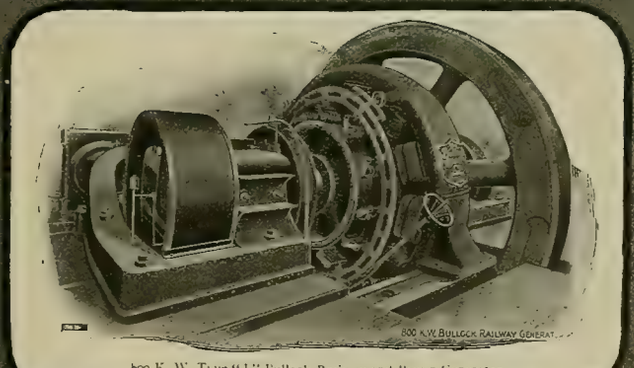

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What could be more simple in construction than the

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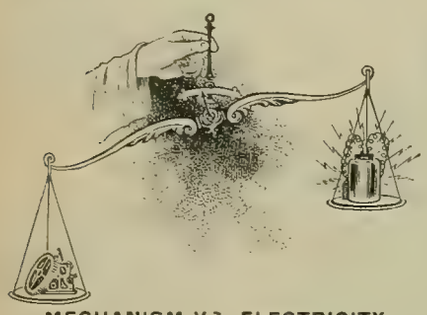

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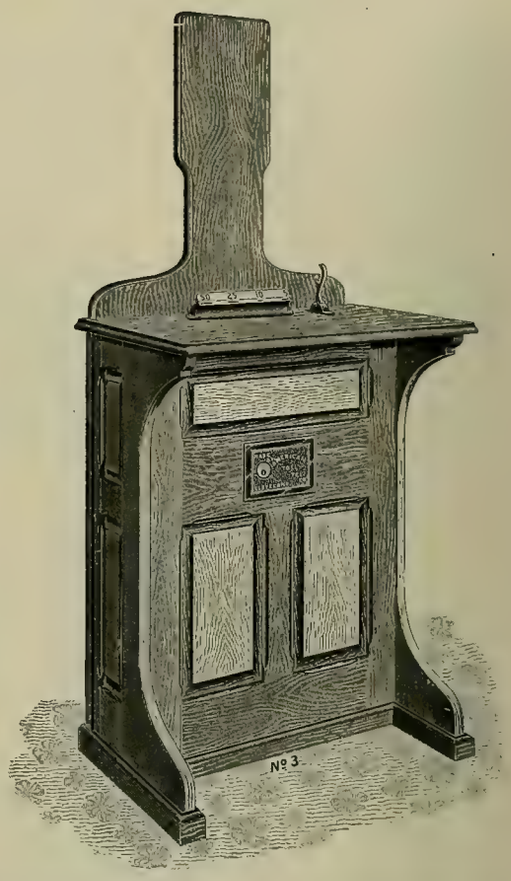

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These machines are entirely mechanical, as we eliminate electricity from all machines of our manufacture.

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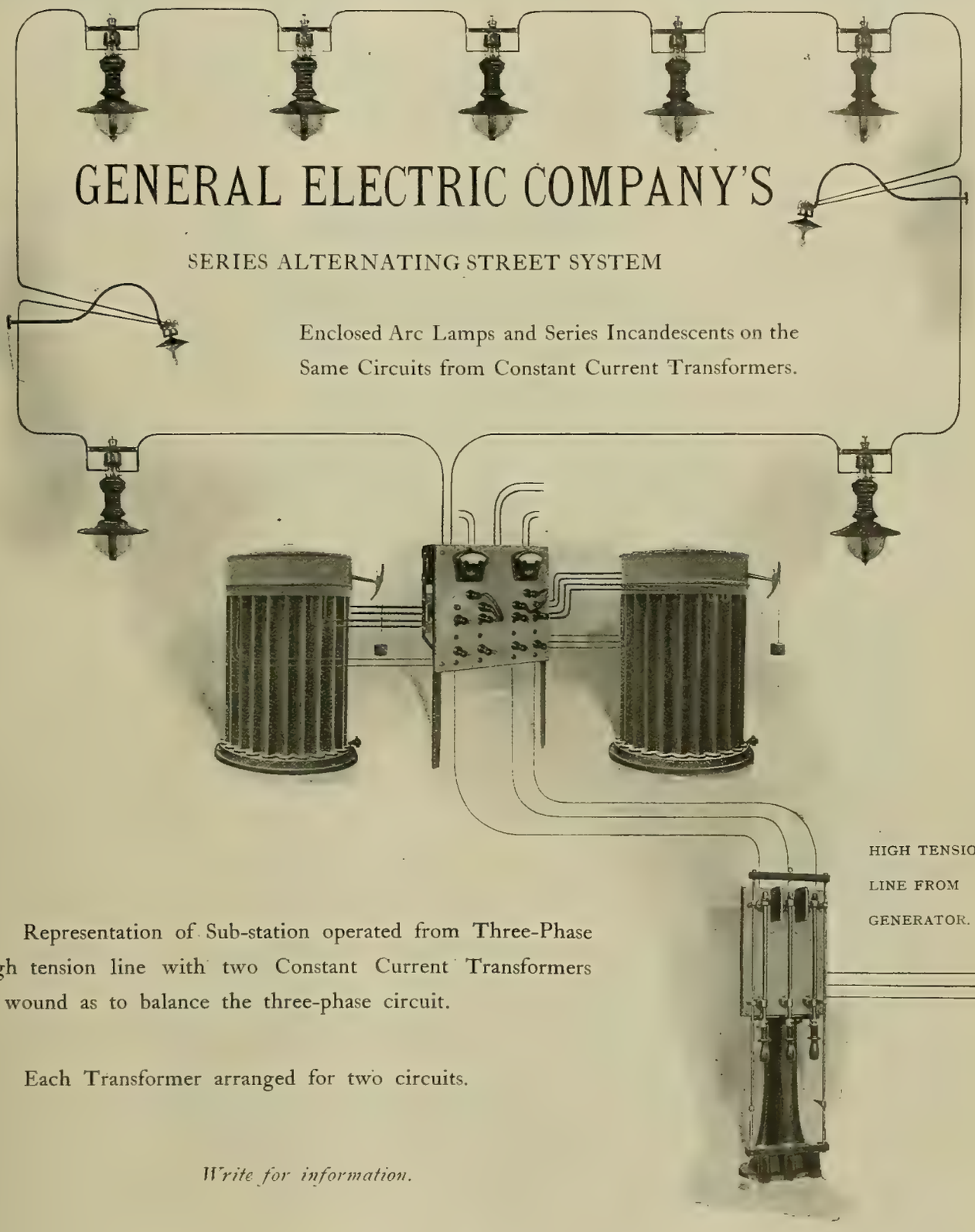

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AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.
ST. LOUIS OFFICE, Security Building, St. Louis, Mo.
STANDARD ELECTRIC COMPANY, Cincinnati, Ohio. CALIFORNIA ELECTRICAL WORKS, San Francisco, California.

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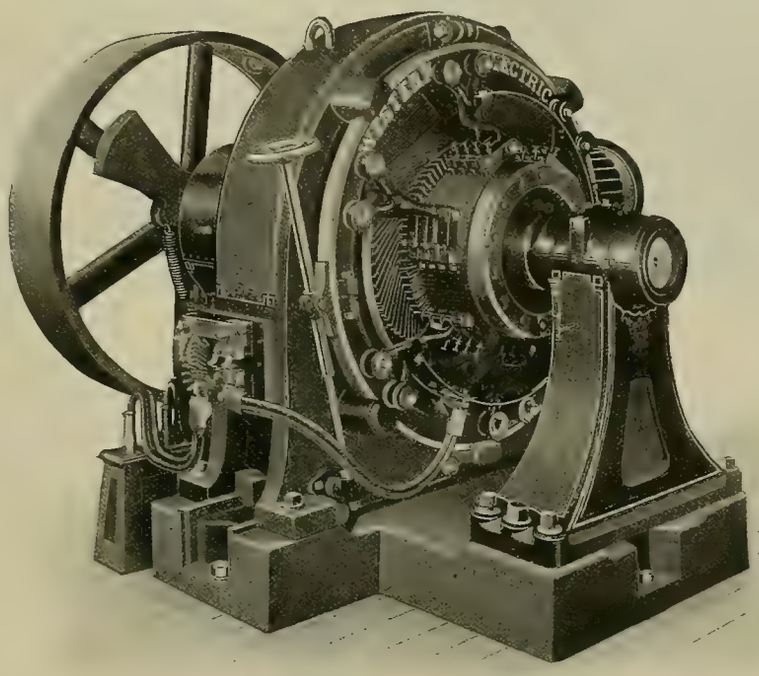
WESTERN ELECTRIC COMPANY'S GENERATORS.

DIRECT CONNECTED.



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MOTORS

FROM 1-12 H. P. TO 600 H. P.

DIRECT CONNECTED.

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WRITE FOR OUR CATALOGUE.

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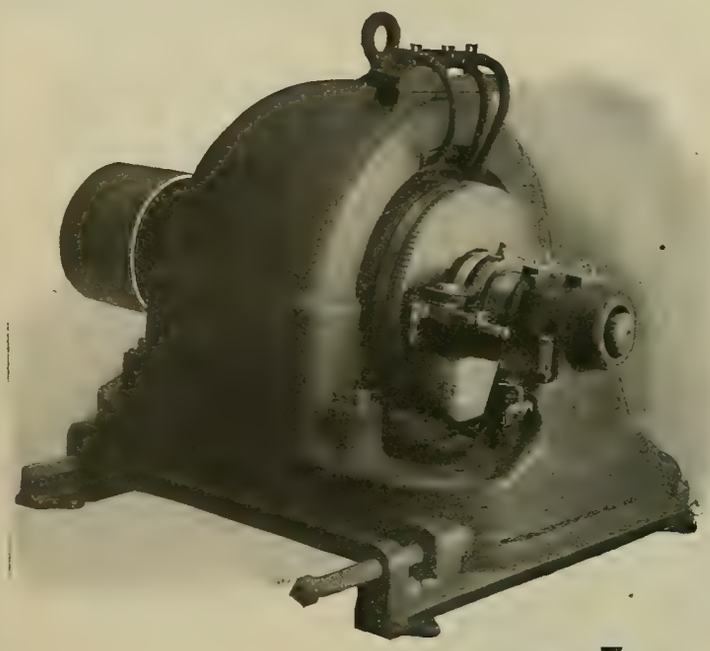
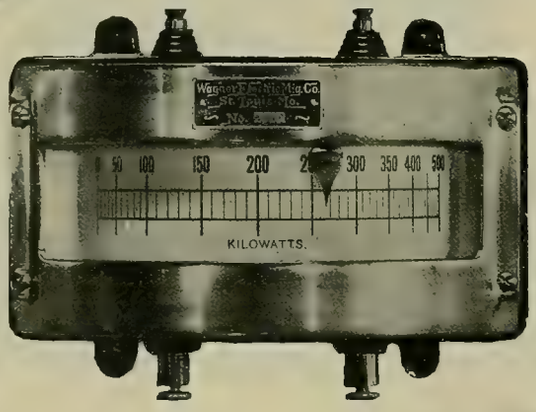


Wagner Electric Mfg. Co.'s

SINGLE PHASE SELF STARTING A. C. MOTORS.

Built for any frequency and 104, 208 or 500 volts. Simply close a main switch and the motor takes care of itself.

Our indicating Wattmeters, Voltmeters and Ammeters are also built for back of the board with illuminated dial.

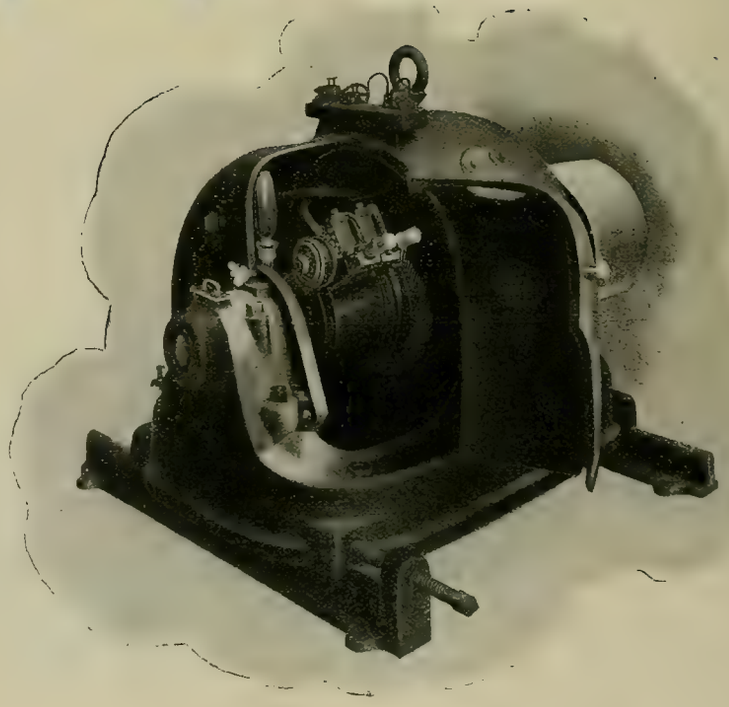


Their dead-beatness does not in the least affect their sensibility and accuracy.

WE ARE NOW READY

To supply either direct or alternating current motors, enclosed, either completely or with wire screen over the ventilator.

Send for Bulletin Z40.



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SAN FRANCISCO, 593 Mission Street.
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UNITED STATES COMMISSION
TO THE
PARIS EXPOSITION OF 1900

PARIS 20 AVENUE RAPP | CHICAGO AUDITORIUM BUILDING | NEW-YORK EQUITABLE BUILDING

PARIS OFFICES. November 9 1900.

Ball Engine Company,

Mr. D. N. McBrier, Vice President,

Erie, Pennsylvania.

Dear Sir:

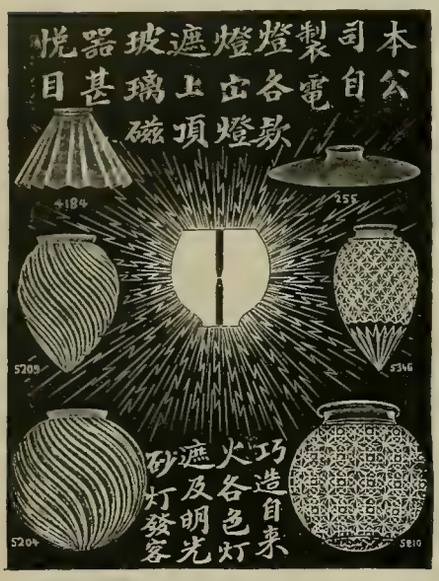
The end of the exposition having arrived I feel it my duty and privilege to inform you, officially, concerning the operation of the 300 h.p. tandem compound engine, which you supplied this department for the operation of the power generator at the United States Machinery Building at Vincennes. Our plant was the first of the entire exposition to be put in active service and since the starting of your engine we have never had a moment's shut down or the least difficulty which could, in any way, be traceable to your engine. It has operated noiselessly and continuously and has made many friends among the foreigners who have visited the plant . I must congratulate you upon the workmanship and execution, in all directions, of the engine, as was evidenced by the fact that we procured for you at the hands of the International Jury of Award a Gold Medal which is an exceedingly high honor for an engine of this size and class.

I must again thank you for your many courtesies, and the promptness with which you dispatched the engine.

Yours very truly,

F. E. Drake

Director of Machinery & Electricity



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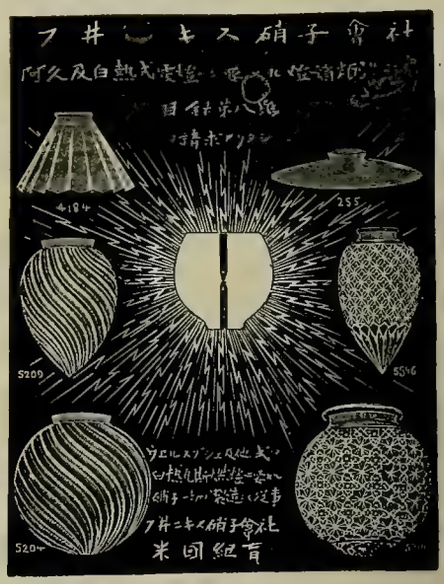

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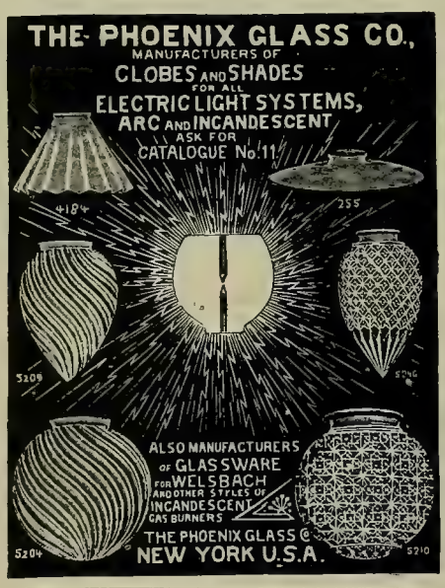

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IT OUGHT TO PARALYZE A BUSINESS MANAGER

of an electric station who sits by and sees his profits vanishing into thin air. He ought to know that

Eighty-five per cent of his fuel is going to waste,

and if he would adopt the HOLLY SYSTEM which utilizes his exhaust steam for heating he could

PAY HIS ENTIRE FUEL BILL

for the year from the proceeds from steam sold for heating business blocks, churches, etc. It is now being done extensively.

OUR PAMPHLET EXPLAINS OUR PLAN. SEND FOR IT.

American District Steam Co.,

LOCKPORT, N. Y.

Our Trade Follows the Flag.

We are prepared to supply the trade at manufacturers' prices and solicit your inquiries for

FALCON INCANDESCENT ARC LAMPS which illustrate Twentieth Century progress in interior illumination.

FALCON FAN AND POWER MOTORS are in our opinion good Motors and we've had much experience selling Fan Motors.

EDISON-LALANDE BATTERIES,
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Central Electric Company,

264-266-268-270 Fifth Ave., Chicago.

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BUILDERS OF

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Electric and Steam Railways, Electrical Construction AND Power Transmission Plants.

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Some of Our 1900 Contracts.

Alley L, Chicago, installation 48,000 ft. 1,500,000 c. m. feeder wire and removal 29,000 ft. old feeder wire.
Chicago & Alton R. R., complete equipment power plant Bloomington shops.
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Illinois Eastern Hospital, Kankakee, Ill, remodeling steam heating and power plant.
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Chicago Tribune and *Chicago Daily News*, complete equipment of press-rooms with our patented mechanical and electrical devices.
McCormick Harvesting Machine Works, Chicago, wiring foundry No. 2 and installing trolley line.
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Link-Belt Machinery Co., wiring shops for power and light.
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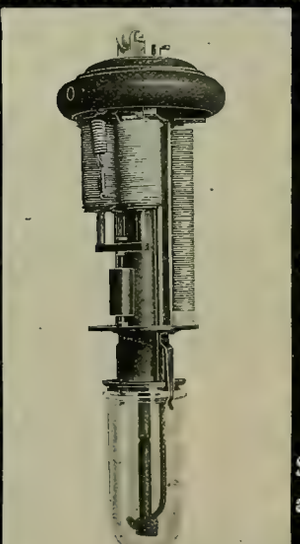
L-H Enclosed Arc Lamps.

FOR ALL CIRCUITS.

GUARANTEED TO MEET REQUIREMENTS OF ALL PRACTICAL ENGINEERS.

Designed on scientific principles and constructed of the highest grade materials.

Accessibility to working parts, which are few and absolutely interchangeable.



Positive cable contact.

Resistance cannot be short-circuited.

10-in. globe, using full length carbons.

Solid copper or aluminum case.

WE WANT ACTIVE AND RESPONSIBLE AGENTS IN ALL THE PRINCIPAL CITIES.

Catalogue and Terms on Request.

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FOR

CENTRAL STATIONS, STREET RAILWAYS AND ISOLATED PLANTS.

No Cast Plates. No Perforations. No Applied Paste. No Infringement.

HIGH EFFICIENCY. GREAT CAPACITY.

Superior Electrical Chemical Formation.

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PARTRICK, CARTER & WILKINS,

Manufacturers of Electrical House Goods, PHILADELPHIA.

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PLATINUM SHEET AND WIRE FOR SALE. HIGHEST PRICES PAID FOR OLD INCANDESCENT LAMP BASES. SEND US SEVERAL AVERAGE SAMPLES OF BASES YOU HAVE ON HAND; OUR OFFER WILL REACH YOU BY RETURN MAIL.

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ONE OF OUR SPECIALTIES—
HERE IT IS—EVERY OTHER WEEK—
AND ITS LITTLE STORY—ALL THE FINE POINTS—
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PHILA. PA.

IT'S STORY—
The most popular type of Switchboard Instrument on the market Size, appearance, system, accuracy, durability and price are right. All ra' ges, either series or shunt Ammeters. Particularly adapted to isolated plants and feeder panels.

We wish you all

A HAPPY NEW YEAR

and a prosperous entry into

THE NEW CENTURY.

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Chicago. Boston. St. Louis. Baltimore.

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DESIGNERS
MANUFACTURERS
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Steel Bridges
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The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

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ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

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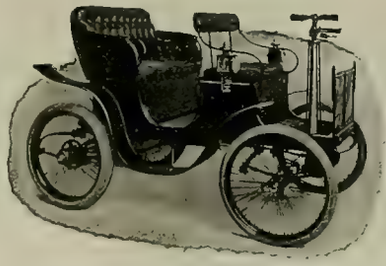
De Dion-Bouton "Motorette" Co.

ONE OF OUR LATEST MODELS IS THE



DE DION SURREY

We are the Sole Agents and Licensed Manufacturers in the United States for DE DION-BOUTON & CO., Puteaux, France. We build COUPES, HANSOMS, SURREYS, MOTORETTES, QUADRICYCLES and TRICYCLES.

A full line of the world-renowned De Dion Gasoline Motors is always in stock, and may be had from 1 3-4 H.P. to 5 H. P.

We carry a stock of supplies.

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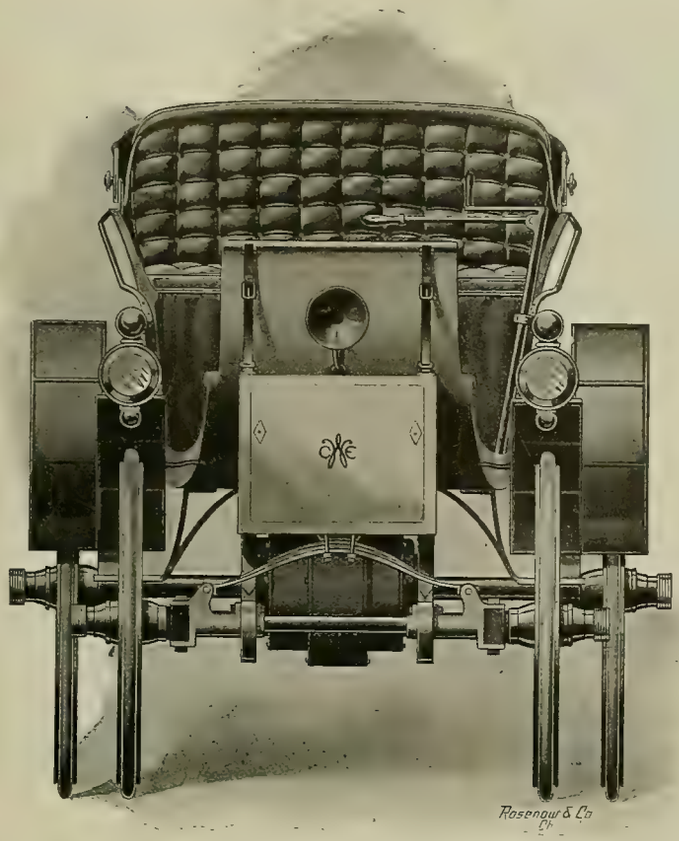
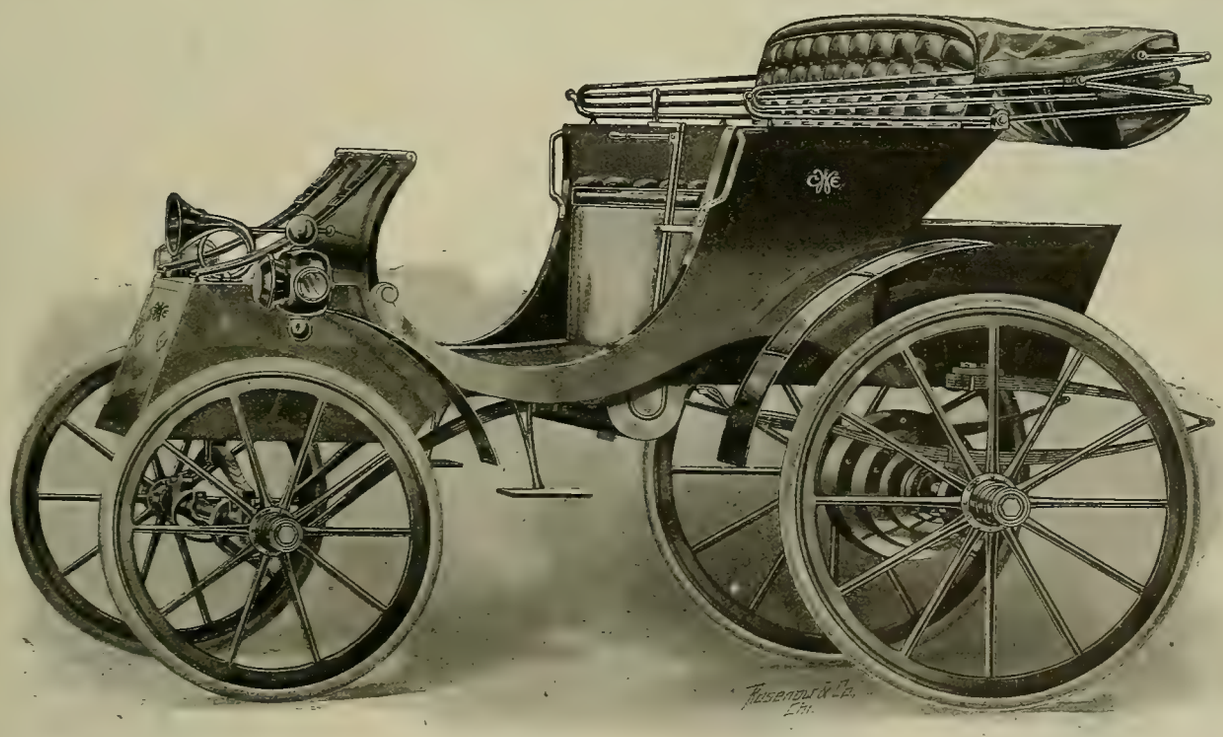
WE all believe that ELECTRICITY is the great power that DRIVES the wheels of PROGRESS—perhaps the wheels of Time; but we all know that Electricity drives the wheels of an Automobile more successfully than any other power that can be applied to them; but it did not feel at home in a "horseless carriage." It wanted the REAL THING—an AUTOMOBILE—in which to exhibit its best prowess, and

HERE IT IS

With every improvement in electrical, mechanical and carriage construction that science, long experience and absolute necessity have suggested, and the electricians of the world need no longer hesitate to own the foster child of their profession. Its entire conception and construction, mechanically and electrically, is as much of a departure from methods heretofore adopted as is its general design, and its operation is as pleasing to the purchaser as is the completeness of its appearance to the eye. All moving parts thoroughly protected in dust and waterproof casings. One electric and two friction brakes on every vehicle, giving as much comfort in hill coasting as in riding



CLINTON E. WOODS AUTOMOBILES.



on level roads. Forty miles on one charge of the batteries and an *absolute guarantee* of the vehicle in every particular. PRICES REDUCED. A GOOD THING for electric light and power companies to interest themselves in the sale of. THINK IT OVER. Responsible agents wanted everywhere. Address all communications to

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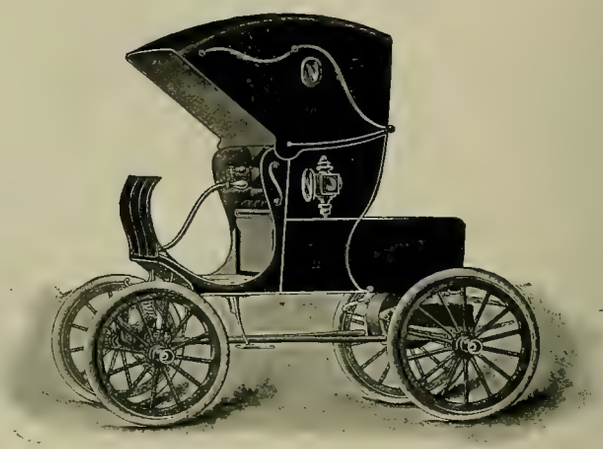
OLDSMOBILE BROUGHAM. All four passengers face forward.

Electric and Gasoline Automobiles

For Business and Pleasure.



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40 Miles on One Charge of the Batteries.

Send for Complete Descriptive Catalogue.

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We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Mechanical Drawing, etc., at your home, by mail. Institute indorsed by Thos. A. Edison.

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An excellent opportunity for private instruction in Mathematics, Mechanical Drawing or the sciences, under the direction of competent instructors.

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On an order of one dozen shades received before January 15th, we will prepay the freight to destination.

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The most modern system in the world for Electric and Telephone.

We also Make the Following Supplies:

Steel Conduit Dowel Pins, 50c. to 75c. per 100.
Stringing Reels, $5.00 to $10.00 each.
Cross Arm Braces, $1.85 per 100 lbs.
Pole Steps, Plain Nail Point, 1¾c. each.

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MINNEAPOLIS, MINN.

THE NEW YEAR

Is ever the time for New and Better Resolves.

Resolve

To start the new year right by installing a

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In home or office. The cost is

16c Per Day and up.

Ask about the Measured Service.

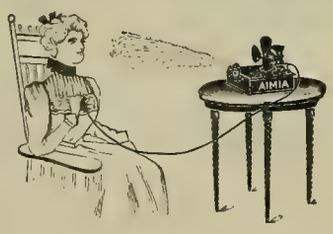
CHICAGO TELEPHONE CO.,

Contract Department, - - - - 203 Washington Street.

MY GOODS ARE WELL RECOMMENDED

BY EVERY PURCHASER,

THEREFORE YOUR TRADE WILL BENEFIT ALSO.



"AIMIA" VITALIZED AIR CIRCULATOR.

The "Aimia" Vitalized Air Circulator is an ideal one for the sick room, in winter or summer. It can be placed on a table and the invalid can start or stop the fan by pressing the button. It is noiseless and its refreshing coolness is of the greatet value.

A BLESSING for the bed room, serving room, office, store, telephone closet, dining table, etc. It may be used to deodorize toilet rooms by placing any desired deodorizer in front of the fan. The Dry Batteries (contained in the hardwood box) will run the fan many months without renewal, with the intermittent use it receives.

The battery can be renewed at a cost of only 50 cents.

Price, including a Bottle of Smelling Salts, Complete, $3.50.

"ODDO" MOTORS.

These Motors are the most perfectly constructed, carefully designed and best finished electric motors at the price, which are now in the market.

Construction allows all the magnetism generated to be turned into POWER, and this, in conjunction with the length of the arms of the armature (the magnetism going to extreme ends) brings into play the greatest of all applications of power, LEVERAGE.

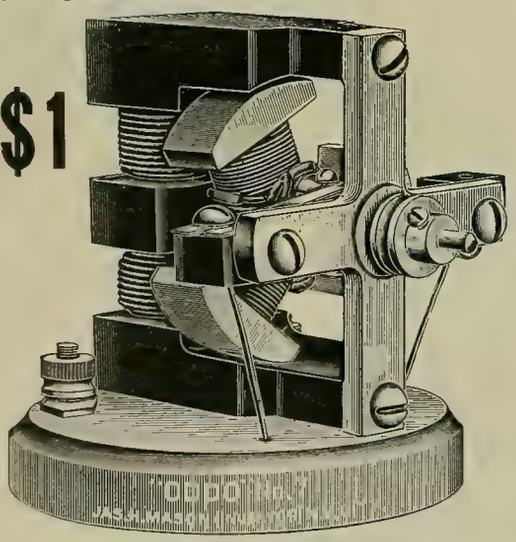
Being designed so that nothing is wasted, the combination of MECHANICAL AND ELECTRICAL LEVERAGE enables Mason's "Oddo" Motors to surpass any motors of equal size and weight, in power and neatness, beauty and efficiency.

They are finished in gold and black.

They can be operated by any good battery.

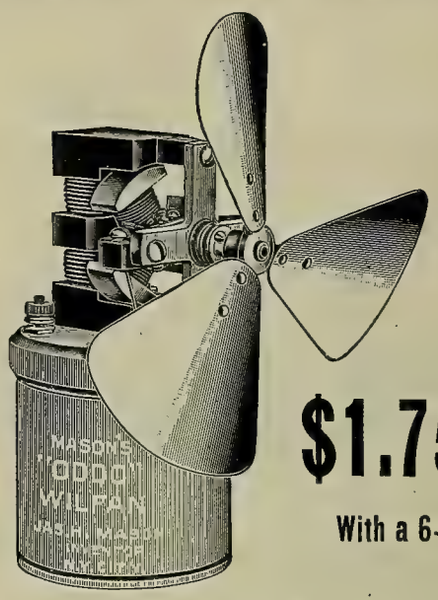
They are great savers of current.

$1



CUT IS FULL SIZE OF MOTOR.

This Motor has great power, is well made and nicely finished. A motor to operate sewing machines, $5.



$1.75

With a 6-inch Fan.

The stand is hollow and the space is intended to contain sand, bird gravel or any weighty substance. TO REDUCE COST OF MAILING CHARGES, the receptacle is always shipped empty, as purchaser can readily obtain the necessary weight.

This Outfit will run well for 25 hours with electric current from one cell of battery, such as I supply for $1 each.

Two cells will revolve fan over 2,000 times a minute.

A Dry battery of one or two CELLS will LAST for MONTHS when fan is only occasionally used for a minute or two.

A bottle of perfume or smelling salts placed in front of the revolving fan will refresh the air in parlors, bedrooms, etc., and sick-rooms can be deodorized and disinfected by substituting any good disinfectant, etc. (See vitalized air circulator.)

OUTFIT W. F.

CONSISTS OF

1 "WILFAN"	$1.75
1 Battery Type M	1.00
1 Double flexible conductor 7 feet long, which connects motor to battery	.50
5 Charges "Redalite"	.25
4 Extra Zincs, at 7 cents	.28
Boxing	.15
Total	$3.93

Each charge of "Redalite" will operate fan at fast speed for over 20 hours. Each zinc will last not less than 20 hours' work, so that COST OF A BREEZE with outfit W. F. is as follows:

Charge "Redalite"	5 cents
Zincs consumed	7 cents
Sulphuric acid less than	2 cents
Cost of over 20 hours' work (should get 30 hours)	14 cents.

Write for Trade Discounts, or I will Send Goods at the Right Prices, If Left to Me.

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JAS. H. MASON, INVENTOR,

Dept. 19. **150 Nassau Street, NEW YORK CITY, U. S. A.**

MANHATTAN ENCLOSED ARC LAMPS

FOR ALL CIRCUITS.

Alternating, Direct, High Tension, Low Tension.

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MARKS ENCLOSED ARC LAMP

PATENTS.

These patents broadly cover all forms of Enclosed Arc Lamps and users will take notice that with MANHATTAN Lamps they purchase thorough patent protection. Beware of lamps made by unlicensed companies.

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ORIGINAL DESIGNS FOR ADVERTISING PURPOSES ILLUSTRATIONS PERFECT PLATES BY ALL PROCESSES.

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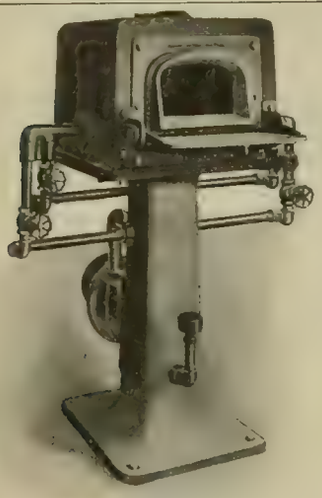
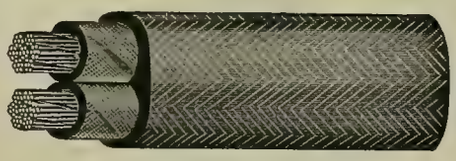


MAGNETS ARE GOOD

If they are properly heated, but did you ever think of the thousands of magnets that are ruined every day by being tempered in an open fire? The proper method of heating magnets is with a Stewart Gas Blast Furnace. You take no chances with it of getting the required temperature. You cannot go wrong. Every piece can be thoroughly heated. If you want to build up a big business on magnets by making them good and making lots of them, you must have a Stewart Gas Blast Furnace. There are several styles. You can be suited. Your magnets and tools of all kinds will cost you less to heat, and they will be heated right. No more guesswork. No use to put the blame on the steel man; the fault is in the heating. Increase your capacity. More pieces can be heated in one day with one of our furnaces and heated right than can be heated by the old method in three days. The furnace illustrated here costs but $85.00. We have others. Catalogue for the asking. We send furnaces on thirty days' trial. Shall we send you one?

THE CHICAGO FLEXIBLE SHAFT CO., 158-160 HURON ST., CHICAGO, ILL.

INSULATED RUBBER WIRES AND CABLES.



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WORKS AT TRENTON, N. J.

Stewart Patent Cord ADJUSTER.

(Patented August 21, 1900.)

Cuts illustrate two methods of adjustment.

A device everyone wants.
Can be used on any size of cord.
Can be adjusted easily.
Can be used after rosette and socket are connected.
Made of fiber.
Sold as cheap as common wood adjusters.
Order from your supply house or us.
Same price everywhere.

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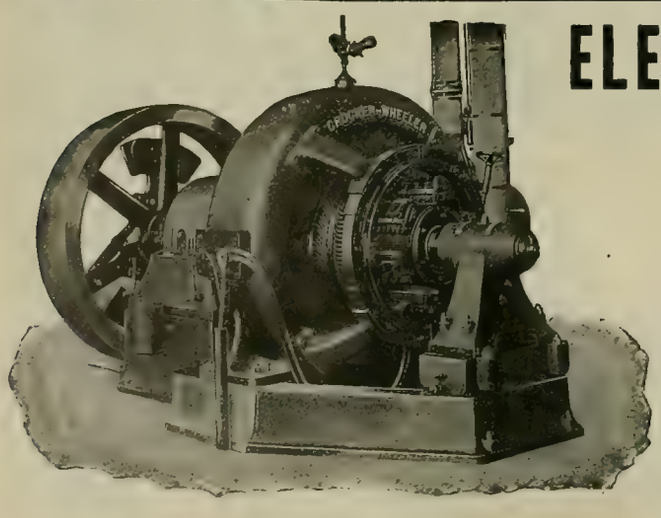

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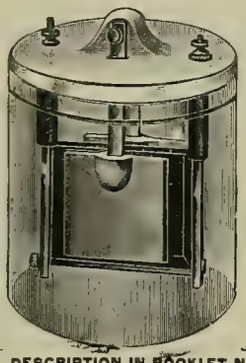

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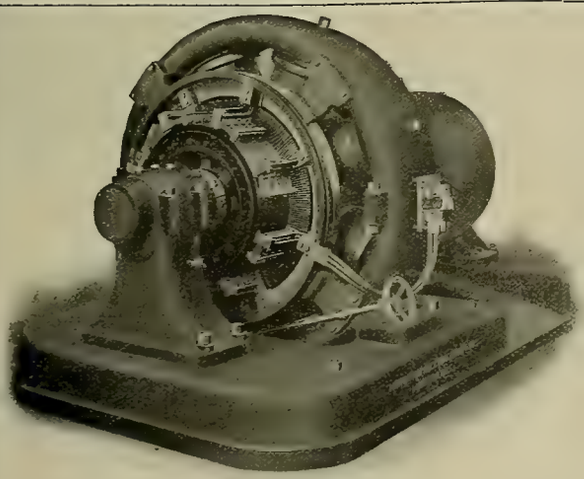

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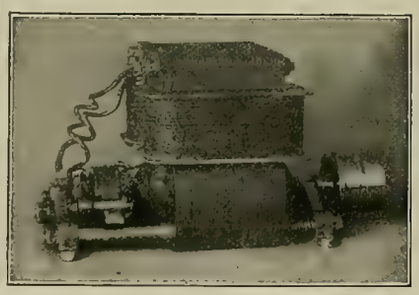

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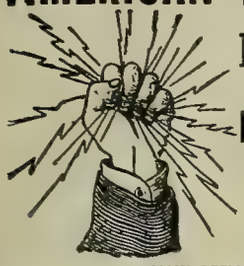

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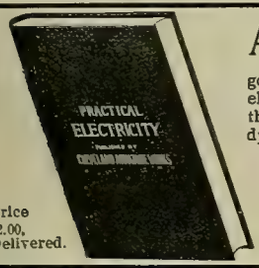

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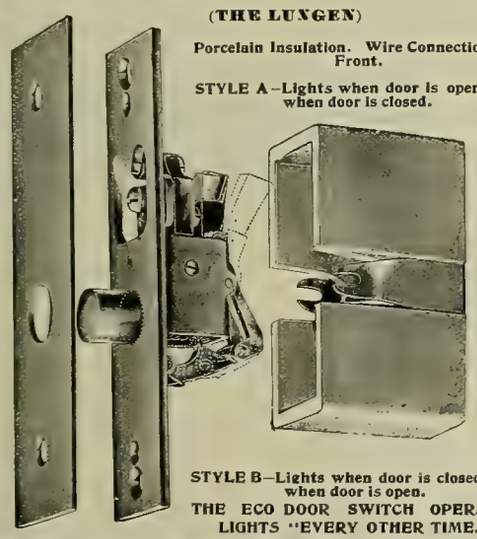

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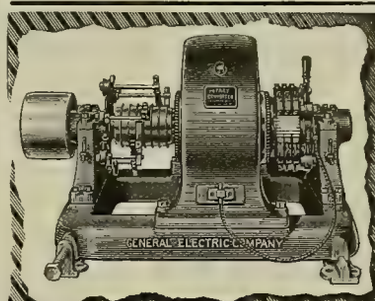

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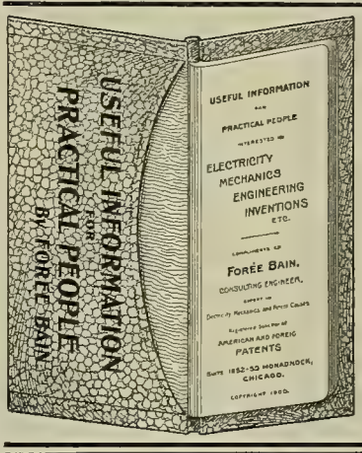

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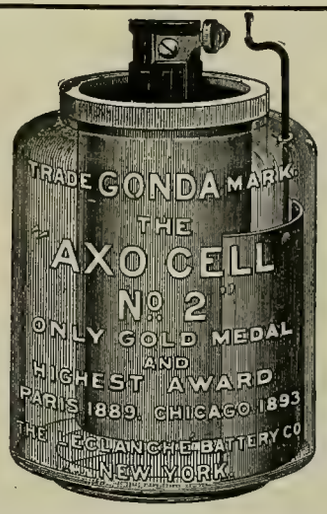

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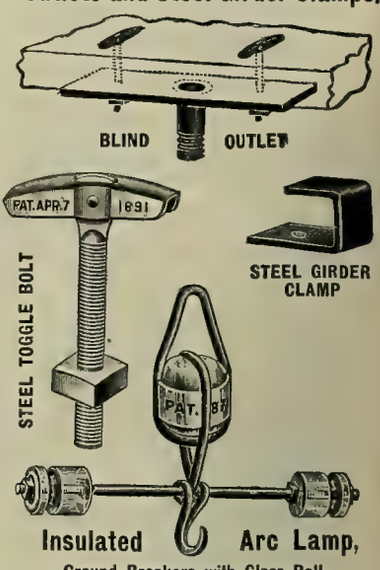

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3	150-light Gibbs, M. P., compound, self-oilers, speed 1650.
1	150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1	160-light Card, self-oiler.
2	180-light Siemens & Halske, M. P., self-oilers, brand new.
1	200-light Western Electric, self-oiler, comp.
2	210-light Edison, self-oilers, 12 K. W.
4	210-light Siemens & Halske, 12 K. W.
2	210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4	210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1	250-light Westinghouse.

110-Volt Incandescent Dynamos.—Continued.

1	250-light Commercial, comp., self-oiler.
1	250-light Eddy, self-oiler.
1	270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2	270-light Westinghouse, M. P., slow speed, 15 K. W.
1	300-light Columbian, multipolar, comp., self-oiler, slow speed.
4	300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1	340-light Eddy, self-oiler, compound.
2	350-light Hawkeye, compound.
1	350-light National, self-oiler, compound.
1	350-light Edison, 20 K. W., self-oiler.
6	350-light Siemens & Halske, type L. H., self-oilers.
1	360-light Duplex, multipolar, self-oiler, compound, slow speed.
3	500-light Siemens & Halske, type L. H., self-oilers, brand new.
4	540-light Edison, 30 K. W., self-oilers, compound.
1	600-light Eickmeyer.
2	700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
2	800-light Edison, 45 K. W., self-oilers.
1	1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1	1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
3	1500-light Siemens & Halske, type L. H., self-oilers, 100 K. W.
1	1500-light Siemens & Halske, 100 K. W., type I., 6 pole, for direct connection, brand new.

220-Volt Generators.

Rheostat, base-frame and pulley accompany each machine.

1	8½ K. W. Westinghouse, multipolar, self-oiler.
1	9 K. W. Lundell, self-oiler.
1	10 K. W. Lundell, self-oiler, multipolar, slow speed.
1	12 K. W. Edison, self-oiler.
1	15 K. W. Edison, compound, self-oiler.
1	30 K. W. Siemens & Halske, M. P., ironclad type, self-oiler, brand new.
1	45 K. W. Edison, compound, self-oiler, new armature.
1	50 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection. 1 marble panel switchboard for above.
1	100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2	15 K. W. Edison, self-oilers.
1	15 K. W. T.-H., self-oiler.
1	35 K. W. Mather, self-oiler.
2	35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1	45 K. W. Edison, compound, self-oiler.
1	75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

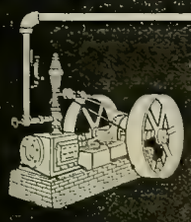
Alternating Generators.

1	350-light Thomson-Houston, A. 18.
1	600-light Thomson-Houston, A. 6.
1	600-light Thomson-Houston, 30 K. W., two-phase.
1	600-light Thomson-Houston, 30 K. W., slotted armature.
2	600-light General Electric, A. 30, toothed armature.
2	650-light Thomson-Houston, A. 35.
2	750-light Westinghouse, 37½ K. W.
1	900-light Warren, 45 K. W., 1100 volts.
1	1000-light Wood, 50 K. W., self-oiler.
1	1000-light Siemens & Halske, 50 K. W., self-oiler, 60 cycle.
1	1200-light National, with exciter.
1	1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1	50 K. W. Siemens & Halske, Churchward type, brand new, 60 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1	1200-light Westinghouse, 60 K. W.
1	1200-light Thomson-Houston, 60 K. W.
1	1200-light Warren, 60 K. W., self-oiler.
1	1200-light General Electric, A. 60.
2	1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1	1500-light Wood, 75 K. W., self-oiler.
1	1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1	1800-light National, 90 K. W.
1	4000-light Wood, 200 K. W., self-oiler.

Arc Dynamos.

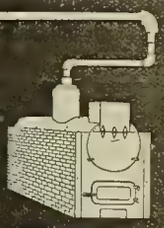
1	20-light 2000 C. P. Western Electric.
1	30-light 1200 C. P. T.-H., K. 12.
1	30-light 2000 C. P. Brush, No. 7.
2	35-light 2000 C. P. T.-H., L. D. 2.
1	35-light 1200 C. P. Wood No. 6.
3	40-light 2000 C. P. Western Electric, self-oilers.
2	45-light 1200 C. P. T.-H., M. 12, ball arm.
2	45-light 1200 C. P. Brush, No. 7.
1	50-light 1200 C. P. T.-H., L. D. 12.
1	50-light 2000 C. P. T.-H., M. D. 2.
2	60-light 2000 C. P. Western Electric, self-oilers.
1	60-light 2000 C. P. Westinghouse.
3	60-light 2000 C. P. Wood, No. 8.
1	65-light 800 C. P. Ball, 4 amp.
1	65-light 2000 C. P. Brush, No. 8.
2	75-light 1200 C. P. Wood, with new arm'e.
2	75-light 1200 C. P. Standard, self-oilers.
2	75-light 2000 C. P. Westing'se, self-oilers.
3	125-light 1200 C. P. Excelsior, latest type.

SEND FOR OUR MONTHLY BARGAIN SHEET WITH NET CASH PRICES ON DYNAMOS, MOTORS, TRANSFORMERS, METERS, STATION INSTRUMENTS, ARC LAMPS and SUPPLIES.



REBUILT MOTIVE POWER

THE LARGEST DEALERS ON EARTH



WE ARE HEADQUARTERS FOR REBUILT MOTIVE POWER. OUR MACHINERY IS ABSOLUTELY WARRANTED IN EVERY WAY. WE COVER ALL SALES BY A BINDING GUARANTEE. OUR STOCK IS THE MOST EXTENSIVE IN THE LAND.

WE OFFER THE FOLLOWING, SUBJECT TO PRIOR SALE:

ELECTRICAL MACHINERY.

No. S145—Two T.-H. 500-light, 110-volt, direct connected.
No. S146—One 50-light Edison dynamo.
No. S147—One 25-light C. & C. dynamo.
No. S148—One 250-light Edison dynamo.
No. S149—One 100-light Rockford dynamo.
No. S150—Two 500-light T.-H. dynamos.
No. S151—One 150-light Eddy dynamo.
No. S152—One 100-light, 110-volt, Weston dynamo.
No. S153—One 250-light Hawkeye dynamo.
No. S154—One No. 8 T.-H., 75 K. W., 500-volt.
No. S155—Two type U. S. Westinghouse bipolar, 80 K. W., 350 revolutions, 550-volt.

ALTERNATORS.

No. S156—One 50 K. W., 1,000-volt, Westinghouse, complete with switchboard, exciter, one extra brand new armature for exciter, two field coils.
No. S157—One 500-light National, exciter on shaft.
No. S158—One 500-light T.-H. alternator, 1,000-volt.
No. S159—One 600-light T.-H., 2,040-volt.
No. S160—Two 25 K. W. Westinghouse alternators, 1,150-volt, 16,000 alternations, switchboard and instruments.

ARC DYNAMOS.

No. S161—25-light, 2,000 c. p. low tension, one extra armature for same
No. S162—Three 50-light, 2,000 c. p., T.-H.
No. S163—One No. 8, 60-light, arc, 2,000 c. p., Wood.
No. S164—One 80-light Western Electric dynamo.
No. S165—20-light, 2,000 c. p. Sperry, switchboard and instruments.

MOTORS.

No. S166—One 20 H. P., 500-volt, Ft. Wayne.
No. S167—One 3 H. P., 500-volt, T.-H.

ELECTRICAL SUPPLIES.

In connection with our purchase of the Omaha Exposition and the dismantling of buildings, we secure large quantities of Electrical apparatus and supplies. It is good material, and we ship nothing that is not practical for further use.

WIRE OF ALL KINDS.

Following is our list of good copper wire on hand:

RUBBER COVERED.

Gauge No.	Quantity feet.	Price per 1000 ft.
6	10,000	$ 27.00
4	10,000	37.00
000	8,000	125.00
0000	6,000	150.00

WEATHER-PROOF COPPER WIRE.

Gauge No.	Quantity feet.	Price per pound.
6	3,000	16c
1	2,000	15½c

COMBINATION RECEPTACLES.

1,500 Combination Receptacles, consisting of fuse rosette and socket, to be used the same as in ordinary fuse rosette, only has the sockets for inserting lamps.
Each $0.10

INCANDESCENT LAMPS.

The following lamps are warranted in good condition:

		Each.
6,000	16-candlepower Edison	10c
7,000	8-candlepower Edison	9c
1,000	4-candlepower Miniature	9c

KEYLESS SOCKETS.

A large quantity of Edison Porcelain Weatherproof Keyless Sockets. Second-hand, in good condition.
Price, each $0.08

PORCELAIN KNOBS.

Second-hand, but as good as new.
Prices, per thousand, No. 2..... $6.50
Prices, per thousand, No. 4..... 5.00
Prices, per thousand, No. 5..... 4.00
Prices, per thousand, No. 6..... 4.00
Also arc globes, incandescent lamp clusters, transformers, pony relays, rheostats, cut-outs, fuse boxes, carbons, switches, etc., etc.

ENGINES.

No. S81—One 3 H. P. Rochester Automatic.
No. S82—Seven 3 H. P.
No. S83—One 3 H. P. Marine.
No. S84—One 5 H. P.
No. S85—One 6 H. P.
No. S86—One 7 H. P.
No. S87—Three 8 H. P.
No. S88—One 8 H. P. Farquhar Portable.
No. S89—One 8 H. P. Davis & Rankin.
No. S90—One 10 H. P. Portable.
No. S91—One 10 H. P. Traction.
No. S92—One 10 H. P. Niles Horizontal.
No. S93—Four 10 H. P. Slide Valve.
No. S94—Four 10 H. P. Center Crank.
No. S95—One 10 H. P. Horizontal Davis & Rankin.
No. S96—One 10 H. P. Chartier.
No. S97—One 12 H. P. Slide Valve.
No. S98—One 12 H. P. Reversible.
No. S99—One 12 H. P. Traction.
No. S100—One 13 H. P. Center Crank.
No. S101—One 15 H. P. Compound.
No. S102—One 15 H. P. Slide Valve.
No. S103—One 16 H. P. Slide Valve.
No. S104—One 16 H. P. Stationary.
No. S105—One 20 H. P. Atlas.
No. S106—One 20 H. P. Portable.
No. S107—One 20 H. P. Slide Valve.
No. S108—One 20 H. P. Milburn.
No. S109—One 25 H. P. Westinghouse.
No. S110—One 25 H. P. Atlas.
No. S111—One 25 H. P. Slide Valve.
No. S112—One 25 H. P. Portable.
No. S113—One 30 H. P. Slide Valve.
No. S114—One 35 H. P. Automatic.
No. S115—One 40 H. P. Center Crank.
No. S116—One 40 H. P. E. P. Allis, Corliss.
No. S118—One 45 H. P. Rice Automatic.
No. S120—One 60 H. P. Westinghouse Standard Automatic No. 2026.
No. S121—One 68 H. P. Atlas.
No. S123—One 80 H. P. A. B. Farquhar Engine. Stroke, 34 in.; shaft, 6 in.; length, 6 ft.; D. W., 24 in., 7 diam.; bed style.
No. S124—One 80 H. P. Westinghouse Automatic.
No. S125—One 100 H. P. American Ball Automatic.

BOILERS.

No. S1—One 10x36 Horizontal Tubular, ½ front.
No. S2—Two 16x72 Horizontal Tubular.
No. S3—Three 21x44 Horizontal Tubular.
No. S4—One 24x48 Horizontal Tubular.
No. S5—One 26x44 Horizontal Tubular, 2 flue.
No. S6—Four 28x48 Horizontal Tubular.
No. S7—One 34x10 Horizontal Tubular.
No. S8—Three 36x10 Horizontal Tubular.
No. S9—Two 40x12 Horizontal Tubular.
No. S10—One 44x14 Horizontal Tubular, 30 3½-inch flues.
No. S11—One 44x14 Horizontal Tubular, 42 3-inch flues.
No. S12—Three 44x16 Horizontal Tubular.
No. S13—One 44x16 Horizontal Tubular, 28 4-inch flues.
No. S14—One 48x12 Horizontal Tubular.
No. S15—Two 48x14 Horizontal Tubular.
No. S16—One 48x14 Horizontal Tubular, Atlas D. R.
No. S17—Two 48x16 Horizontal Tubular, 40 3½-inch flues.
No. S18—Two 50x14 Horizontal Tubular, 40 3½-inch flues.
No. S19—One 54x14 Horizontal Tubular, 42 3½-inch flues.
No. S20—One 56x18 Horizontal Tubular.
No. S21—Two 60x14 Horizontal Tubular, O'Brien make.
No. S22—Two 60x14 Horizontal Tubular, 64 3½-inch flues.
No. S23—Two 60x16 Horizontal Tubular, 44 4-inch flues.
No. S24—One 60x16 Horizontal Tubular, 32 3-inch flues.
No. S25—Two 60x16 Horizontal Tubular, 63 2½-inch flues.
No. S26—Two 60x16 Horizontal Tubular, 56 3½-inch flues.
No. S27—One 66x14 Horizontal Tubular.

THE ABOVE IS ONLY A SMALL PART OF OUR LARGE STOCK OF REBUILT MACHINERY. OUR **CATALOGUE NUMBER 156** CONTAINS A COMPLETE LIST.

SEND FOR IT.

Chicago House Wrecking Co.

WEST 35TH AND IRON STS.

CHICAGO.

READY FOR NEW YEAR'S CALLS.

THE FOLLOWING IS PART OF OUR STOCK. **SEND FOR LATEST CATALOG.**

Direct-Current Dynamos. 110 Volts.

(Direct-Connected.)

2 100 K. W. Westinghouse, 8-pole, 225 R. P. M., direct-connected to McIntosh & Seymour compound engines.

Belted Dynamos. 110 Volts.

2 150 K. W. Edison bipolar.
4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 100 K. W. M. P., 4, Westinghouse.
1 45 K. W. M. P., 4 Westinghouse.
1 30 H. P. Westinghouse.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 45 K. W. General Electric, M. P., 850 R. P. M.

Arc Dynamos.

2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush.
10 50-light, 2000 C. P., T.-H., with ring armatures.

Alternators.

1 325 K. W. Siemens & Halske, 2000 volts, 7200 alternations, single-phase, 115 R. P. M.
1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 240 K. W. Stanley, two-phase, 380 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
2 A-120 General Electric, single-phase, 1000 volts, 16000 alternations.
2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.
3 60 K. W. General Electric, single-phase, 1050 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
1 75 K. W. Stanley, 2000-1000 volts, two-phase, 16000 alternations.
1 45 K. W. Westinghouse, 2200 volts, 16000 alternations.

Direct-Current Motors and Generators. 220 Volts.

(Direct-Connected.)

1 75 K. W. General Electric, direct-connected to Ideal engine.

(Belt-Driven.)

1 75 K. W. Siemens & Halske bipolar.
1 70 K. W. M. P. Siemens & Halske. New.
1 15 H. P. Excelsior bipolar.
1 10 H. P. Eddy bipolar.
1 5 H. P. Eddy bipolar.

Direct-Current. 500 Volts.

2 60 K. W. Edison.
1 50 H. P. M. P., General Electric.
1 30 K. W. C. & C. bipolar.
1 25 H. P. Eddy, M. P.
1 15 H. P. Eddy.
1 10 H. P. Eddy.
1 2 H. P. Cent. Elect. Co.

Railway Motors.

G. E. 800 S. R. G., 30.
G. E. 1000 W. P., 30.
G. E. 1200, W. P., 50.
Westinghouse 3.
Westinghouse 12A.
Westinghouse 38B.
K, K2 and K12 G. E. Controllers.
Westinghouse 38 and 49 Controllers, and a constantly changing stock of everything pertaining to street car equipment.

5 200 K. W. Railway Units, each consisting of a 200 K. W. Edison Generator belted to an 18½x18 Ideal Automatic Engine.

Railway Generators. 500 Volts.

1 500 K. W. M. P., 4, Gen. Electric.
2 111 K. W. M. P., 4, Westinghouse.
2 100 K. W. M. P., 4, Gen. Electric.
5 200 K. W. Edison bipolar.
2 150 K. W. Edison bipolar.
2 100 K. W. Edison bipolar
4 60 K. W. Edison bipolar.
1 100 K. W. Ft. Wayne.

Engines.

1 26 and 48x60 Cross Compound Geo. H. Corliss.
40x72 Corliss.
18x42 Allis.
16x25x15 Armington & Sims.
18½x18 Ideal.
16x16 Erie Ball.
14x13 Armington & Sims.
14x13 Watertown.
13x12 N. Y. Safety Power.
10x12 Watertown.

Boilers.

2 375 H. P. Sterling boilers.
2 175 H. P. Sterling Boilers.
2 200 H. P. National Water Tube.
2 42-inch by 16-foot Return Tubulars.
Boilers of various styles and sizes at low rates.

Street Cars.

Opened and closed, of all sizes, and for all gauges. Let us know your wants.

Rossiter, Mac Govern & Co.

Principal Offices, 141 BROADWAY, NEW YORK. **Factory, BROOKLYN, NEW YORK.**

625 "USED" OUTRIGGERS.

Complete with Windlass as shown in Cut.

Also 200 Miles No. 6 "Used" W. P. Copper Wire; 100 Miles No. 8 "Used" W. P. Copper Wire. 2,500 Arc Lamp Hoods, as shown in Cut.

This wire has all been thoroughly overhauled, the bad places in the insulation cut out and soldered and taped connections made where necessary. Write for prices if interested.

W. N. MATTHEWS & BRO., 320 N. 6th St., ST. LOUIS.

SECOND-HAND

ELECTRICAL MACHINERY.

One 500 L. 110-volt S. O. Dynamo	$ 245
One 150 L. 110-volt O. C. Dynamo	135
One 100 L. 110-volt Compound Dynamo	100
One 600 L. 1100-volt Alternator with Exciter, Volt and Ammeter	260

Other sizes of Motors and Dynamos quoted at lowest prices. Write us when in the market for Electrical Machinery. We buy, sell, exchange and repair.

Repairing and Rewinding.

LOW PRICES. HONEST WORK.

AARON ELECTRIC CO.,

180-82 South Clinton Street,

CHICAGO, ILL.

WE START THE NEW CENTURY

WITH

ELECTRICAL SPECIALTIES

OF MERIT ONLY.

Write us, or consult our salesmen that are everywhere, when in the market for high-class Electrical Equipment and Supplies of every description. Prompt attention given all inquiries.

Western Electrical Supply Co.,

OUR NEW MAMMOTH STORE,

Seventh and Clark Avenue, ST. LOUIS.

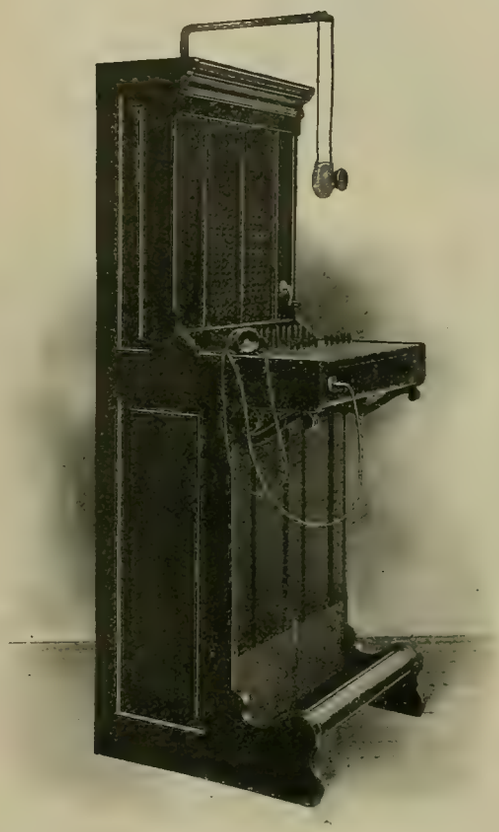
EVERYTHING ELECTRICAL.

KELLOGG SWITCH

MANUFAC

TELEPHONES, SWITCHBOARDS

FOR SMALL OR



Twenty Reasons Why the "KELLOGG EXPRESS" is the Best on the Market:

1. It has the simplest and most perfectly designed mechanically self-restoring drop ever produced.
2. It has an absolutely reliable night alarm.
3. The drops are of the well-known tubular type.
4. The drop and jack are rigidly connected together by a metallic mounting plate.
5. All parts are easy of access, and any single drop and jack can be removed without the use of a soldering iron.
6. The drop is entirely cut out of the talking circuit during conversation.

7. The drops and jacks are mounted five per strip, insuring rigidity.
8. The fronts of the drop and jack strips are of hard rubber, reinforced by heavy brass.
9. Clearing out drops are of the tubular type, high wound, and bridged across the cord circuit.
10. All drops and jacks are mounted in an iron frame.
11. The combined ringing and listening keys are the simplest ever manufactured, and have platinum pointed springs.
12. The plugs and cords stand wear.
13. The cabinet work is first class and of quarter-sawed oak.
14. The key shelf is hinged, and all panels are removable.
15. It is wired on the full metallic plan, and consequently is readily adaptable to common return or grounded circuits.
16. The operator's transmitter and receiver are adapted for long distance work.
17. All wiring is done with the best grade tinned copper wire, silk and cotton insulated, manufactured by ourselves.
18. All labor is done by skilled workmen, under the supervision of experts.
19. All material is the best obtainable.
20. All parts of the switchboard are absolutely guaranteed.

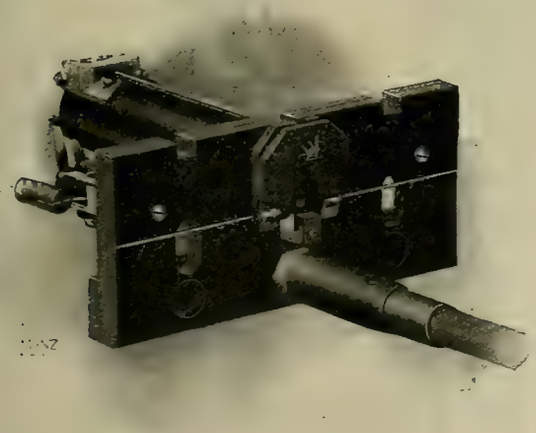
BOARD & SUPPLY CO.

TURERS OF

AND COMPLETE EQUIPMENTS

LARGE EXCHANGES.

A recent Kellogg Exchange at Pittsburg, Pa., is shown in this cut. It operates on the central battery system, with automatic calling and supervisory signals. Its present equipment is 4,080 lines with a capacity of 5,400 lines. With its six branch exchanges, the present equipment of the system is 7,040 lines, with an ultimate capacity of over 16,000 lines. Among other large exchanges recently installed by this company are those at St. Louis, Mo., 8,800 lines; Cleveland, O., 9,600 lines; Baltimore, Md., and branches, 7,000 lines; Columbus, O., 4,160 lines, and Indianapolis, Ind., 4,000 lines.

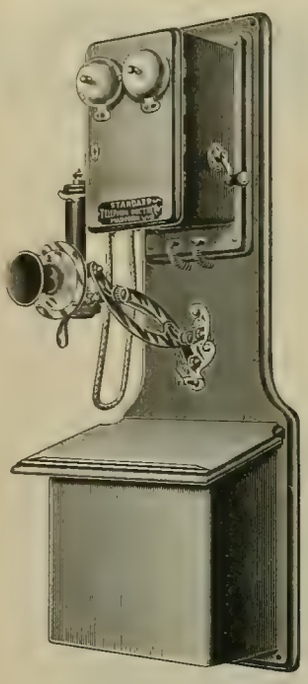


Front View of Single Self-Restoring Drop and Jack.

FACTORY AND OFFICES:

229 S. GREEN ST., CHICAGO.

This Portable Desk Set is higher priced than others, but its first cost is its only item of expense.

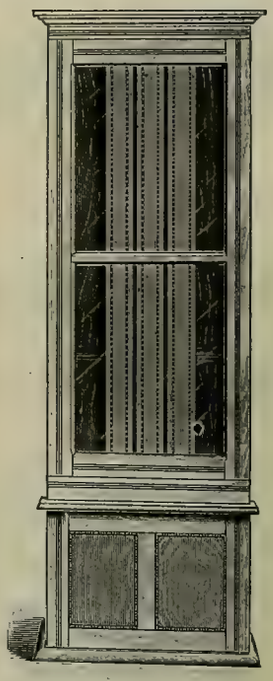


Instruments in all styles.

As in
everything else,
there is but

ONE STANDARD IN TELEPHONY

And that is the
apparatus manufactured
by the



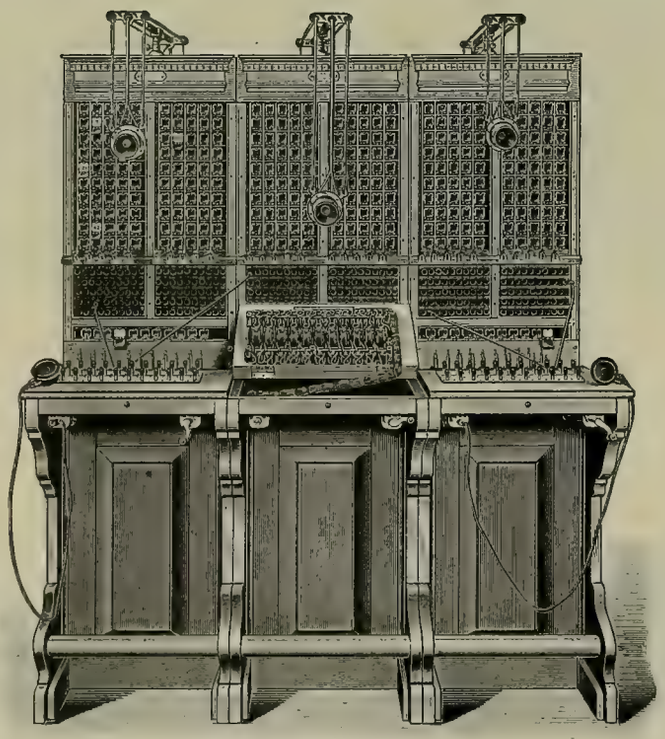
Distributing Board.
Any desired capacity.

STANDARD

TELEPHONE AND ELECTRIC COMPANY, MADISON, WIS., U. S. A.

Pioneers among manufacturers of Telephone Apparatus of all kinds and for all requirements of service.

SWITCHBOARDS,
TELEPHONES,
DISTRIBUTING
BOARDS,
PROTECTORS,
SOUND-PROOF
BOOTHS, ETC.



Eclipse Switchboard.

Our Exhibit at PARIS was awarded medal for

WORKMANSHIP,
MERIT AND
GENERAL
EFFICIENCY
IN OPERATION
AND
MAINTENANCE.

WRITE FOR PARTICULARS.

SOLE LICENSEES IN U. S. FOR THE MILDÉ TRANSMITTER.

THE BEST!

Having good qualities in the highest degree; most good; most advanced; most correct or complete; beyond all other.—WEBSTER.

THE ABOVE DEFINITION FITS

National Apparatus

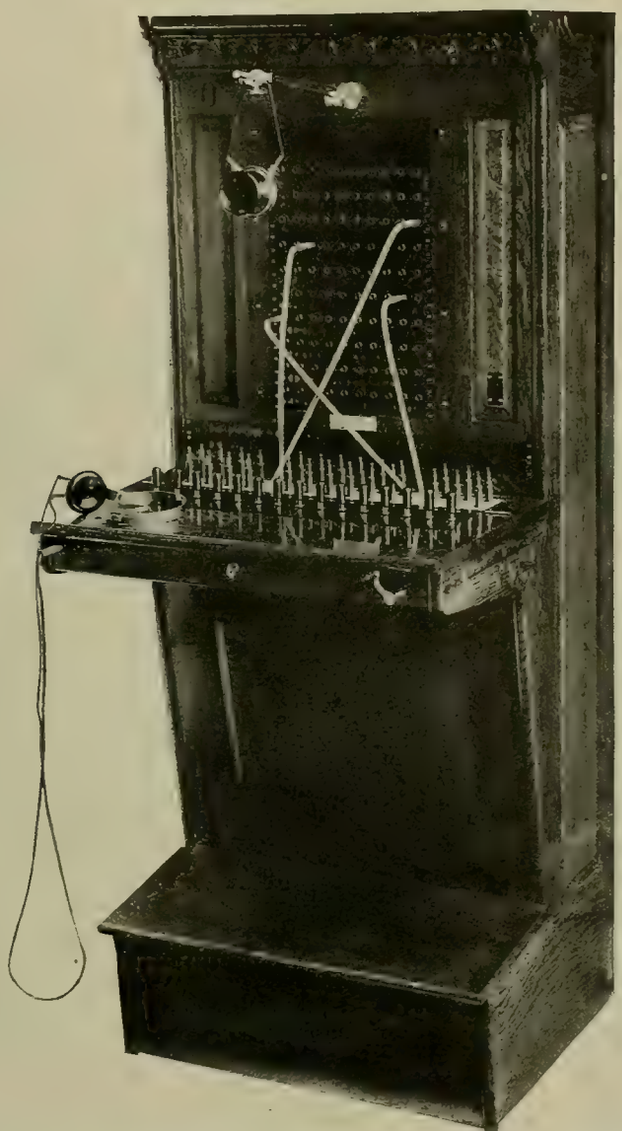
TO A

T

ITS MANY SUPERIOR FEATURES MAKE IT

The Ideal System

TO INSTALL.



OUR 100-LINE CENTRAL ENERGY TYPE SWITCHBOARD.

Note the following features in our

Metallic Circuit Multiple Switch-boards:

Positive double supervisory signals. Central energy. Simple and mechanically perfect. All circuits perfectly balanced electrically. Cost of operation and maintenance reduced to a minimum. The method of operating that we have adopted has been determined upon by long years of experience and practical operation by the very best telephone engineers, to be unexcelled.

SEND US YOUR SPECIFICATIONS.

NATIONAL TELEPHONE EQUIPMENT CO.

330-332 LAFAYETTE AVE., DETROIT, MICH.

The Haines & Noves Co.,

MANUFACTURERS OF THE HIGHEST GRADE

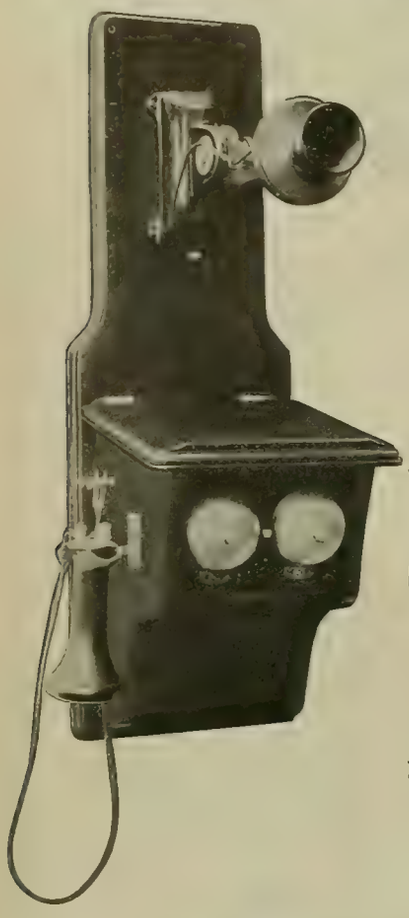
Telephones, Switchboards and Accessories,

INTER-COMMUNICATING SYSTEMS AND PRIVATE PLANTS.

"OUR 'PHONES ARE MADE RIGHT AND THEY STAY RIGHT."

Write To-day for Our Latest Catalog.

It Treats of Twentieth Century Apparatus.



"STYLE 11" WALL TELEPHONE.

"STYLE 5" DESK TELEPHONE.

THE HAINES & NOYES CO.,

SALES DEPARTMENT, THE ROOKERY,
CHICAGO, ILL., U. S. A.

AGENTS FOR THE
NATIONAL AUTOPHONE CO.'S
FIRE AND POLICE PATROL SIGNAL SYSTEMS.

C. W. FARR PRES. N. B. FARR, VICE PRES. E. W. HURST, GEN. MGR. R. J. GRAM SECY & TREAS. DETROIT, MICH.

FARR TELEPHONE & CONSTRUCTION SUPPLY CO.

MANUFACTURERS AND DEALERS IN TELEPHONES AND GENERAL TELEPHONE SUPPLIES

GENERAL OFFICES AND SALESROOM 357 DEARBORN ST.

CHICAGO, ILL., Jan. 1st, 1901.

To Our Customers Throughout the United States, Canada and the World.

GREETING.

Gentlemen:

We take this opportunity to wish you A Happy and Prosperous New Year and thank you for the liberal patronage given us the past year. About March first we will remove into the Eight Story Building, Nos. 118 and 120 Jackson Blvd., West, where we will be in better shape than ever to fill your orders promptly. Thanking you again for favors, we remain,

Very truly yours,

FARR TELEPHONE & CONSTRUCTION SUPPLY CO.
C. W. Farr, Prest.

WE CARRY IN STOCK A LARGE SUPPLY OF TELEPHONES, ALL SIZES, LARGE AND SMALL. PRICE FROM $3.50 TO $18.00. LINE MATERIAL, ALL KINDS. BRACKETS, GLASS INSULATORS, WIRE, CROSS ARMS, LINEMEN'S TOOLS. ORDERS SHIPPED SAME DAY WE RECEIVE THEM. SEND FOR CATALOGUE, 333 ILLUSTRATIONS AND WIRING DIAGRAMS.

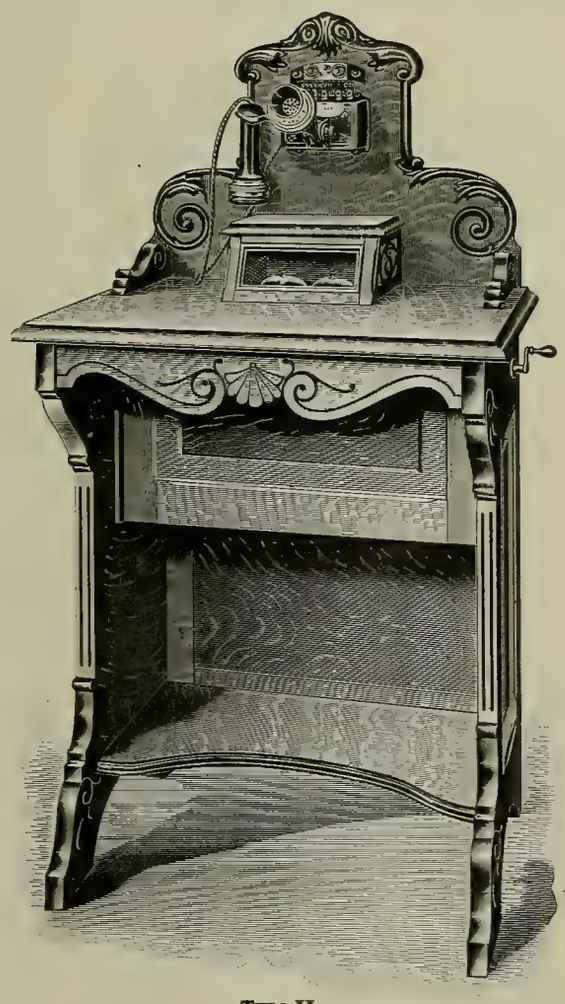
INDEPENDENTS!

TO SUCCEED IN 20TH CENTURY

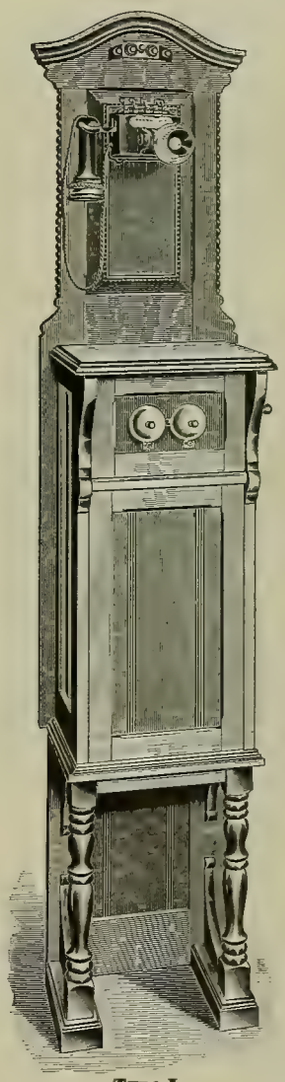
LARGE EXCHANGES REQUIRE

Multiple Switchboard

and "Central Energy."



Type II.



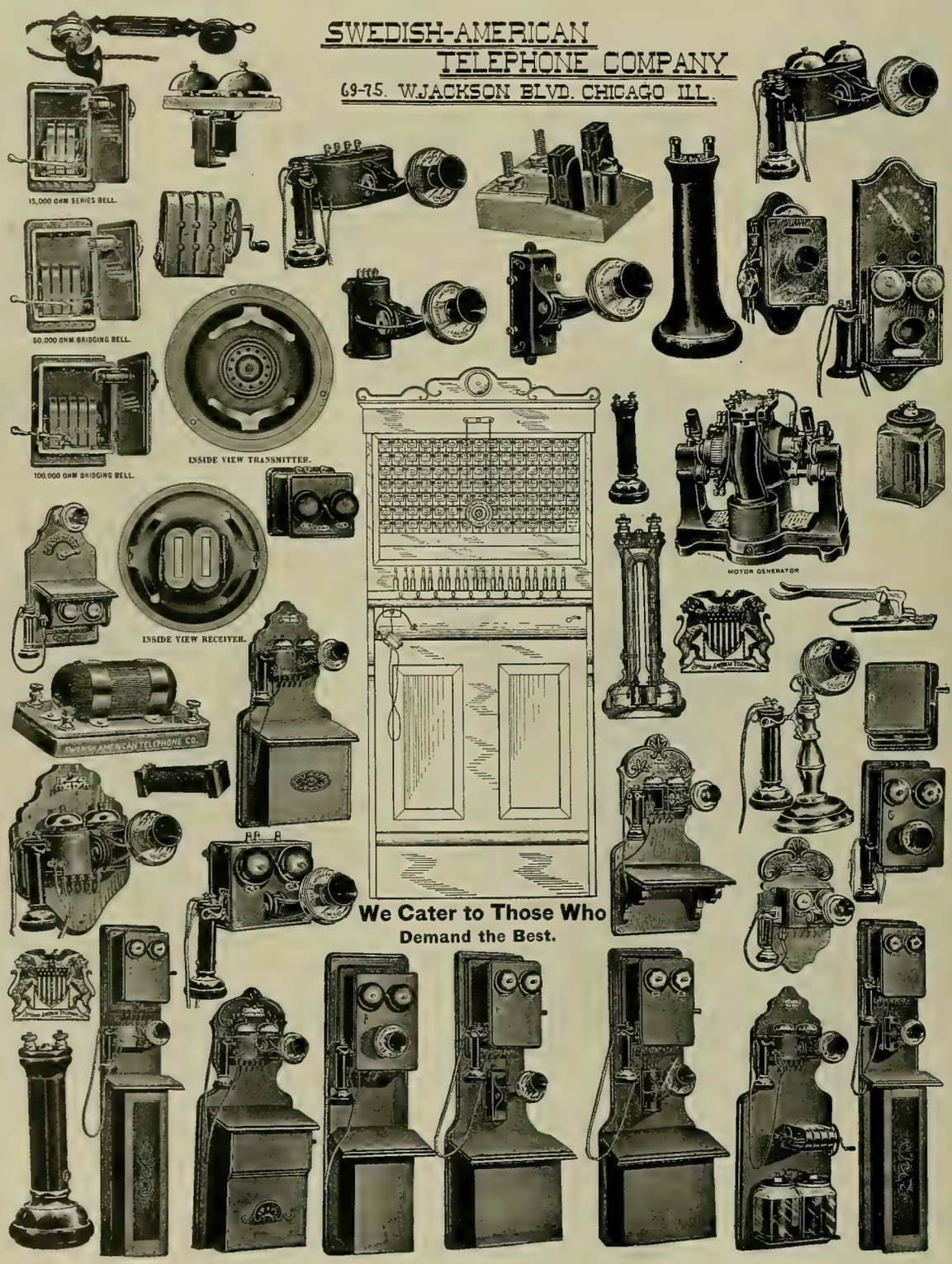
Type I.

We manufacture complete equipment and furnish necessary material for large and small, public and private telephone exchanges, or any specialty in the telephone line.

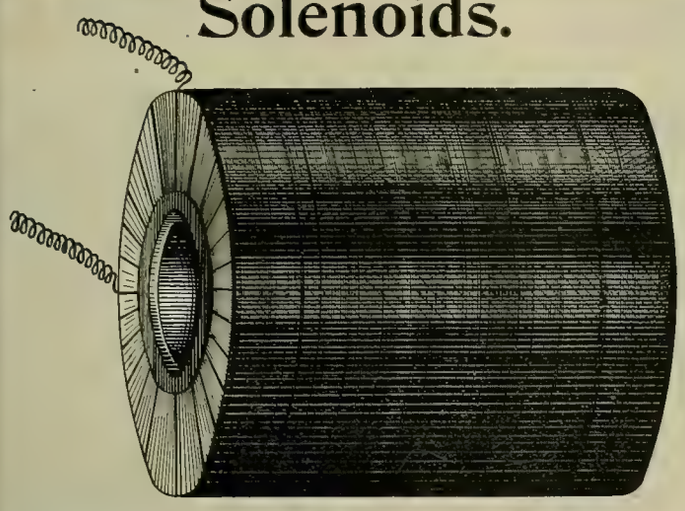
CORRESPONDENCE SOLICITED.

The Stromberg-Carlson Tel. Mfg. Co.

70-82 W. Jackson Boulevard,
CHICAGO, U. S. A.

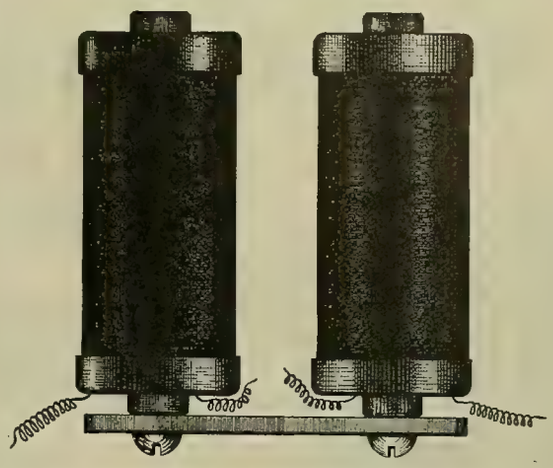

SWEDISH-AMERICAN
TELEPHONE COMPANY
69-75. W.JACKSON BLVD. CHICAGO ILL.
15,000 OHM SERIES BELL.
50,000 OHM BRIDGING BELL.
100,000 OHM BRIDGING BELL.
INSIDE VIEW TRANSMITTER.
INSIDE VIEW RECEIVER.
MOTOR GENERATOR
SWEDISH AMERICAN TELEPHONE CO.
We Cater to Those Who
Demand the Best.

Solenoids.



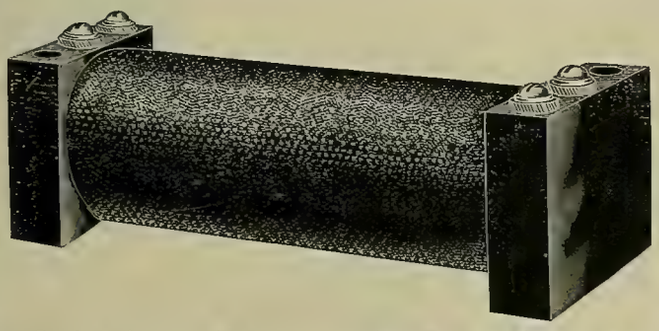
Solenoid windings made up on fibre or brass spools, any size from ½-inch to 8-inch diameter, and from ⅞-inch to 6 inches long. Made to any winding specifications. These windings are sold at about the cost of wire, no charge being made for the winding.

Ringer Magnets.



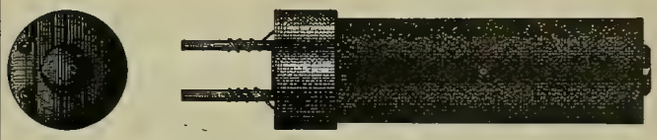
Ringer and bridge bell magnets, complete, including cores. Made to any specifications. Can ship any quantity, any size, on one week's notice.

Induction Coils.



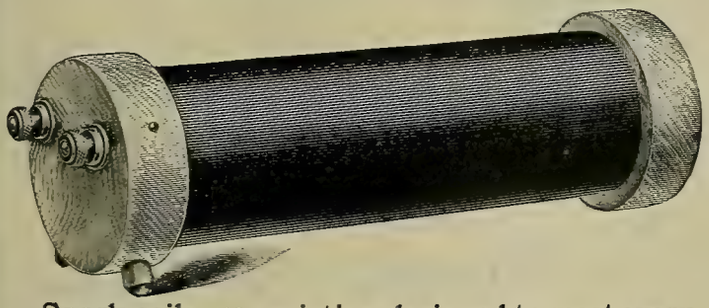
Induction coils, 100 varieties, made to any desired specifications; large stock of standard coils always on hand.

Drop Magnets.



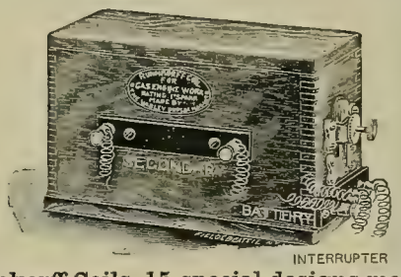
Drop magnets, complete, including cores and terminal pins. Made to any specifications. Prompt deliveries.

Spark Coils.



Spark coils, 50 varieties, designed to meet every condition.

Ruhmkorff Coils.



INTERRUPTER

Ruhmkorff Coils, 15 special designs made up in quartered oak boxes or encased in polished hard rubber shell; can ship any quantity at a week's notice.

EVERYTHING IN THE LINE OF

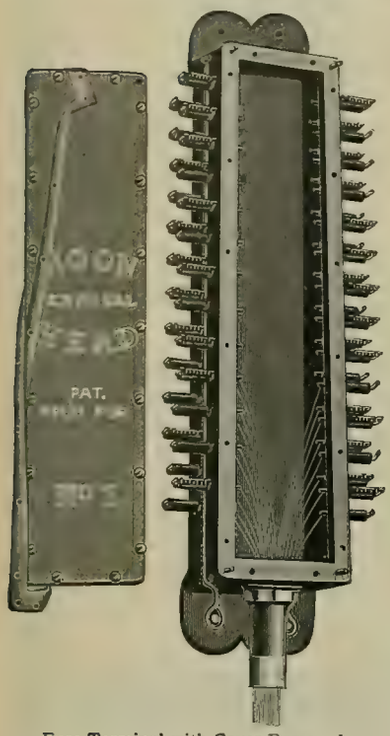
Electro-Magnets, Covered and Bare Wire Windings

TO ANY SPECIFICATIONS.

VARLEY DUPLEX MAGNET CO., Jersey City, N. J. Chicago, Ill.

THE MOON FUSE TERMINAL.

Equal to Any Emergency.



Fuse Terminal with Cover Removed.

LOW COST OF MAINTENANCE.

SUPERIOR CONSTRUCTION.

ADOPTED BY THE LARGEST INDEPENDENT EXCHANGES THROUGHOUT THE UNITED STATES.

We invite you to look into its merits.
Send for Descriptive Circular.

THE MOON MANUFACTURING CO.,

43 to 49 S. Canal Street, CHICAGO.

The Moon Terminal Head, with Metal Outer Casing, showing that it is possible to place The Moon Terminal Head at any desired place on the pole to advantage, owing to the fact that the door for Outer Casing slides.

Fuse Terminal with Outer Casing Open.

TELEPHONES,

TRANSMITTERS AND SWITCHBOARDS.

No. 909.
Long Distance Telephone.
Adjustable Arm.
Concealed Cord.
Solid Back Transmitter.
Double Pole Receiver.

LATEST and MOST APPROVED DESIGN.

MAGNETO BELLS, INDUCTION COILS, Etc.

Write for Catalogue and Price-List.

ST. LOUIS ELECTRICAL SUPPLY CO.,

911 Market St., ST. LOUIS, MO.

We Don't Want the Earth

Merely give us your ear and consider our

DIVIDEND PAYERS....

Telephones that never wear out. Magnets that never deteriorate. Carbon that never disintegrates. Toll Boards that take care of themselves. Switchboards that never give trouble. Multiple Boards for exchanges—all sizes. Current Protectors that never fail.

Maintenance Repair **EXPENSE** Reduced to the Minimum

THAT'S WHY PATRONS UPHOLD

The North Electric Co.

Write for Catalog. 63-75 FRANKFORT STREET, CLEVELAND, O.

NEW EDITION.

THE

TELEPHONE HAND-BOOK

BY HERBERT LAWS WEBB.

Containing a Chapter on "Recent Progress" which brings this practical book UP-TO-DATE.

The General Principles of

Telephony

Are Now Well Established.

The Telephone Hand-Book deals with them.
No matter what kind of Telephones and Switching Apparatus you use, or expect to use,

YOU WILL FIND IT USEFUL.

It is a Practical Book
for the Practical Man
and for the Student.

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ELECTRICIAN PUBLISHING CO.,

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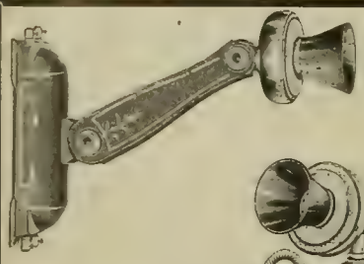
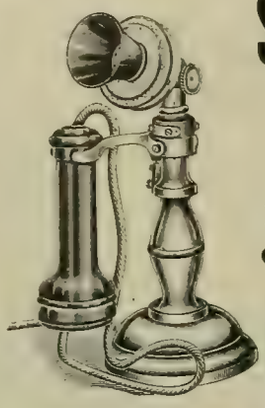


STEPPING STONES



TO **SUCCESS** IN **EXCHANGE OPERATION.**

WE furnish the material—

YOU do the rest, if you buy

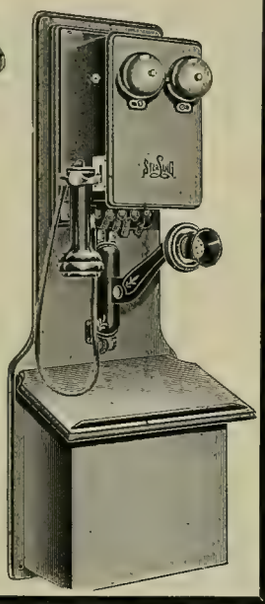
TELEPHONES, SWITCHBOARDS, PROTECTORS,

manufactured by

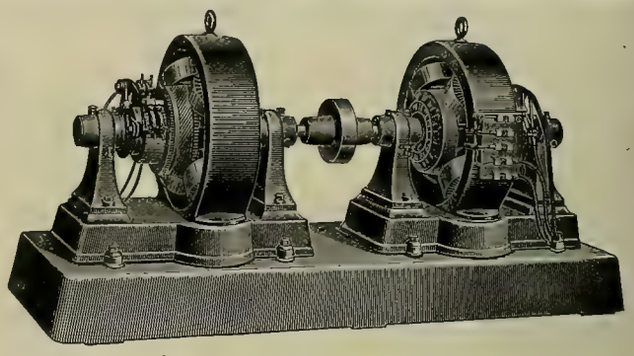
STERLING ELECTRIC COMPANY,

LAFAYETTE, IND., U. S. A.

Send for Catalogue "B."



SOMETHING NEW UNDER THE SUN!



THE HOLTZER-CABOT

TELEPHONE DYNAMO

FOR DIRECT CONNECTION TO TRANSMITTER CIRCUIT FOR CENTRAL ENERGY SYSTEMS, OR FOR CHARGING STORAGE BATTERIES. MOTOR END ARRANGED FOR EITHER DIRECT OR ALTERNATING CURRENT. WRITE FOR INFORMATION.

We also Manufacture a Full Line of MOTOR-GENERATORS FOR RINGING CIRCUITS,

THE HOLTZER - CABOT ELECTRIC CO.

397 Dearborn Street, CHICAGO, ILL.

Factory: BROOKLINE, MASS.

Switchboards=Telephones

No. 1. Desk Telephone.

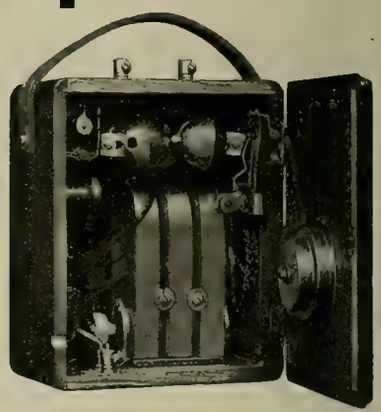
CATALOGUE No. 7,
Illustrating Complete Telephones and Switchboards.

CATALOGUE No. 8,
Illustrating Telephone Supplies, Telephone Parts and Construction Material, with Net Prices.

SOUVENIR WATCH CHARM. ALL FREE FOR ASKING.

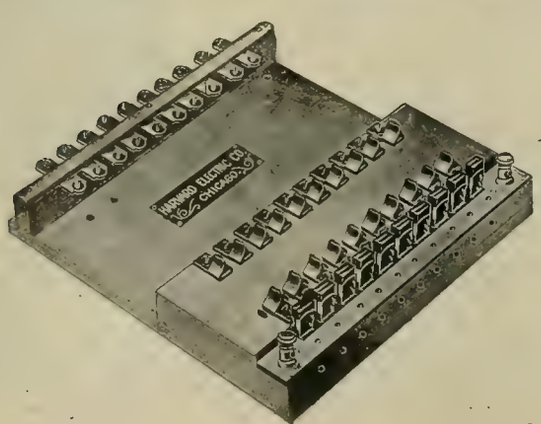
CENTRAL TELEPHONE AND ELECTRIC CO.,

909 Market Street, ST. LOUIS, MO.



Test Telephone.

Fuses and Lightning Arresters.



We carry a large stock of FUSES, FUSE BLOCKS, LIGHTNING ARRESTERS, DISTRIBUTING BOARDS, FUSE WIRE, LINKS OF ALL DESCRIPTIONS and PAPER SLEEVES.

SEND FOR CATALOG AND LOWEST PRICES.

HARVARD ELECTRIC COMPANY,

225-227 South Clinton Street,
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Our Trade Follows the Flag.

BARE AND INSULATED WIRE.

We carry Double Galvanized E. B. B., B. B. and Steel, Telegraph and Telephone Wires. Bare Copper, Hard and Soft Drawn for Telegraph and Telephone, Electric Light and Electric Railways.

SEND US YOUR SPECIFICATIONS AND LET US QUOTE YOU PRICES ON NATIONAL LEAD-ENCASED PAPER CABLES.

The large demand for I X L Weatherproof Wire which we have been unable heretofore to supply necessitated the enlargement of the factory, and we are now able to furnish this superior brand from stock.

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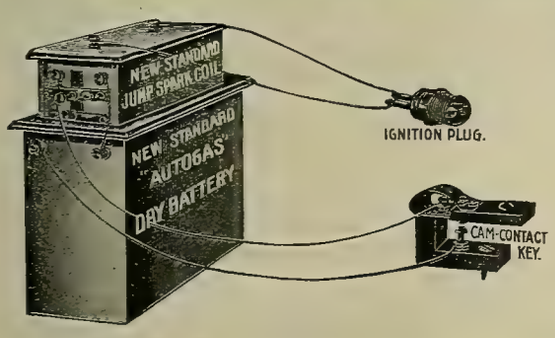
TELEPHONES The Name COUCH & SEELEY Co. SWITCHBOARDS

GUARANTEES SUPERIORITY
BOSTON, MASS.

THE "AUTOGAS" DRY BATTERY

FOR AUTOMOBILES, GAS AND GASOLINE ENGINES, LAUNCHES, ETC.

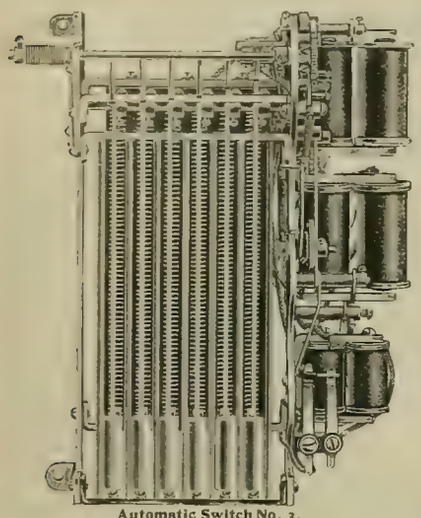


THIS COMPLETE SET IS MY INVENTION AND SOLD ONLY BY ME. Any size battery made to operate the system. Dry Automobile cell, same size as the French cell, guaranteed superiority, 400 per cent., $5.00 per set of four. Send for complete Catalogue.

WILLIAM ROCHE,

Inventor and Sole Manufacturer "NEW STANDARD" Dry Battery,

42 VESEY STREET, - NEW YORK.



Automatic Switch No. 3.

Do You Want

A service that is quick and true?
To carry on a conversation uninterruptedly?
To escape from the dependence of the pleasure of a central operator?
The same speedy service by night as by day?
An investment that is safe and profitable?

IF SO, USE

The National Automatic Telephone Apparatus.

MANUFACTURED BY THE

NATIONAL AUTOMATIC TELEPHONE CO.,

Write for **Catalogue A.**

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AMERICAN ELECTRIC TELEPHONE CO.

Our Paris "EXPO" No. 36.

36 to 50 Jackson Blvd., CHICAGO, ILL.

New powerful transmitter. Concealed cord. Bridging and series. Very compact.

Our new No. 1900 Telephones with Disc Carbon Lightning Arrester for **SERIES** and **BRIDGING** work are winners. Try them.

OUR CENTRAL ENERGY SYSTEM
is a great success; likewise our
MULTIPLE SWITCHBOARDS.

Telephone Apparatus Of All Kinds Manufactured.

CONSTRUCTION MATERIAL AND TOOLS LOWEST PRICES.

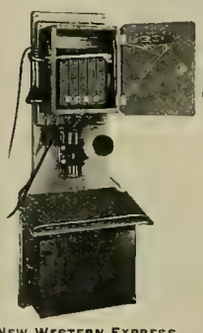
A BIG LOT OF SECOND-HAND PHONES, IN GOOD ORDER, CAN BE HAD FOR A SONG.

LET US TELL YOU ABOUT THEM.

J. H. VAN VLISSINGEN, President. W. C. HEINROTH, Treasurer.
L. G. WHEELER, Vice-President. L. G. BOWMAN, Secretary and General Manager.

WESTERN TELEPHONE CONSTRUCTION CO.,

153-159 SOUTH JEFFERSON ST., CHICAGO, ILL.



NEW WESTERN EXPRESS No. 3 BRIDGING TELEPHONE.

NEW WESTERN EXPRESS No. 3

BRIDGING TELEPHONE

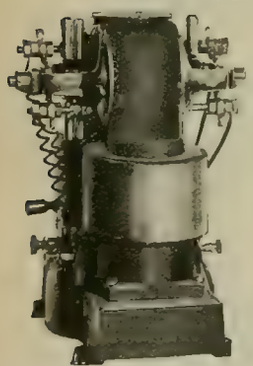
ON FAIRLY WELL CONSTRUCTED LINES WILL RING FROM 25 TO 35 TELEPHONES.

NOTICE THE GOOD POINTS:

The heaviest telephone generator made.
Wide cut gear.
Heavy cast bearings.
Silk wound armature.
Platinum contact hook switch.
Receiver has no exposed metal parts.
Finest adjustable arm in use.
Transmitter has heavy cast brass front.
Ringers 1200 or 1600 ohms' resistance.
Magnetos can be removed from backboards without cutting wires.
All connections soldered.
Two batteries.

WRITE FOR PRICES. ORDERS FILLED PROMPTLY.

ROTH CHARGING MOTOR DYNAMOS AND TELEPHONE RINGERS.



Telephone Ringer.

Motors direct connected to dynamos for charging storage batteries. Ringers for ringing telephone call bells, built to run on any direct current system of 110, 220 or 500 volts.

We make a specialty of machines for telephone work and will be glad to hear from telephone exchange managers in regard to their requirements in this line.

Send for Bulletin No. 146.

ROTH BROS. & CO., MANUFACTURERS,
86-92 West Jackson Blvd., CHICAGO, ILL.

SEND FOR OUR NEW 20th CENTURY CATALOG.

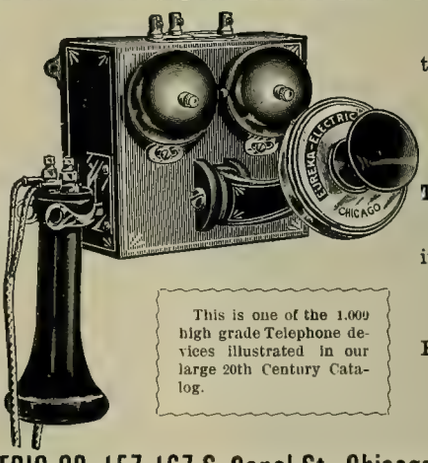
20th Century Apparatus.

Toll Line Equipment.

Bridging Apparatus.

Switchboards.

Terminals and Protectors for Large and Small Plants.



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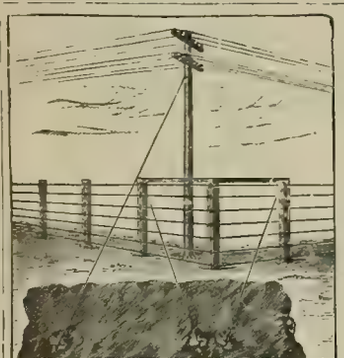
We Manufacture the most COMPLETE LINE OF TELEPHONE APPARATUS in the world.

Name Right Prices and Make Prompt Deliveries.

EUREKA ELECTRIC CO., 157-167 S. Canal St., Chicago, Ill., U. S. A.



Showing Manner of Securing.

THE ROCK OF GIBRALTAR IS NO FIRMER THAN A

Telephone Pole

Secured by the

Stombaugh Guy Anchor.

The cheapest and most effective method of securely fastening Telephone, Telegraph and Trolley Poles.

No holes to dig; bore them in the ground and there they stay. "Brace up" the weak points on your line and avoid further trouble.

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3½ to 6 in. Diameter.

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Correspondence Invited.

Manufactured by **PHILIP SMITH,** SIDNEY, OHIO, U. S. A.

HUGO SCHUMACHER, Prest. MAX SCHUMACHER, Sec'y and Treas.
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Hotel or House Telephone.

Garl Electric Company,

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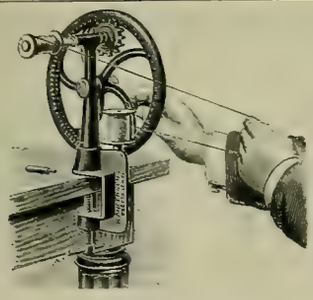
Sole Patentees and Manufacturers of

Garl Railway, Hotel and Factory Telephone Systems. Garl Electric Gun for Fire and Burglar Alarms.

Intercommunicating Factory Telephone.



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HAND, FOOT POWER and SPEED LATHE ELECTROMAGNET WINDERS.

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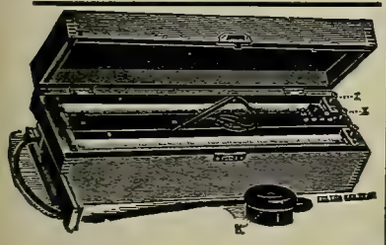
PEEKSKILL, N. Y.

CHICAGO TELEPHONE SUPPLY CO.—CHICAGO, U. S. A.
MANUFACTURE EVERYTHING TELEPHONIC.

Send for Circular and Prices.

Manufactured by
HARTWIG & MILLER,
DETROIT, MICH.



A Direct Reading Ohmmeter.
Ohmmeters, Ammeters, Voltmeters.
Special Electrical Machinery.
F. B. SAGE & BRO.,
Successors to American Electric Specialty Co.,
128 Liberty St., New York City.
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WE EXCEL AND UNDERSELL ALL.

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Battery Hanging Lamps	$10.00
Telephone, complete,	5.95
Electric Door Bells,	1.00
Electric Carriage Lights,	5.00
Battery Fan Motor,	5.95
Electric Hand Lanterns,	2.00
Pocket Flash Lights,	1.50
Miniature Electric Lamps,	.40
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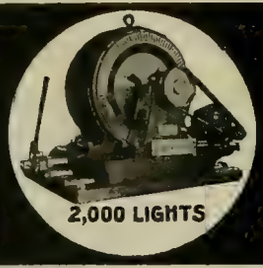

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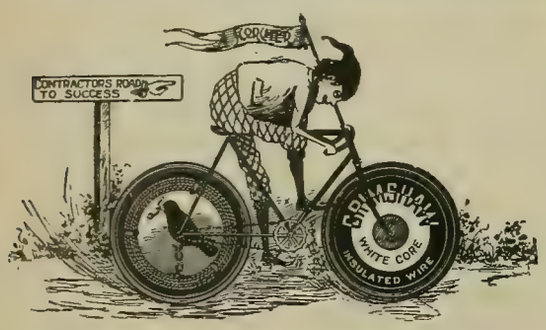

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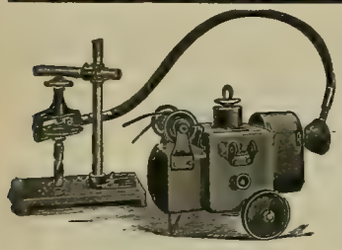

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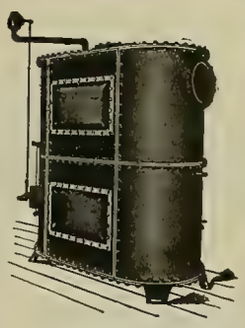

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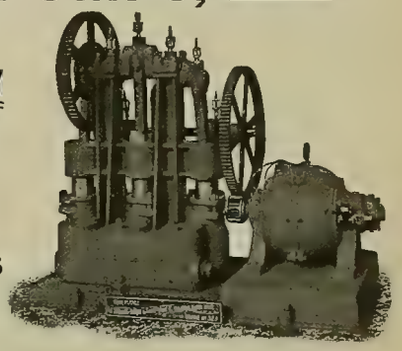

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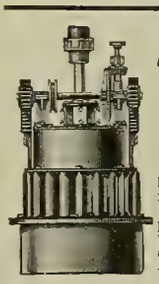

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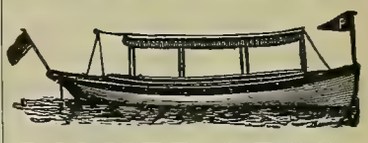

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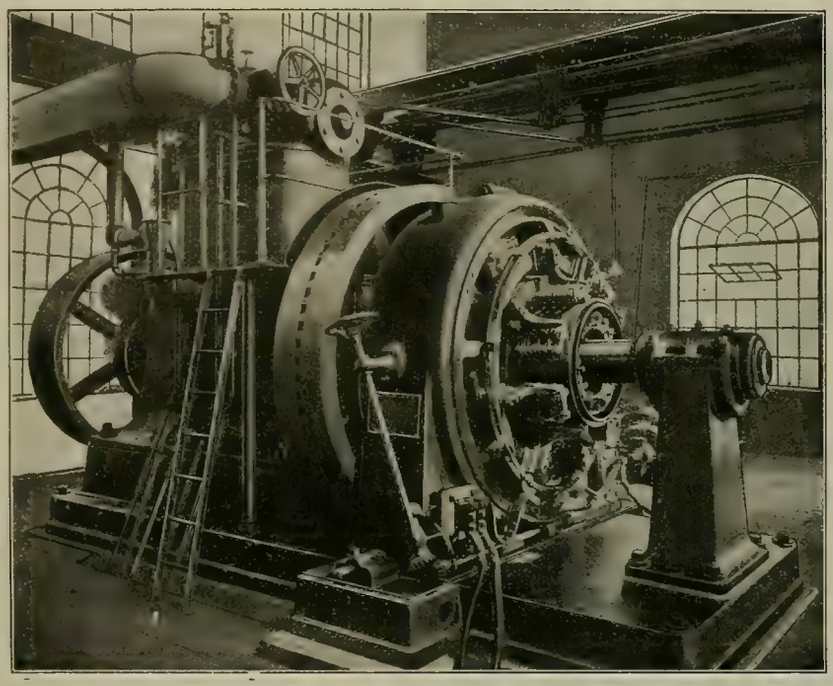

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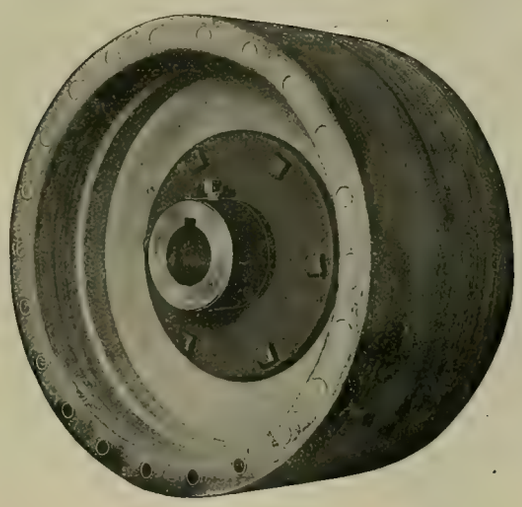

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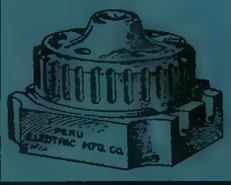

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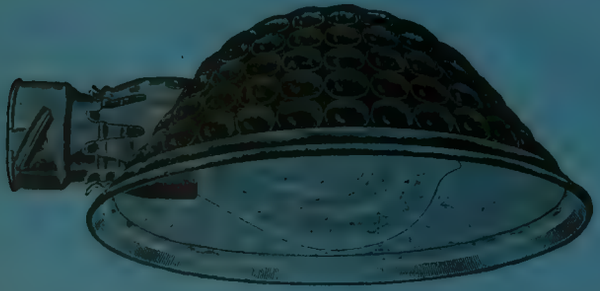

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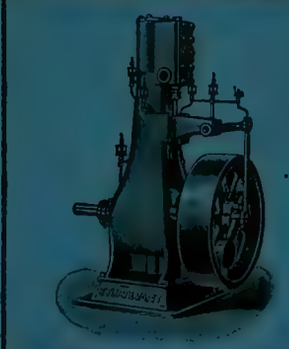

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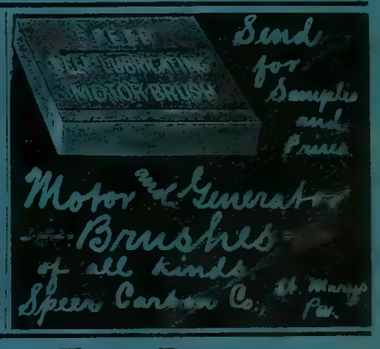

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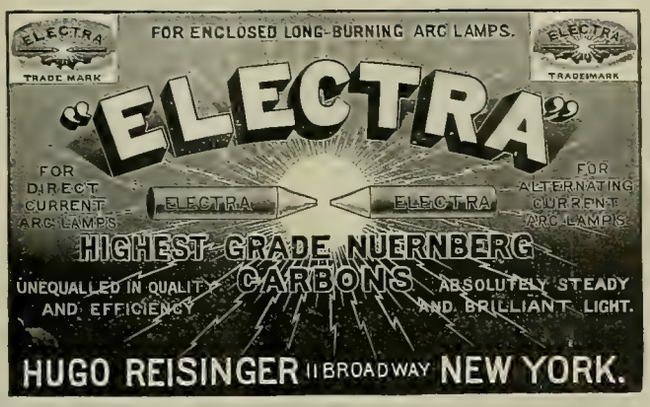

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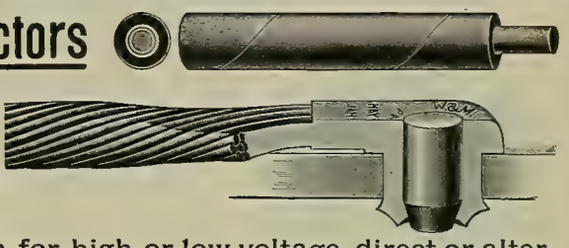

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

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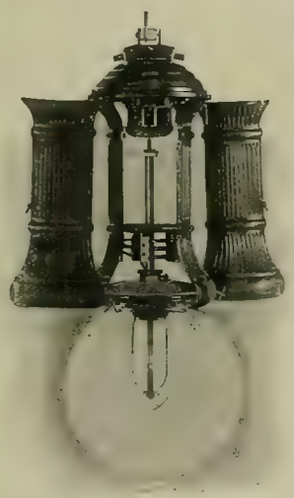

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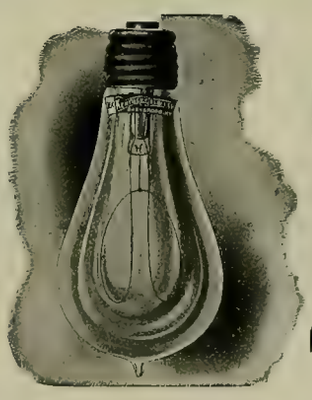

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Phosphor Bronze Sm.Co., Ltd.

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Hodge-Walsh Elec. Eng. Co.
Illinois Maintenance Co.
Matthews & Bro., W. N.
Rose Electric Co.
Rossiter, MacGovern & Co.
Schureman & Hayden.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
Pacific Electric Co.

Soldering Flux.
Cream Flux Co.

Sparking Plugs.
Crest Manufacturing Co.

Speaking Tubes.
Central Electric Co.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
American Steel & Wire Co.
Barnes Co., The Wallace.
Manross, F. N.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.
Oxide Battery Co.

Structural Iron Work.
American Bridge Co.

Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.

Telephones, Telephone Material and Switchboards.
American Electric Co.
American Elec. Fuse Co.
American El. Telephone Co.
American Toll Telephone Co.
Central Electric Co.
Central Tele. & Elec. Co.
Chicago Telephone Sup. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Gari Electric Co.
Independent Tel. Supply Co.
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
National Tel. Equipm. Co.
North Electric Co.
Palmer Bros.
R. I. Telephone & Elec. Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Viaduct Mfg. Co.
Warner Electric Co.
Western Electric Co.
Western Elec. Supply Co.
Western Tel. Const. Co.

Tools.
Klein & Son, Mathias.

Transformers.
Alden Electric Co.
American Electric Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Rose Electric Co.
Rossiter, MacGovern & Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbine and Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

White-Washing M'ch's.
Star Brass Works.

Wire, Bare.
American Electric Co.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
Queen & Co.

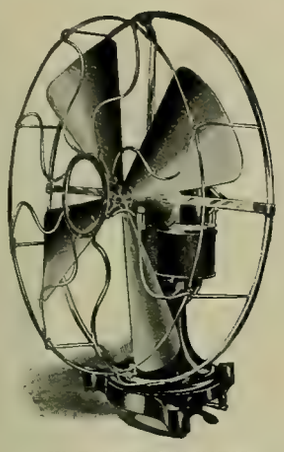
For Alphabetical Index of Advertisements See Page 3.

W. E. FAN MOTORS

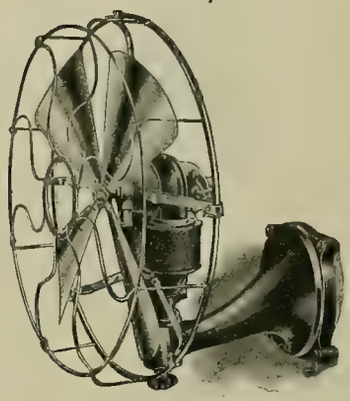
1901

FOR

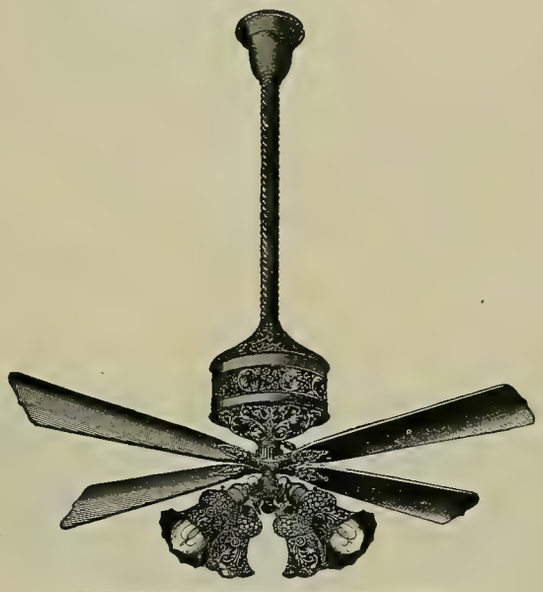
DIRECT CURRENT CIRCUITS.



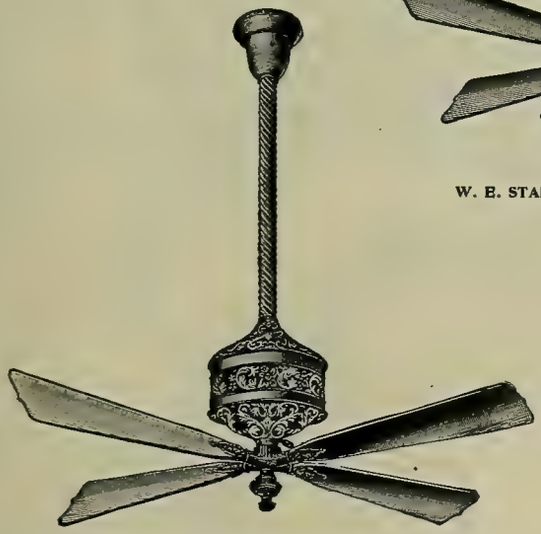
W. E. DESK FAN MOTOR.



W. E. BRACKET FAN MOTOR.

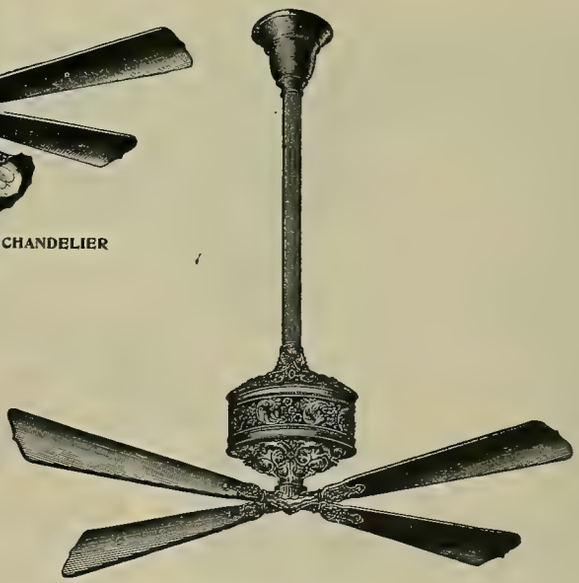


W. E. STANDARD CEILING FAN, CHANDELIER ATTACHMENT.



W. E. STANDARD CEILING FAN, WITHOUT CHANDELIER ATTACHMENT.

CEILING STYLES.



ARCTIC CEILING FAN MOTOR.

WRITE FOR CATALOGUE.

WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.

ST. LOUIS OFFICE, Security Building, St. Louis, Mo.

STANDARD ELECTRIC COMPANY, Cincinnati, Ohio. CALIFORNIA ELECTRICAL WORKS, San Francisco, California.

ANTWERP:
32 Rue Boudewyns.

LONDON:
Bridge Chambers, 171 Queen Victoria Street, E. C., and
North Woolwich, E.

PARIS:
46 Avenue de Breteuil.

OKONITE IT NEVER DISAPPOINTS

THE HYLO BABY FILAMENT LAMP

Has two light giving filaments, one large and one small, the large one giving out sixteen candles and the smaller, or Baby Filament, giving one candle of illumination. The change from the high to the low candlepower is brought about by turning the lamp in the socket. The mechanism which makes the change is part of the lamp itself, and is very simple.

It
- **Can be turned up and down—a simple twist of the wrist does it.**
- **Saves five-sixths of the light bill when turned down.**
- **Goes into any socket like a common lamp.**
- **Takes up no more room than a common lamp.**
- **Is made to fit the Edison, T.-H. and Westinghouse socket.**

Among the places where the Hylo may be used to advantage are theaters, lodge rooms, hospital wards, fireproof vaults, hotel halls and rooms, telephone booths, night lamps for office buildings, stores and factories.

State voltage and base in ordering.

Will mail sample on receipt of 75c. The trade supplied from stock.

SELLING AGENTS,

CENTRAL ELECTRIC COMPANY,

CHICAGO, ILLINOIS.

OKONITE IT NEVER DISAPPOINTS

A Substantial Christmas Present

which he never had before, but last January he

ADOPTED THE HOLLY SYSTEM,

utilized his exhaust steam (heretofore wasted) by selling it at three times its cost for general heating purposes, and thus secured his electric current at the station free of cost.

RESULT: $10,000.00 Extra Profit.

Our pamphlet explains our plan. Send for it.

AMERICAN DISTRICT STEAM CO.,

LOCKPORT, N. Y.

Mention WESTERN ELECTRICIAN.

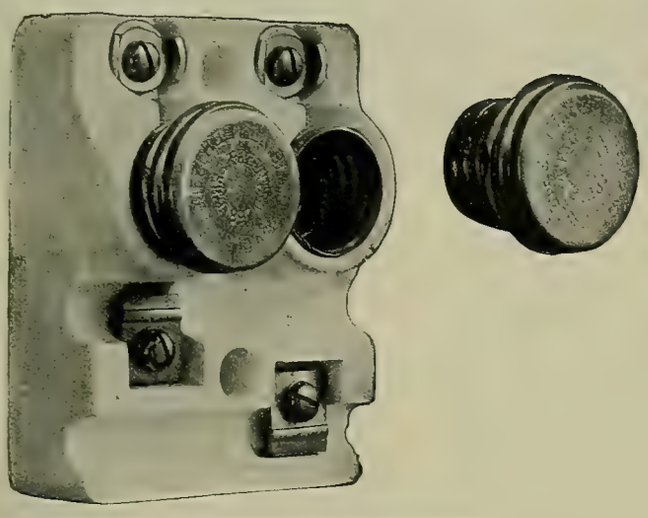
DEARBORN { Drug and Chemical Works, Laboratories---Water Chemists. Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

29, 30, 31, 32 and 33 RIALTO BUILDING, CHICAGO, ILL.

THE GENERAL ELECTRIC COMPANY'S



Double Pole Single Branch Plug Cut-Out.

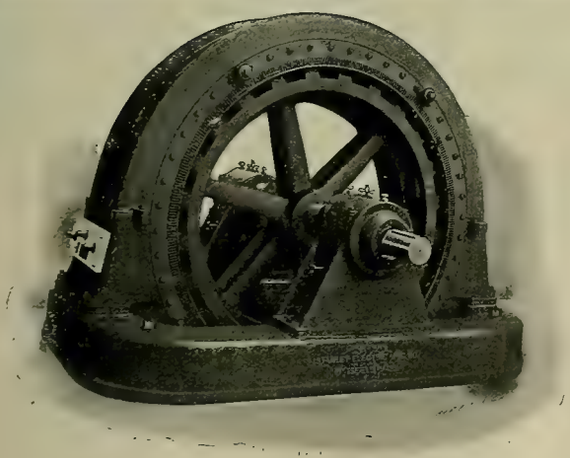
Edison Plug Cut-Outs

Are especially suitable for house use on account of safety and convenience in re-fusing.

WRITE FOR BULLETIN.

Main Office: Schenectady, N. Y.

Sales Offices in All Large Cities. Chicago Office, Monadnock Building.



Alternating or Direct Current Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co., Pittsfield, Mass.

Northern Electrical Mfg. Co., Madison, Wis.

A NEW CENTURY PLANT.

A new century plant can hardly afford to install cheap arc lamps. The Adams-Bagnall is a 20th century lamp. We recommend it—not because we sell it. We sell it because we can recommend it.

It is a simple and practical arc lamp.
We solicit a trial order.

ELECTRIC APPLIANCE COMPANY, Chicago.

FUSE

McIntire and American Joints, Fuse Wire, Lightning Arresters, Fuse Blocks.

Cheap, Good. **MAGNET WIRE.** Guaranteed.

TWO BIG STORES.

AMERICAN ELECTRIC FUSE CO.

NEW YORK: 116 Nassau St. CHICAGO: 345-347 S. Canal St.

INDIA & AMBER **MICA** IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.

EMPIRE INSULATED Cloths and Papers.

M·I·C· COMPOUND UNEQUALED.

Eugene Munsell & Co. Mica Insulator Co.
218 Water St. New York & Chicago. 117 Lake St.
WRITE FOR SAMPLES AND PRICES.

PERFECT. **MICANITE** INSULATOR REGISTERED.

ENGINEERING.

HERBERT A. WAGNER,
Consulting Engineer
Railway Lighting and Power Plants,
415 LOCUST ST., ST. LOUIS, MO.

Something New for the 20th Century.

Smith's Incandescent Lamp Adjusting and Controlling Devices.

Patented Oct. 16, 1900.

Now Ready for the Trade.

Simplest, neatest and handiest device for controlling lamp on end drop cord ever invented. It enables you to throw the light just where you want it. Adjusts your lamp up or down or throws reflection to side of room or at any angle. Weighs less than five ounces. Will hold on any size cord. Can be used where others would be impracticable. Made in various styles. Finished in brass, bronze, nickel, copper or black. Price of adjuster like cut, 75 cents. Mailed on receipt of price. Agents wanted everywhere. Send sample order. It's just what you have been looking for.

THEO. SMITH, Mfr.
151 Throop Street, Chicago, Ill.

YOU NEED IT!

Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

50c. per stick. $5.00 per dozen Send 50c. for trial stick.

FOR SALE BY ALL SUPPLY HOUSES OR

K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, - CHICAGO.

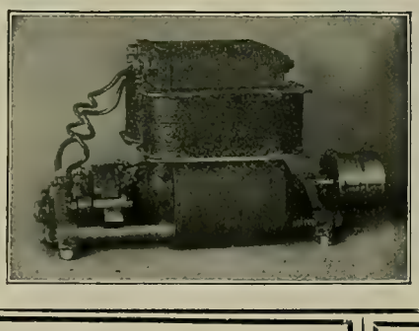
HAZARD MANUFACTURING CO.,

HIGH-GRADE RUBBER-COVERED, WEATHERPROOF **WIRES AND CABLES.**

MAGNET, OFFICE, ANNUNCIATOR WIRE.

GENERAL OFFICE AND WORKS, Wilkesbarre, Pa.
NEW YORK OFFICE, 50 Dey St.
CHICAGO OFFICE, 1201-2 Marquette Bldg

NEW FRANKLIN MODEL DYNAMO.



Sets of castings and material furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron contains eight slots. Pulley for round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Run as motor will drive sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 6-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with these machines. Full size detail blue prints furnished with each set of material, showing how to connect for both SERIES and SHUNT windings.

The change can be made from one winding to the other whenever desired.

Write for Dynamo Circular No. 16.

FRANKLIN MODEL SHOP,
129-131 West 31st Street, NEW YORK CITY.

The next time you see a McRoy conduit just feel how smooth it is inside and out.

JOHN T. McROY
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

COAL AND ASHES HANDLING

MACHINERY, SHAFTING, PULLEYS, CLUTCHES, PATENT MACHINE-MOULDED ROPE SHEAVES, ETC.
CATALOGUE UPON APPLICATION.
LINK-BELT MACHINERY CO.,
Engineers, Founders, Machinists,
CHICAGO, U. S. A.

CREAM FLUX

AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.

YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. ***We guarantee it and if not satisfactory money will be refunded.***

THIS IS WHAT ONE USER HAS TO SAY OF IT:

"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
"Per J. H. Goehst, Constr. Supt. CHICAGO EDISON CO."

FOR SALE BY ALL SUPPLY HOUSES OR

CREAM FLUX CO., Sole Manufacturers, 100 Washington St., **CHICAGO.**

General Electric Company's

Inductorium Sets and **High Frequency Coils** are the standard X-ray apparatus. They give a constant heavy spark and have the highest possible degree of insulation.

Send for Catalogue No. 9050.

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
Harrison, N. J.

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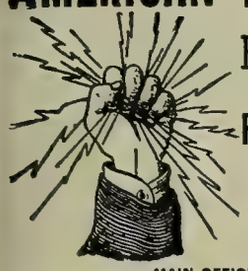
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donahoe, 241 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

CHAS. G. PAGE,
PATENT ATTORNEY,
185 Dearborn Street, Chicago Ill.,
Has attended to all of our patent matters continuously since 1891. Morgan & Wright, Chicago.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

"I've got a FREE SCHOLARSHIP."

Technical Education
BY MAIL.
To introduce the high standard of The American School of Correspondence, the Trustees have voted to award a limited number of Free Scholarships in Mechanical, Electrical, or Steam
Engineering,
including a complete course in Mechanical Drawing.
An excellent opportunity for private instruction in Mathematics, Mechanical Drawing or the sciences, under the direction of competent instructors.
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American School of Correspondence
(Chartered by the Commonwealth of Massachusetts),
Boston, Mass., U. S. A.

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Consulting Electrical Engineer.
CENTRAL LIGHTING STATIONS, ELECTRIC POWER TRANSMISSION.
Suite 1305, Chemical Bldg., St. Louis.

American Vitrified Conduit Company,
MANUFACTURERS OF
VITRIFIED SALT GLAZED UNDERGROUND AND INTERIOR CONDUITS.
Contractors for Complete Installation of Conduit Systems.
General Offices: 39 Cortlandt St., N. Y.

Crest Manufacturing Co.,
Cambridgeport, Mass.
GASOLINE MOTORS AND SPARKING PLUGS.

THE GORDON PRIMARY CELL.

The most improved, efficient, long lived and economic primary cell of the new century.

Extensively used for telephone, telegraph, fire and police alarm service, railroad signal work, gas engine ignition and automobiles.

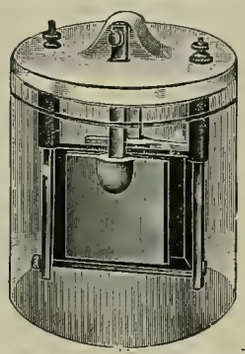
Manufactured in ten different styles.

Catalogue, price-list, etc., upon application.

THE GORDON BATTERY CO.,
13 and 15 Laight Street, New York.

EDISON LALANDE BATTERIES.

FOR GAS ENGINES,
SLOT MACHINES,
AUTOMOBILES,
RAILROAD SIGNALS,
CROSSING BELLS,
SMALL MOTORS,
ETC.



CONSTANT CURRENT.
NO LOCAL ACTION.
WILL NOT FREEZE.
LIQUID TIGHT
CELLS FOR
PORTABLE
WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.
EDISON MANUFACTURING COMPANY,
185 FIFTH AVENUE, NEW YORK.

CHICAGO MICA COMPANY

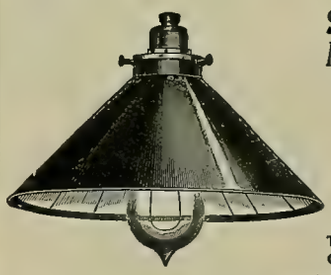
INDIA AMBER

TRADE MARK CRYSTAL

VALPARAISO, IND.
MANUFACTURERS
CHAMPION PAINTS
CRYSTAL VARNISH

TRADE MARK CRYSTAL

PARAGON REFLECTORS



Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows. Get our Catalogue and Prices.

American Reflector & Lighting Co.,
271-273 FRANKLIN ST., CHICAGO.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.

THE LUNDELL "SPLIT-POLE" GENERATOR

Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

SPRAGUE ELECTRIC CO.,
General Offices: 527-531 West 34th Street, NEW YORK.
CHICAGO: Fisher Building. BOSTON: 275 Devonshire Street. ST. LOUIS: Security Building.

WANTED.

Experienced incandescent lamp salesman for the West. State experience, territory covered and salary expected. Address "WEST," care Western Electrician 510 Marquette Building. Chicago.

Wanted to Buy.

Electric light plant in a growing Western city. Are prepared to pay cash for first-class proposition. Address, giving full particulars as to size of town, description of plant, connected load and price of coal, also reason for selling. Address "BUYER," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Salesman for Indiana and Illinois for electrical supplies. Address "SUPPLY," care Western Electrician, 510 Marquette Bldg., Chicago.

Notice is hereby given that the partnership heretofore existing between the undersigned, under the firm name of American Electric Company, has this day been dissolved by mutual consent, Mr. Arch. Miller retiring therefrom.

Detroit, Dec. 31st, 1900 { W. J. Hartwig, Arch. Miller.

The undersigned hereby gives notice that he has purchased the business of the American Electric Company and will continue the same as sole owner, and assumes the indebtedness thereof. The business will be continued at the old stand, No. 256-258 Randolph Street, Detroit, with a full line of supplies at factory prices.

Yours truly,
W. J. HARTWIG.

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
150 WASHINGTON ST., NEWARK, N. J.

WE OFFER FOR IMMEDIATE SHIPMENT

2 100 K. W., 500-volt Edison bipolars.
1 75 K. W., General Electric, 500-volt, 4 pole.
1 120 K. W., A. S. type, General Electric Alternator.
3 120 K. W., A. type, General Electric Alternators.
1 240 K. W., Stanley two-phase, 1,000 or 2,000 volts.
1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
1 65 Light, Brush Arc, 10 amperes.
1 40 Light, Western Electric Brush Arc.
1 600 H. P., Ball cross-compound engine, 20x36x18.
1 200 H. P., Ball, 12x22x16 Tandem compound, with condenser.
1 175 H. P., Ideal, 12x20x14 Tandem compound.
2 18½x18 Ideal engines.
1 14½x15 McIntosh & Seymour engine.

BOILERS, MOTORS, PUMPS.
Write for our latest price-list No. 40.

ILLINOIS MAINTENANCE COMPANY,
E. H. CHENEY, Manager,
204 Dearborn Street, Chicago.

ARMATURES.

2 60-light Western Electric, 10 ampere, each	$150.00
1 45-light Excelsior, 8 ampere	75.00
1 30-light Excelsior, 10 ampere.	75.00
1 25-light Excelsior, 12 ampere.	60.00
1 35-light Thomson-Houston, 10 ampere, ring type	125.00
1 20-light Brush, 10 ampere	60.00
2 30-light Brush, 10 ampere, each	75.00
1 500-light Westinghouse, 1000 volt, brand new	100.00
1 120 K. W. General Electric, 2,000 volt	300.00

Rose Electric Co., St. Louis, Mo.

FOR SALE—A BARGAIN.

150 hard rubber cells, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

BECKER BROTHERS

39-43 W. WASHINGTON ST., CHICAGO.

—REPAIRS—

For Everything Electrical, including **NATIONAL ELECTRIC CO.'S MACHINES.**

Manufacturers of the Celebrated "Perfection" Brushes for Dynamos and Motors.

Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

ELECTRICIAN PUBLISHING COMPANY,
510 Marquette Bldg., Chicago

FOR SALE.

HIGH-SPEED AUTOMATIC ENGINES.

We make a specialty of this class of machinery. Our stock changes so rapidly that we deem it useless to give list here. We handle everything in the line of Steam Power Equipment. All of it is thoroughly repaired and refinished. Write for particulars. **CAMP ENGINEERING CO., 18 S. Canal St., Chicago, Ill.**

WE DO REPAIRING.

The satisfactory kind that brings your second order.

Armatures, transformers and fields rewound. Commutators refilled. Machines rebuilt. All work guaranteed. Low prices. Write us.

GENERAL ELECTRICAL REPAIR CO.,
L. D. Telephone, Main 5114. 141 S. Clinton Street, CHICAGO.

Alden Electric Co.

(Formerly Alden & Co.)

WILL OCCUPY THEIR BUILDING AT

52 and 54 W. Van Buren St., Chicago,

on and after October 1st and will have in stock

All Lines of General Electric Supplies.

"Crescent" Rubber Covered. **Insulated Wires and Cables,** "Index Brand" Weatherproof.

PITTSBURG TRANSFORMERS. "L.-H." ENCLOSED ARC LAMPS.

UP-TO-DATE ELECTRICAL GOODS.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

BARGAINS--FOR SALE.

110-Volt Incandescent Dynamos.

2 12-light Edison, ¾ K. W., self-oilers.
1 25-light Wenstrom.
4 35-light Gibbs, M. P., slow speed, comp., brand new.
1 50-light Hawkeye.
1 50-light Nowotny, self-oiler.
1 50-light Card, multipolar, self-oiler, slow speed, 1150 R. P. M.
1 50-light Crocker-Wheeler, slow speed, self-oiler.
2 55-light Gibbs, M. P., compound, brand new, moderate speed.
4 55-light Gibbs, M. P., compound, brand new, slow speed, 1100 R. P. M.
1 55-light Siemens & Halske, type B., M. P., slow speed, self-oiler, brand new.
1 60-light Thomson-Houston.
1 60-light Westinghouse.
1 80-light Siemens & Halske, type L. H., self-oiler, brand new.
2 80-light Siemens & Halske, ironclad type, M. P., self-oilers, brand new.
1 100-light Bain, compound, self-oiler.
1 100-light J. & C., self-oiler.
4 110-light Gibbs, M. P., compound, self-oilers, slow speed, brand new, 1000 R. P. M.
1 110-light Siemens & Halske, M. P., Churchward type, compound, extra slow speed, brand new, 650 R. P. M.
3 150-light Gibbs, M. P., compound, self-oilers, speed 1650.
1 150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1 160-light Card, self-oiler.
2 180-light Siemens & Halske, M. P., self-oilers, brand new.
1 200-light Western Electric, self-oiler, comp.
2 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske, 12 K. W.
2 210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4 210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1 250-light Westinghouse.

110-Volt Incandescent Dynamos.—Continued.

1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2 270-light Westinghouse, M. P., slow speed, 15 K. W.
1 300-light Columbian, multipolar, comp., self-oiler, slow speed.
4 300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
6 350-light Siemens & Halske, type L. H., self-oilers.
1 360-light Duplex, multipolar, self-oiler, compound, slow speed.
3 500-light Siemens & Halske, type L. H., self-oilers, brand new.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Elckmeyer.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
2 800-light Edison, 45 K. W., self-oilers.
1 1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1 1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
3 1500-light Siemens & Halske, type L. H., self-oilers, 100 K. W.
1 1500-light Siemens & Halske, 100 K. W., type I., 6 pole, for direct connection, brand new.

220-Volt Generators.

Rheostat, base-frame and pulley accompany each machine.

1 8½ K. W. Westinghouse, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 30 K. W. Siemens & Halske, M. P., Ironclad type, self-oiler, brand new.
1 45 K. W. Edison, compound, self-oiler, new armature.
1 50 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.
1 marble panel switchboard for above.
1 100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 35 K. W. Mather, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1 45 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Thomson-Houston, A. 6.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light Thomson-Houston, 30 K. W., slotted armature.
2 600-light General Electric, A. 30, toothed armature.
2 650-light Thomson-Houston, A. 35.
2 750-light Westinghouse, 37½ K. W.
1 900-light Warren, 45 K. W., 1100 volts.
1 1000-light Wood, 50 K. W., self-oiler.
1 1000-light Siemens & Halske, 50 K. W., self-oiler, 60 cycle.
1 1200-light National, with exciter.
1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1 50 K. W. Siemens & Halske, Churchward type, brand new, 60 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1 1500-light Wood, 75 K. W., self-oiler.
1 1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
1 4000-light Wood, 200 K. W., self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 1200 C. P. T.-H., K. 12.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 1200 C. P. Wood No. 6.
3 40-light 2000 C. P. Western Electric, self-oilers.
2 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D. 2.
2 60-light 2000 C. P. Western Electric, self-oilers.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Ball, 4 amp.
1 65-light 2000 C. P. Brush, No. 8.
2 75-light 1200 C. P. Wood, with new arm'e.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westing'se, self-oilers.
3 125-light 1200 C. P. Excelsior, latest type.

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2 150 K. W. Edison bipolar.
4 60 K. W. Edison bipolar.
2 45 K. W. Edison bipolar.
3 30 K. W. Edison bipolar.
4 25 K. W. Edison bipolar.
2 20 K. W. Edison bipolar.
1 100 K. W. M. P., 4. Westinghouse.
1 45 K. W. M. P., 4 Westinghouse.
1 30 H. P. Westinghouse.
1 13½ K. W. M. P. Amer. Ball.
2 10 K. W. Edison bipolar.
1 500-ampere Onondaga.
1 25 K. W. Electro Dynamic.
1 45 K. W. General Electric, M. P., 850 R. P. M.

Arc Dynamos.

2 165-light, multi-circuit Brush, 1200 C. P.
2 125-light, latest type Fort Wayne, 2000 C. P.
2 125-light, brand new Excelsior, 2000 C. P.
2 125-light, multi-circuit Brush, 2000 C. P.
2 80-light, single-circuit Brush, 2000 C. P.
4 No. 8, 65-light, 2000 C. P., Brush.
10 50-light, 2000 C. P., T.-H., with ring armatures.

Alternators.

1 325 K. W. Siemens & Halske, 2000 volts, 7200 alternations, single-phase, 115 R. P. M.
1 300 K. W. Fort Wayne, 2000 volts, 7200 alternations, single-phase.
1 240 K. W. Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 240 K. W. Stanley, two-phase, 380 R. P. M., with engines direct-connected.
2 300 K. W. Westinghouse, single-phase, toothed armatures.
1 150 K. W. Westinghouse, two-phase, 1100 volts, 600 R. P. M., 7200 alternations.
2 A-120 General Electric, single-phase, 1000 volts, 16000 alternations.
2 90 K. W. General Electric, single-phase, 1000 volts, 16000 alternations.
2 120 Westinghouse, single-phase, 1100 volts, 16000 alternations.
1 110 K. W. Fort Wayne, 2200 volts, 16000 alternations.
3 60 K. W. General Electric, single-phase, 1050 volts, 16000 alternations.
1 60 K. W. Stanley, 2000-1000 volts, two-phase, 7200 alternations.
1 75 K. W. Stanley, 2000-1000 volts, two-phase, 16000 alternations.
1 45 K. W. Westinghouse, 2200 volts, 16000 alternations.

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1 75 K. W. General Electric, direct-connected to Ideal engine.

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1 70 K. W. M. P. Siemens & Halske, New.
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1 5 H. P. Eddy bipolar.

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1 50 H. P. M. P., General Electric.
1 30 K. W. C. & C. bipolar.
1 25 H. P. Eddy, M. P.
1 15 H. P. Eddy.
1 10 H. P. Eddy.
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5 200 K. W. Edison bipolar.
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2 100 K. W. Edison bipolar
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1 100 K. W. Ft. Wayne.

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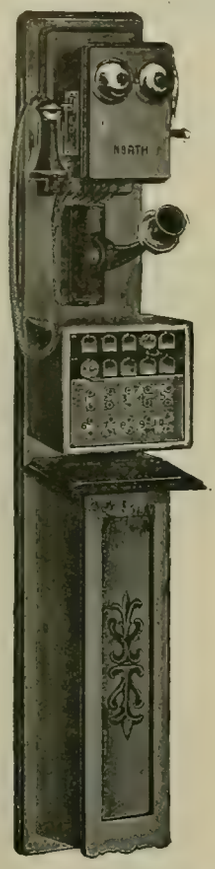

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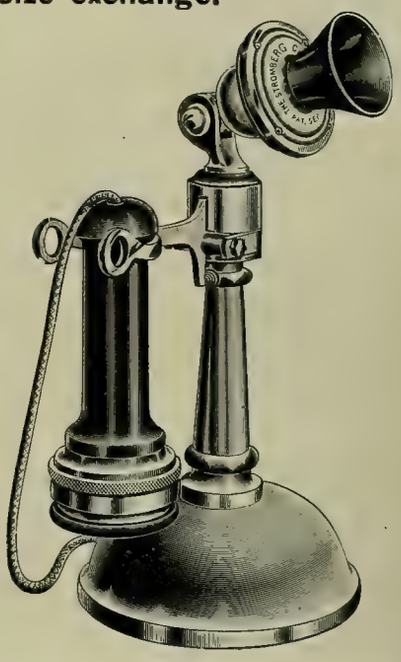

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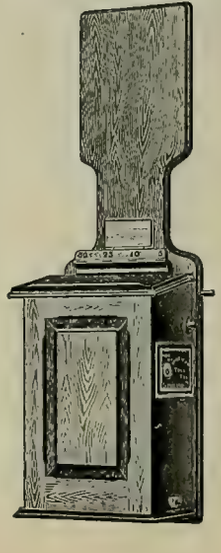

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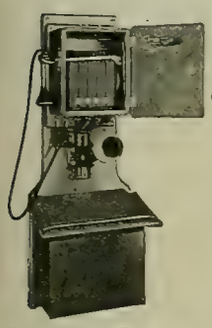

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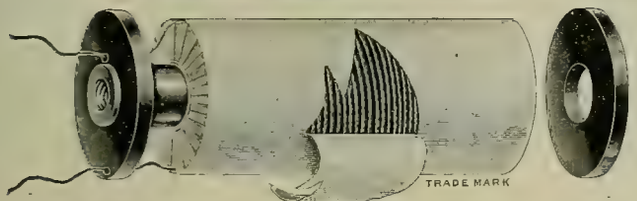

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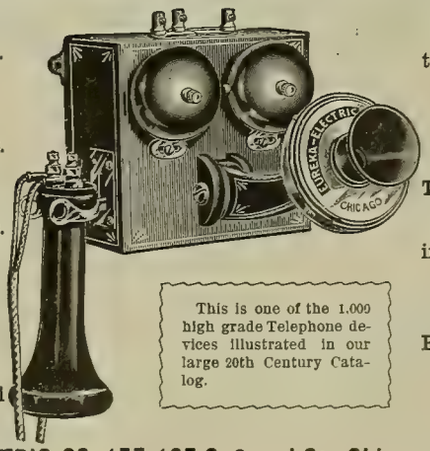

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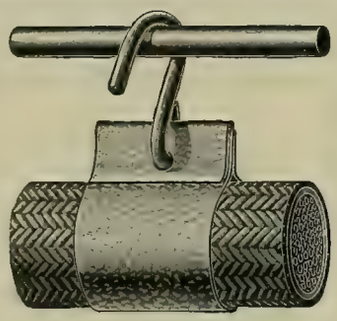

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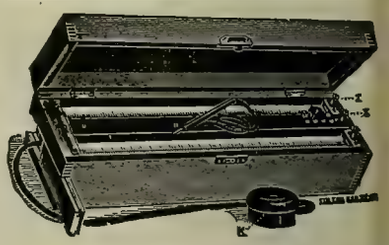

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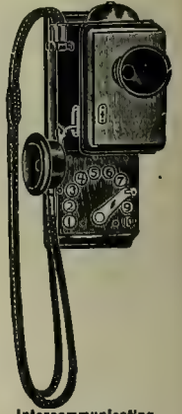

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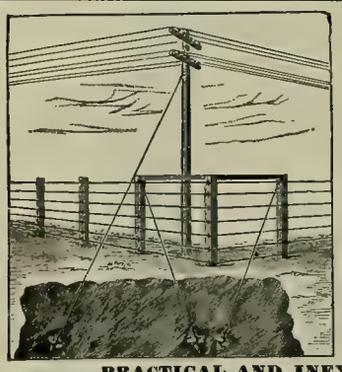

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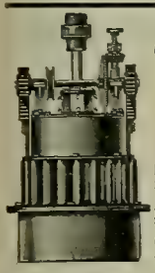

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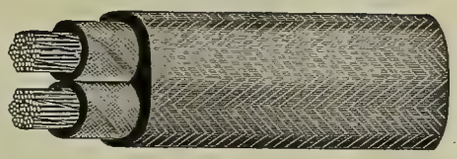

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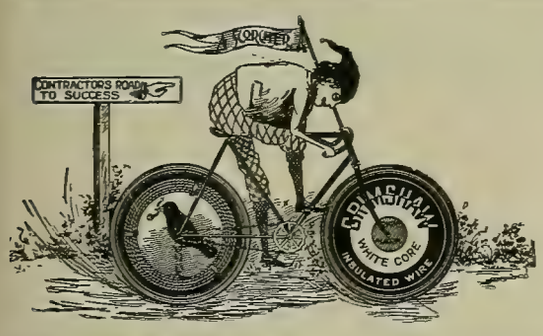

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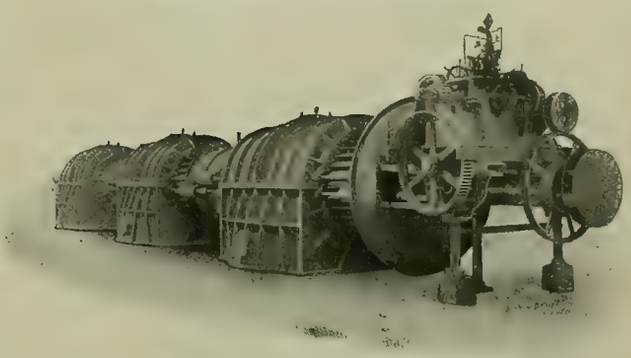

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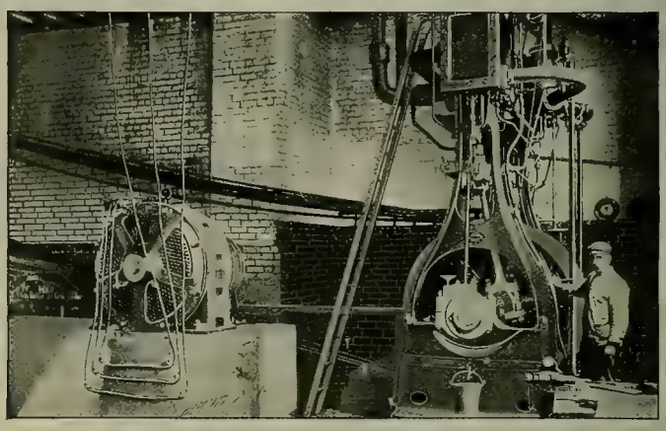

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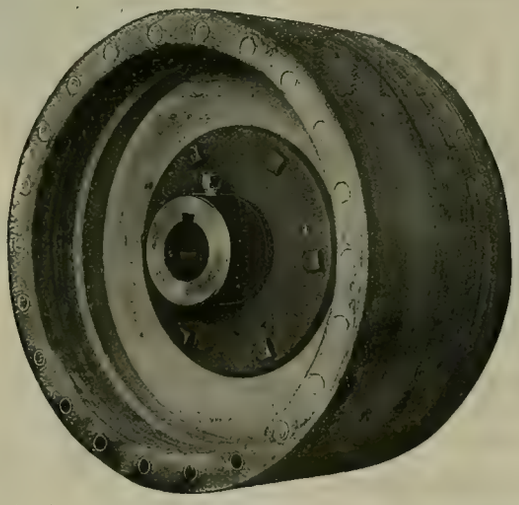

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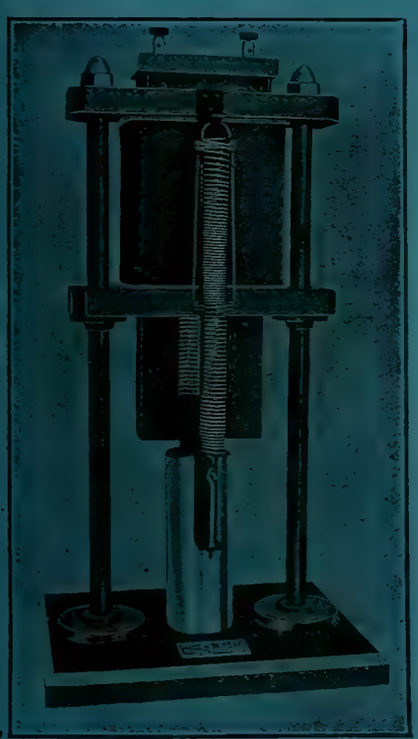

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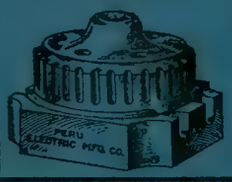

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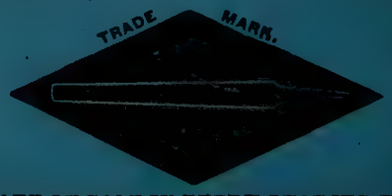

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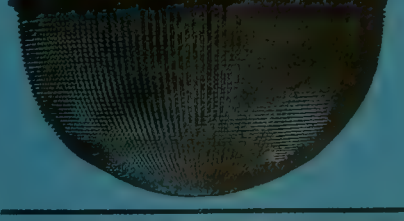
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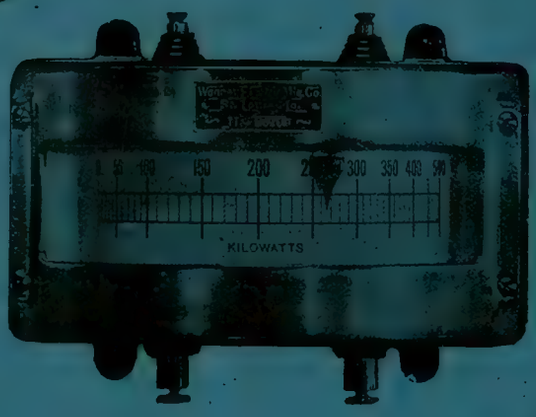

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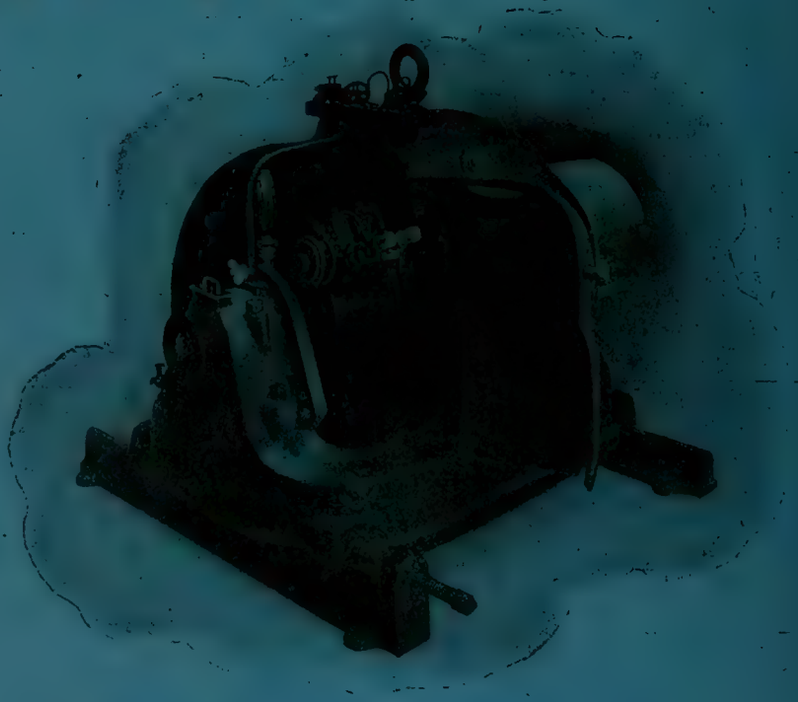

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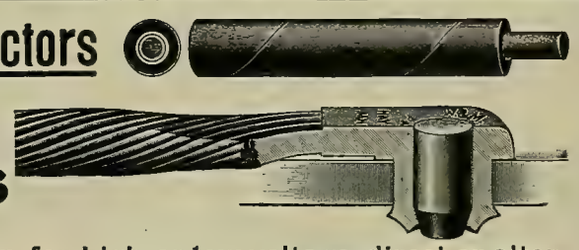

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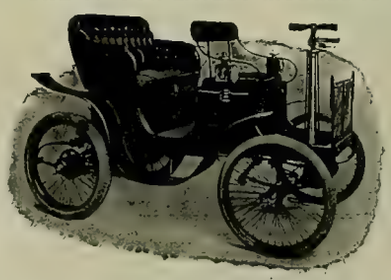

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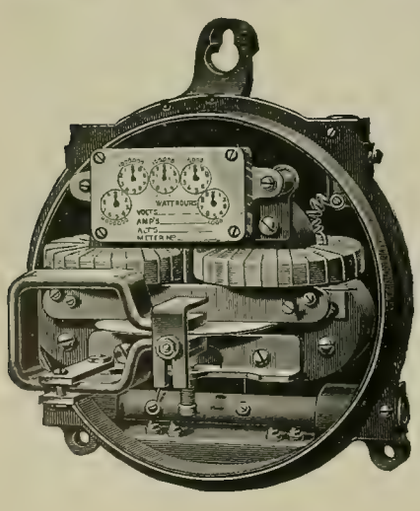

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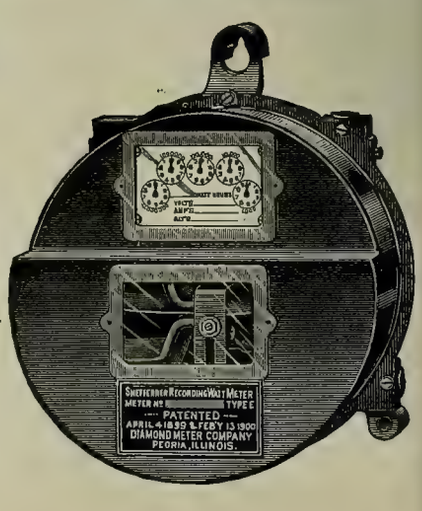

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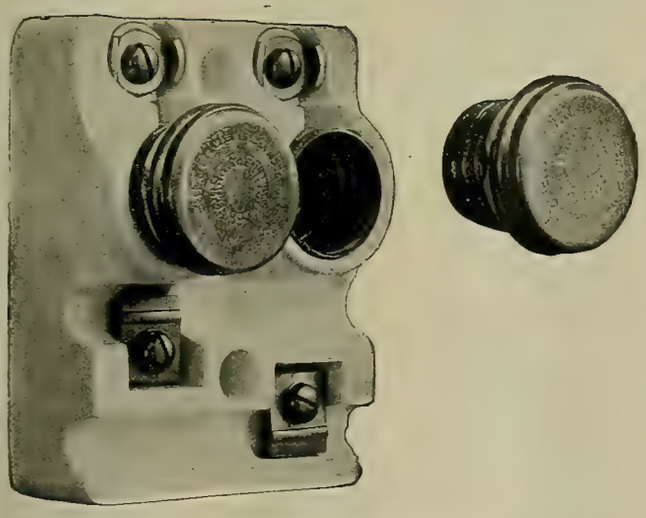

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Blowers.
Sturtevant Co., B. F.

Boilers.
Chicago House Wrecking Co.

Books, Electrical.
Electrician Publishing Co.

Bridges and Buildings (Steel).
American Bridge Co.

Brushes.
Becker Bros.
Central Electric Co.
General Electrical Repair Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Sage & Bro., F. B.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires) **Copper, Sheet and Bar.**
American Elec. Works.
American Steel & Wire Co.
Central Electric Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Carbons, Points and Plates.
American Electric Co.
Central Electric Co
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
United States Carbon Co.
Western Elect. Supply Co

Castings.
Sargent Co., The.
Smith Co., S. Morgan.

Chains.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Coils and Magnets.
Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.

Compound.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
WesternElectric Co.
Western Elect. Supply Co.

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American Electric Co.
Amer. Vitrified Conduit Co.
Central Electric Co.
Electric Appliance Co.
McRoy, John T.
Richmondt Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.

Connectors and Terminals (Patent).
American Elec. Fuse Co.
McIntire Co., The C.

Construction & Repairs.
American Electric Co.
Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

Contractors and Electric Light Plants.
American Electric Co.
Bullock Elec. Mfg. Co.
Crocker-Wheeler Company.
Electric Company of America.
Ft. Wayne Elec. Wks., Inc.
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Northern Elec. Mfg. Co.
Roth Bros. & Co.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
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American Electrical Works.
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General Electric Co.
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Independent Tel. Supply Co.
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Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
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Electrical Engineer Inst.
Int. Correspond. Schools.

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Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
General Inc. Arc Light Co.
Hill, W. S., Electric Co.
Palste Co., H. T.
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Westinghouse El. & Mfg. Co.

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Electrical and Mechanical Engineers.
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Humphrey, Henry H.
Illinois Maintenance Co.
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Wagner, Herbert A.

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Stanley Instrumcnt Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.
Willyoung, Elmer G.

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Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

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Jeffrey Mfg. Co.
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McMullin Motive-Power & Construction Co.
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Ball Engine Co.
Camp Engineering Co.
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General Inc. Arc Light Co.
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Roth Bros. & Co.
Sprague Electric Co.
Sturtevant Co., B. F.
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Western Electric Co.
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Electric Appliance Co.
Garl Electric Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Ohio Electric Works.
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Western Elect. Supply Co.

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Holmes Fibre-Graphite Co.

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Paiste Co., H. T.
Peru Elec. Mfg. Co.
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Vulcanized Fibre Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
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American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
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Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
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Standard Underground C. Co.
Western Elec. Supply Co.

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General Inc. Arc Light Co.

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Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Economy Electric Company.
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Sawyer-Man Elec. Co.
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Western Elec. Supply Co.
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Inc. El. Lt. Manipulator Co.

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Linemen's Climbers.
Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
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Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

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Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

Motors—See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

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Garl Electric Co.

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Gt. West. Sm. and Refining Co.

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Amer. Reflector & Ltg. Co.
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Smith, Theo.

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Westinghouse El. & Mfg. Co.

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Illinois Maintenance Co.
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Schureman & Hayden.
Vandeventer, A.
Walsh's Sons & Co.

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Manross, F. N.

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Western Elec. Supply Co.

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American Toll Telephone Co.
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Western Tel. Const. Co.

Tools.
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Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
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Leffel & Co., Jas.
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Stilwell-Bierce Smith-Vaile.

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Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

White-Washing M'ch's.
Star Brass Works.

Wire, Bare.
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American Steel & Wire Co.
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Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

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Noblett, E. J.

X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

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CLAY TUBES, INSULATORS, CLEATS, KNOBS AND NOVELTIES.

We are located in the center of the clay beds and can furnish the best of material in the clay line.

All sizes and styles according to the requirements of the BOARD OF UNDERWRITERS.

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... FOR ...

Summer Resorts,

PRIVATE RESIDENCES and PUBLIC PARKS.

Paying Investment.

Drawing Attraction.

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DARLINGTON ELECTRIC FOUNTAIN AND SUPPLY CO.,

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L-H Enclosed Arc Lamps.

FOR ALL CIRCUITS.

GUARANTEED TO MEET REQUIREMENTS OF ALL PRACTICAL ENGINEERS.

Designed on scientific principles and constructed of the highest grade materials.

Accessibility to working parts, which are few and absolutely interchangeable.

Positive cable contact.

Resistance cannot be short-circuited.

10-in. globe, using full length carbons.

Solid copper or aluminum case.

WE WANT ACTIVE AND RESPONSIBLE AGENTS IN ALL THE PRINCIPAL CITIES.

Catalogue and Terms on Request.

Lea-Hooven Manufacturing Co.,

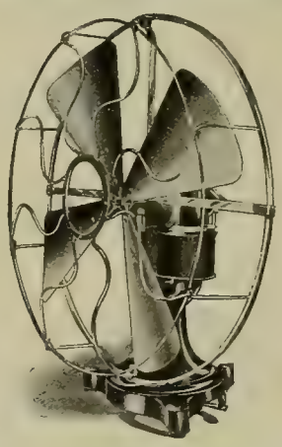
ALDEN ELECTRIC CO., Chicago Agents. ANDERSON, IND., U. S. A.

Mention this paper. BOX 200

FAN MOTORS

1901.

DIRECT CURRENT CIRCUITS.



MADE FOR 110, 220 AND 500 VOLT CIRCUITS
IN DESK, BRACKET AND CEILING STYLES.

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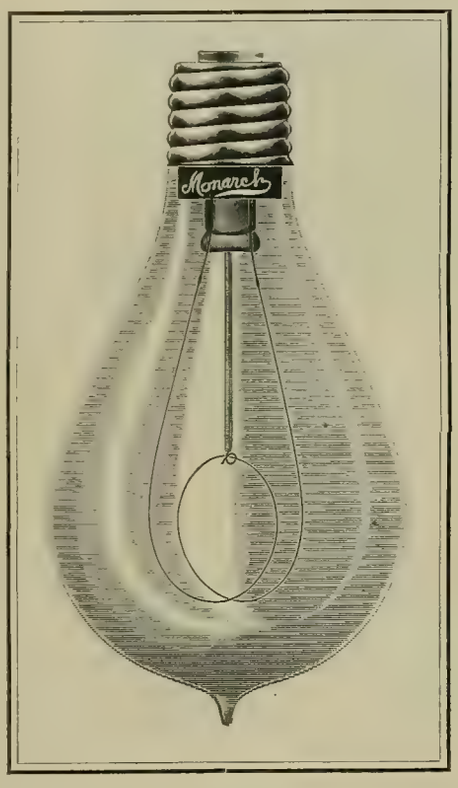

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Lamps are the most "up-to-date," Mechanically and Electrically perfect Lamp on the market to-day.

We Guarantee them Absolutely as for Efficiency, Sustained Candle-power, Current Consumption and Life.

WESTERN ELECTRICAL SUPPLY CO.,

EVERYTHING ELECTRICAL,

St. Louis, U. S. A.

FIFTY MILLION DOLLARS SAVED

Figure it out for yourself and remember that

"FIGURES DON'T LIE" ABOUT ECONOMY LAMPS

250 Other Lamps, at 17c	$42.50
250 "Economy" Lamps, at 13c.	32.50
SAVING	$10.00
Rebate on 250 Burned-out Lamps, at 3c.	7.50
Net saving, each bbl	$17.50

WORTH Saving, Isn't it?

Yes, they are renewed lamps and the saving effected is so great that the conservative buyer is naturally suspicious that we are not "Giving it to him straight"; therefore,

WE SEND ALL LAMPS ON SUSPICION.

Our manufacturing facilities are unexcelled. Cellulose Filaments are used in all Economy lamps and every lamp is chemically treated for vacuum. Economy lamps are equal to any high grade lamp in efficiency, maintenance of C. P. and life. We invite comparative tests.

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WARREN, OHIO.

MANUFACTURERS ECONOMY INCANDESCENT LAMPS.

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A STANDARD Incandescent Lamp that has been upon the market for more than ten years and has always maintained its reputation for excellence.

The special cellulose filament used in this lamp is of our own manufacture. This filament does not greatly increase in brilliancy at the outset and then rapidly deteriorate, but it *maintains its candle power and efficiency* for an unusual length of time. This evenness of illumination will appeal especially to central station managers and to all consumers upon the meter basis.

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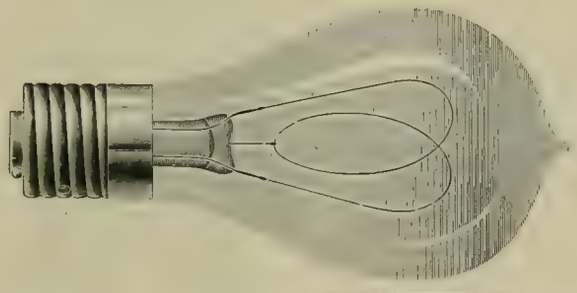

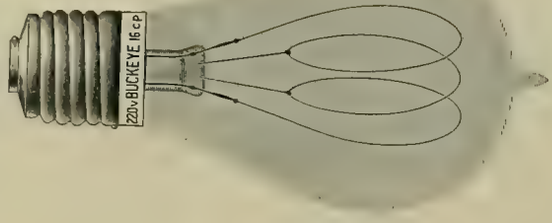

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220-Volt Lamp

That Meets ALL Requirements.

For the better accommodation of our Western trade we carry

50,000 LAMPS IN STOCK AT CHICAGO.

THE BUCKEYE ELECTRIC CO.,
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STANDARD ENCLOSED ARC LAMP

MANUFACTURED FOR ALL SYSTEMS.

For the past six years the record of this lamp is, that for repairs the cost is less than can be shown by any other similar type of lamp. The Standard Lamp has the single solenoid. Not a rod, wheel or bit of complicated mechanism.

A factory expert never required. At our Chicago stock room lamp repairs are promptly made. A full line of parts, globes and carbons are carried. Catalogues and prices on application.

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"A-B"

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ARE

"STANDARD"

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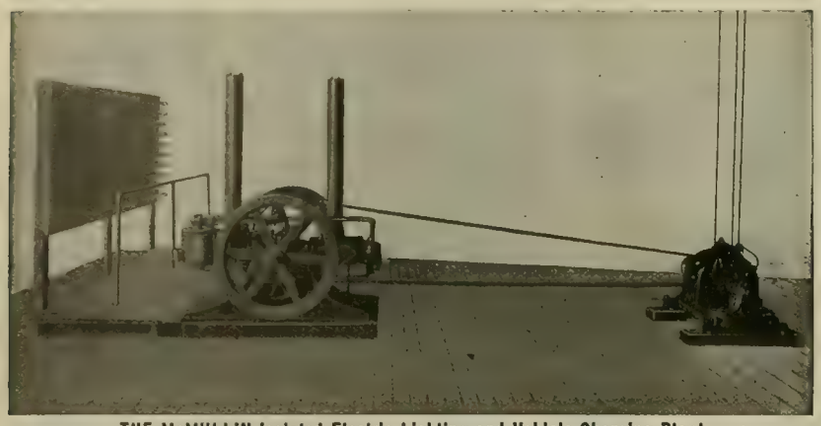
DOUBLEDAY-HILL ELEC. CO.....Pittsburg.
WESTERN ELECTRICAL SUPPLY CO.....St. Louis.
ELECTRIC APPLIANCE CO.....Chicago.
PETTINGELL-ANDREWS CO.....Boston.
B-R ELECTRIC CO.....Kansas City.
WM. C. BENBOW CO.....Columbus, O.
STAR ELECTRIC COMPANY.....Toledo, O.
HUBBARD, HALL & CO.....Cincinnati, O.
WILLIAM HALL.....Dayton, O.



THE McMULLIN Isolated Electric Lighting and Vehicle Charging Plant.

BECAUSE

The McMullin Hydro-Carbon (Gasoline) Engine

Has TWO CYLINDERS, one on either side of the crank shaft, and therefore perfectly balanced both in weight and in power, we warrant it to run a DYNAMO as steadily as a steam engine.

We furnish electric light or power plants complete, from two horse-power up. Two, four, six and fifteen horse-power plants always on hand. They are

Simple, Reliable, Durable, Economical,

Are easily operated, and they meet all requirements of the Board of Underwriters.

McMullin Engines Run Well Because They Are Honestly Made.

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ESTABLISHED 1875.

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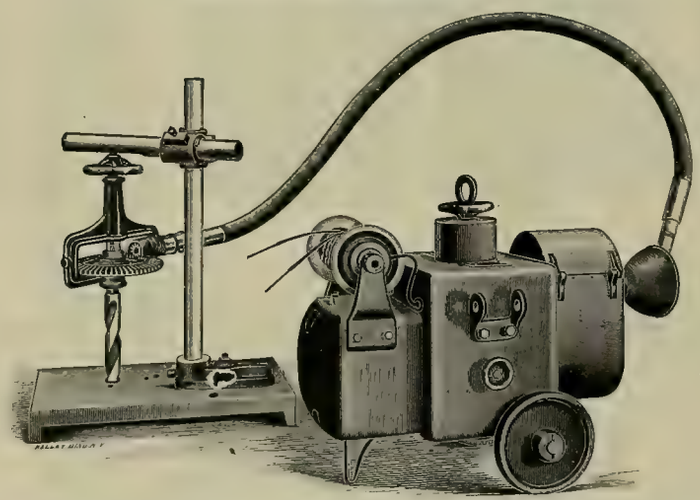

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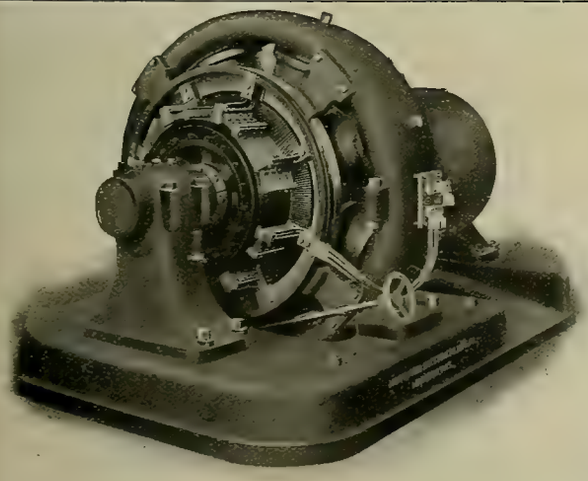

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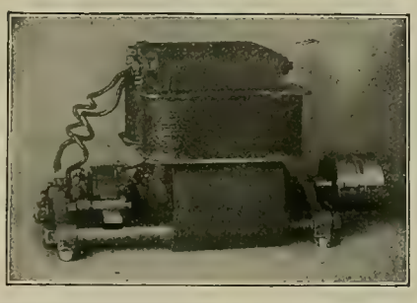
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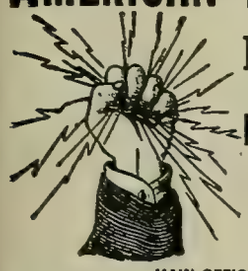

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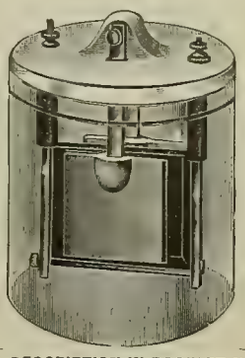

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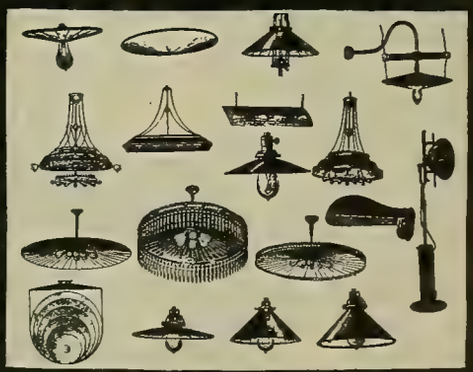

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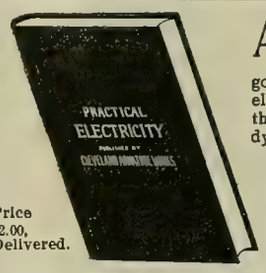

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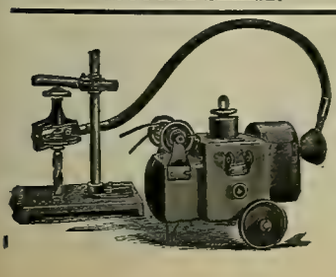

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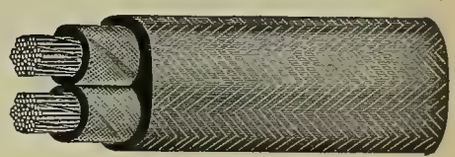

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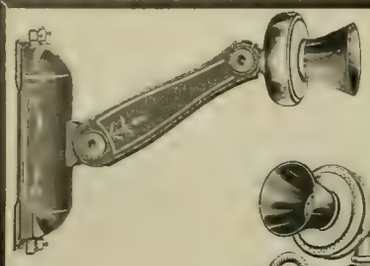

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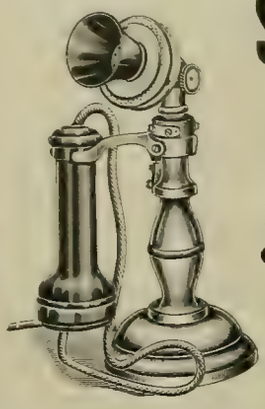

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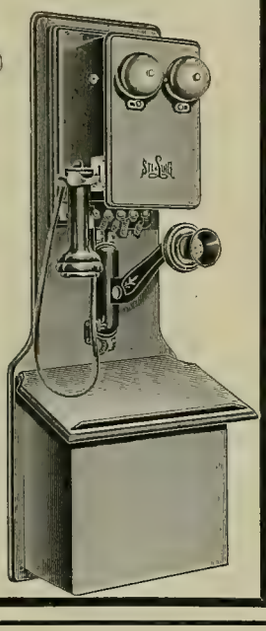

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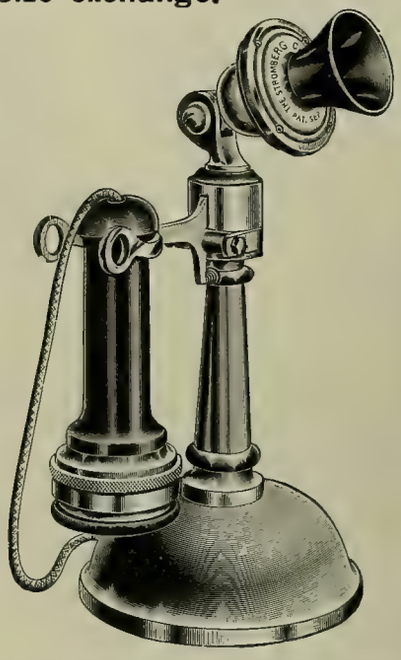

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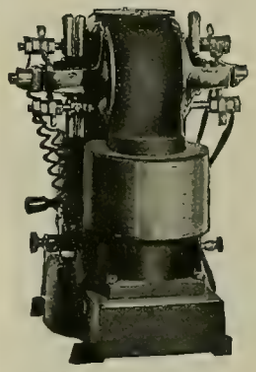

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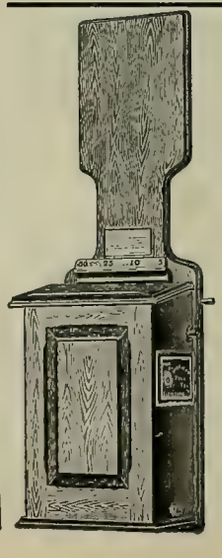

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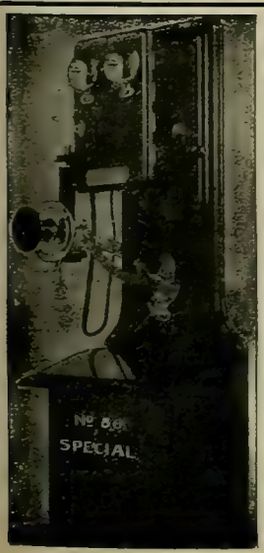

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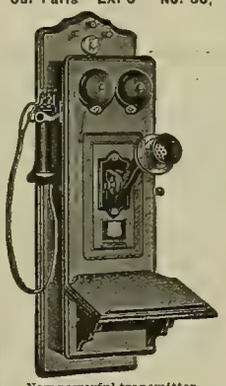

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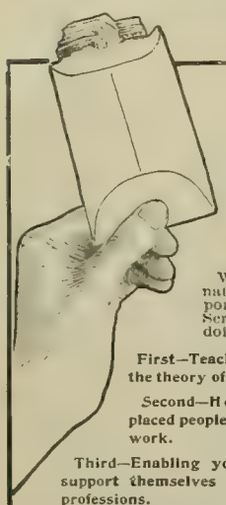

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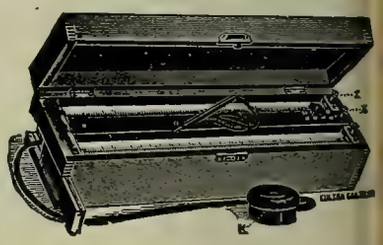

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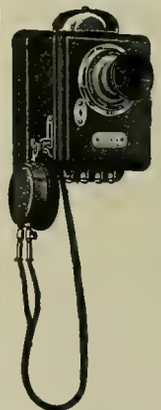

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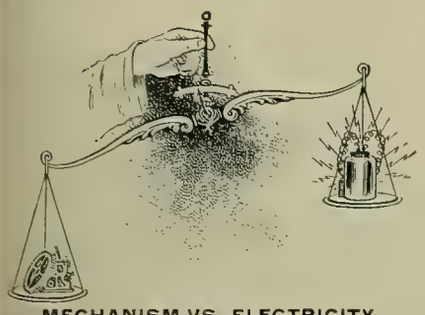

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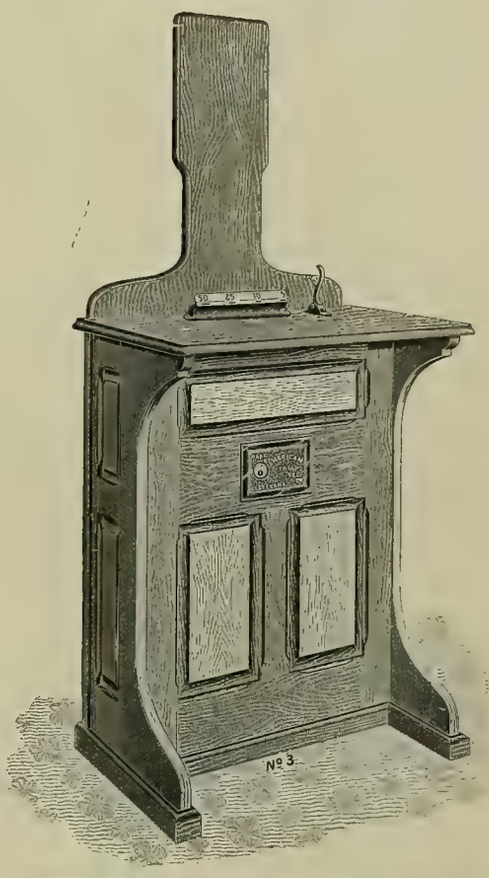

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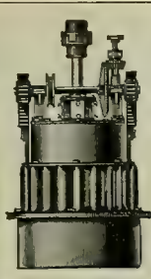

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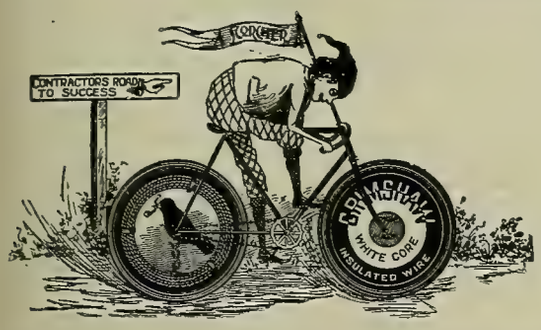

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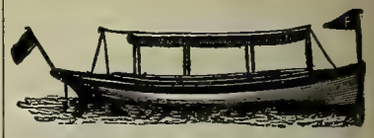
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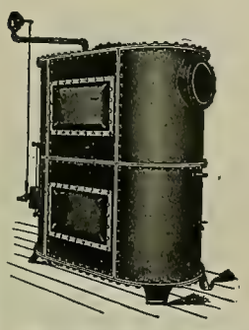

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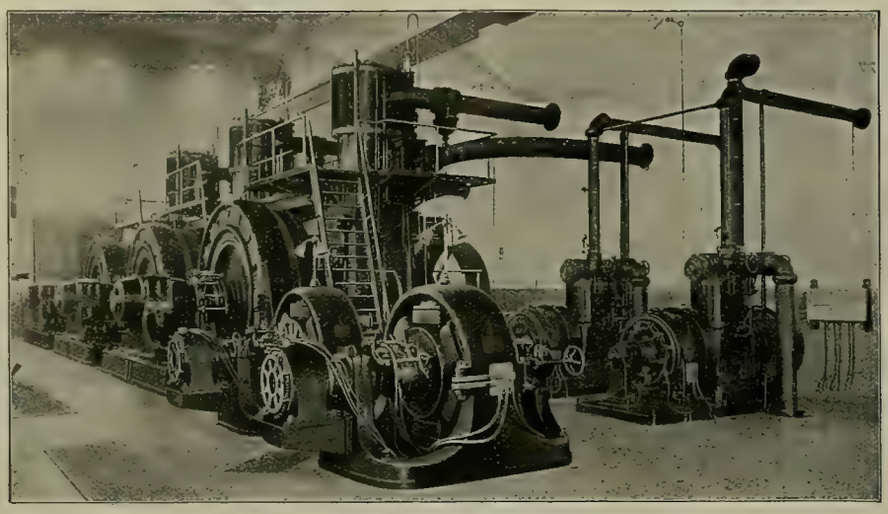

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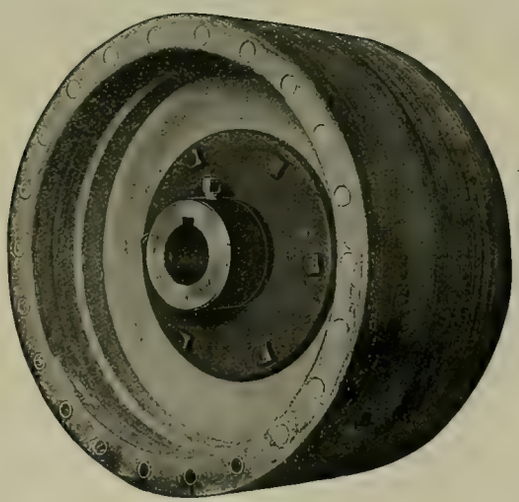

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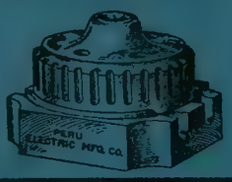

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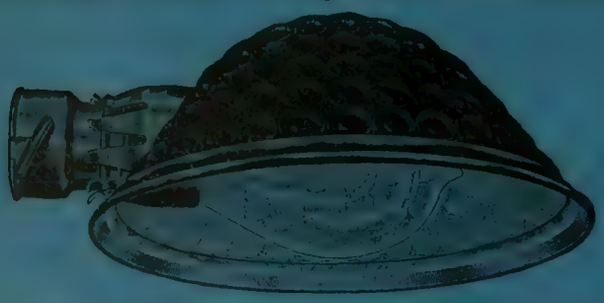

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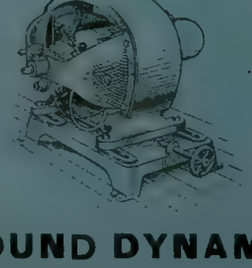

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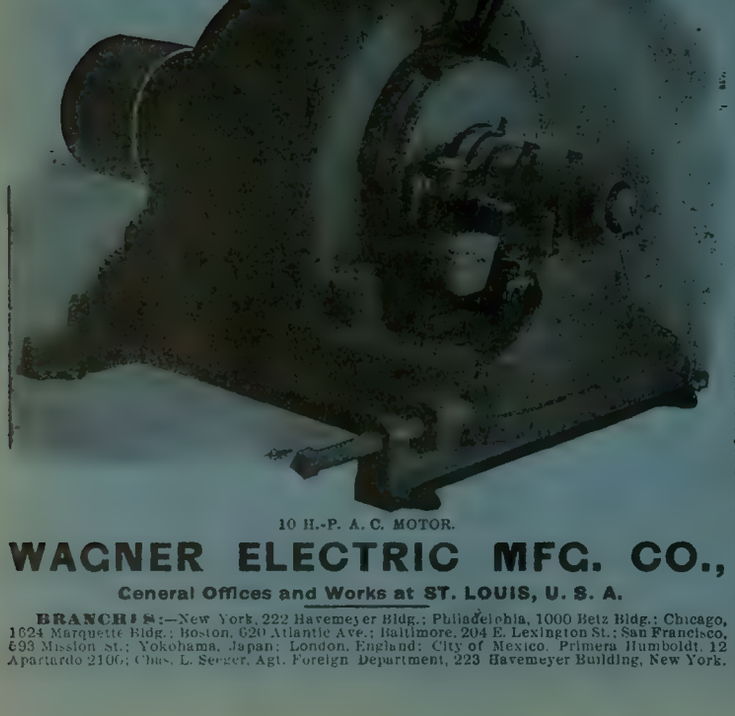

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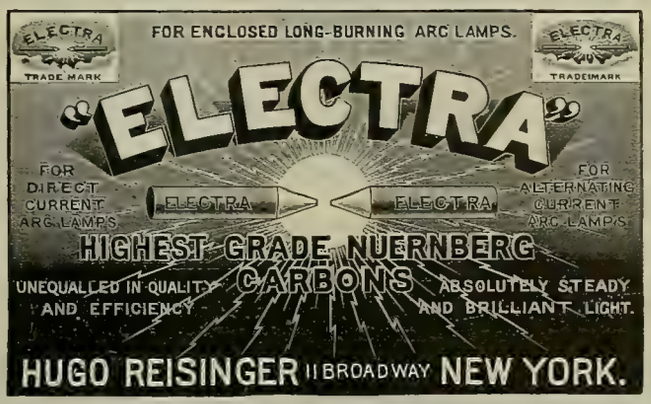

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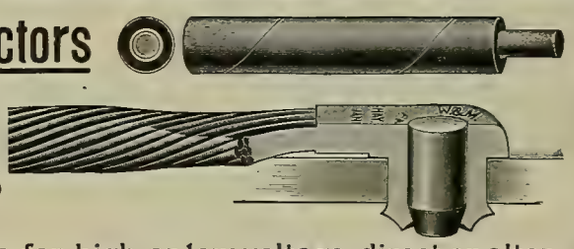

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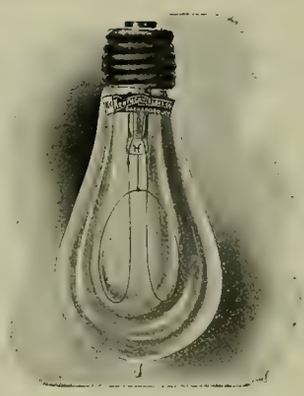

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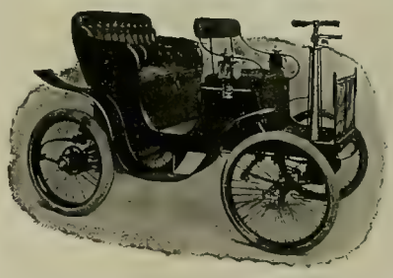

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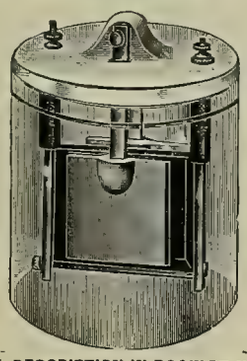

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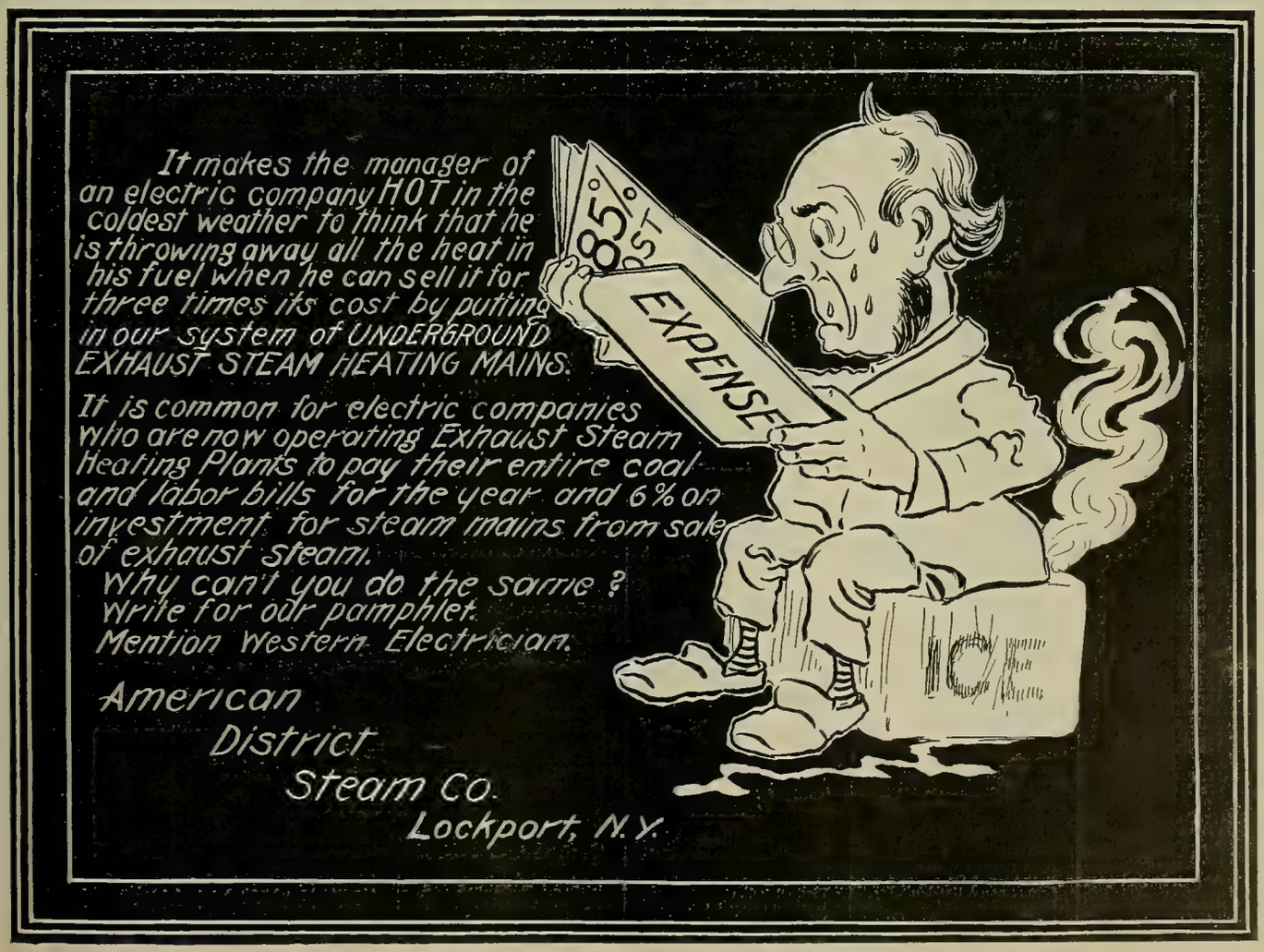

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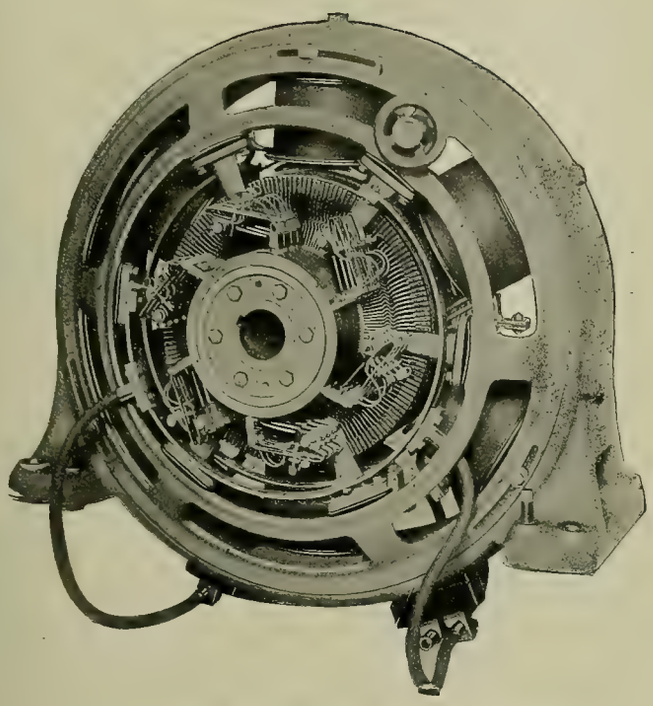

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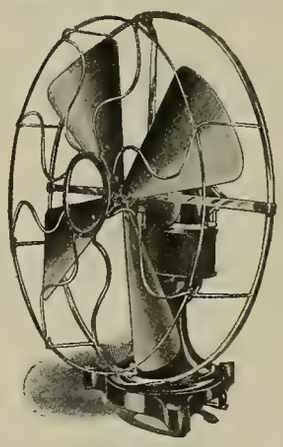

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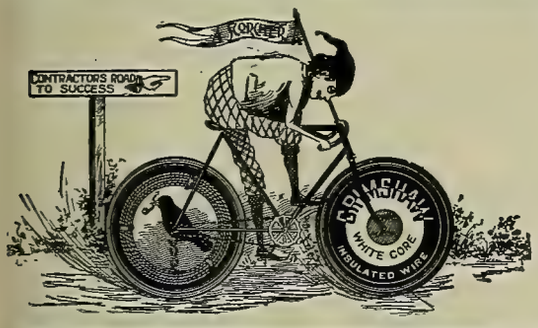

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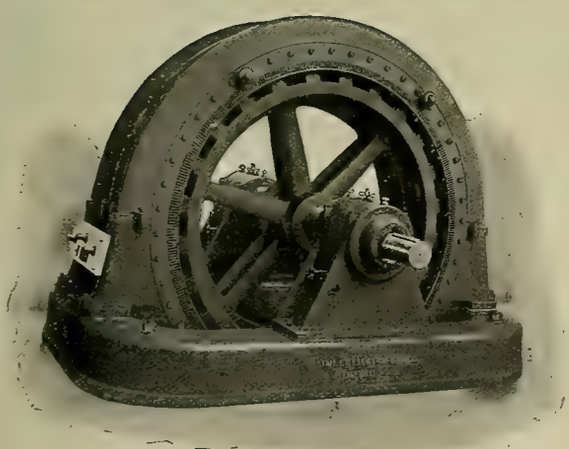

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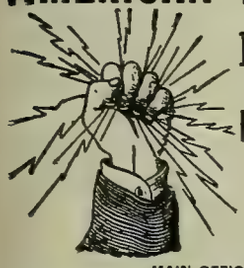

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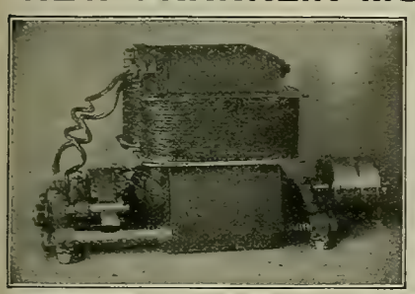

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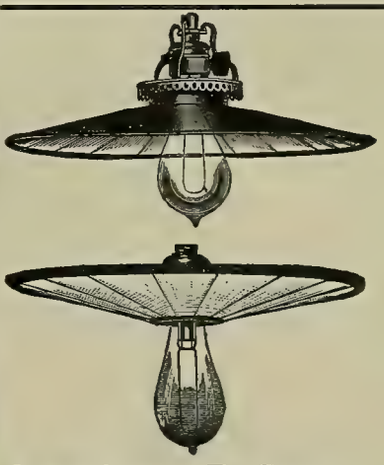

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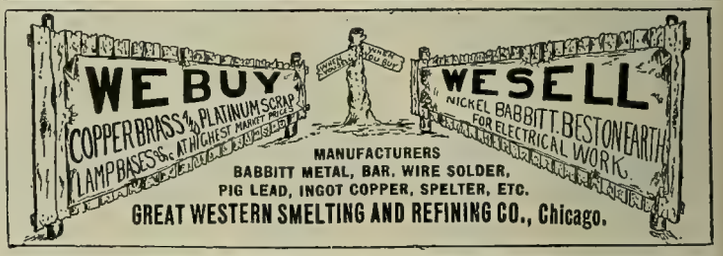

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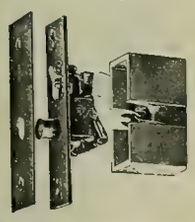

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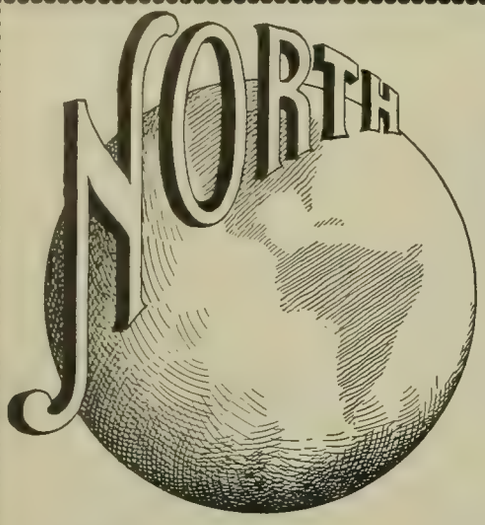

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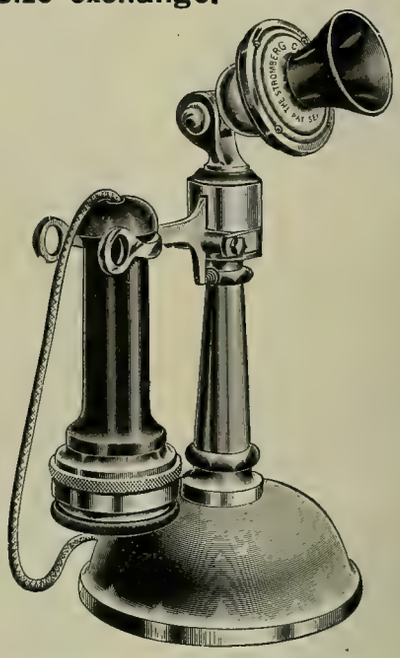

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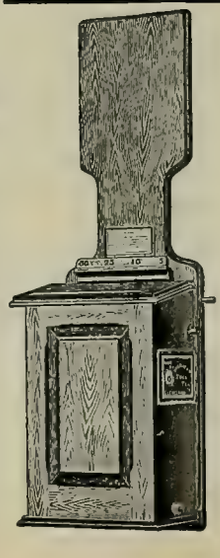

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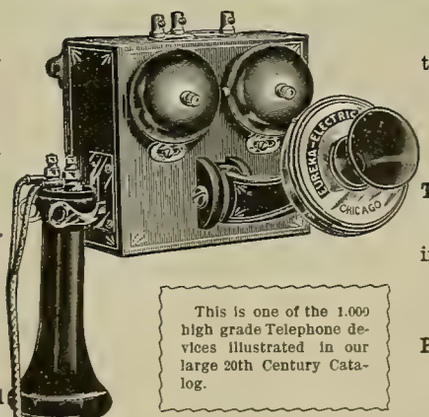

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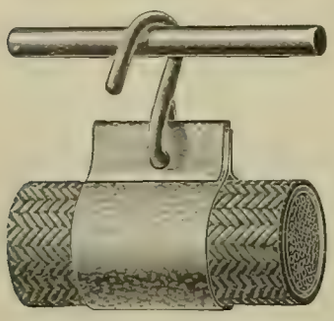

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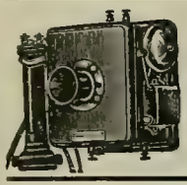

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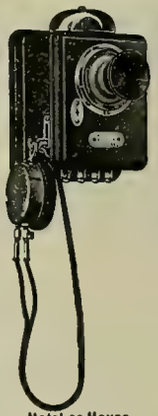

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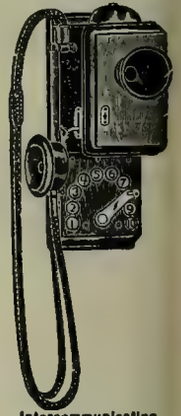

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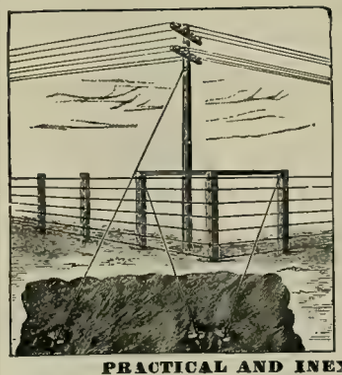

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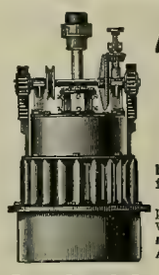

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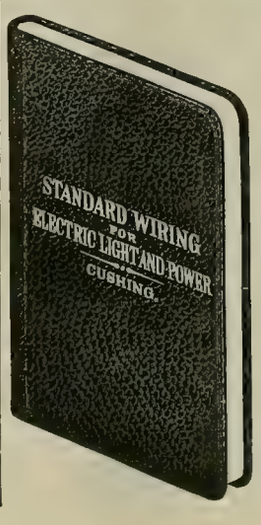

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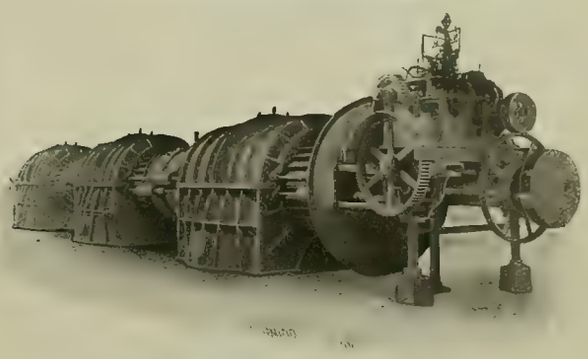

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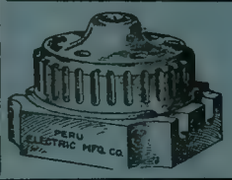

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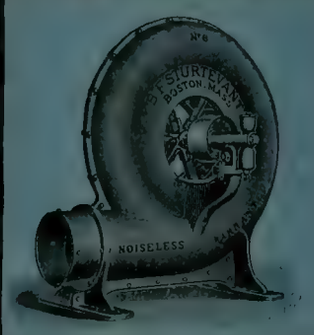

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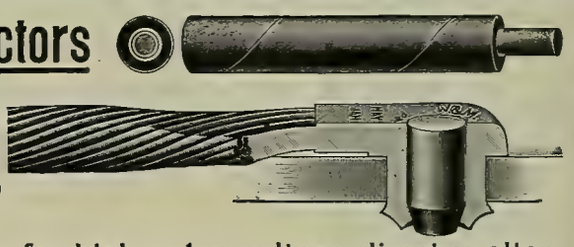

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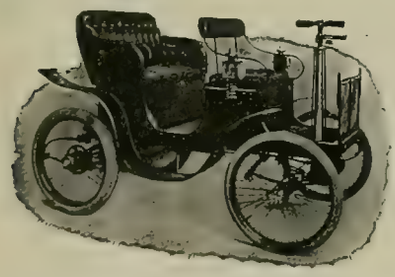

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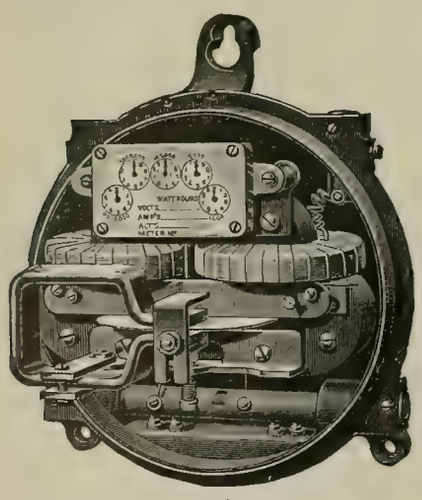

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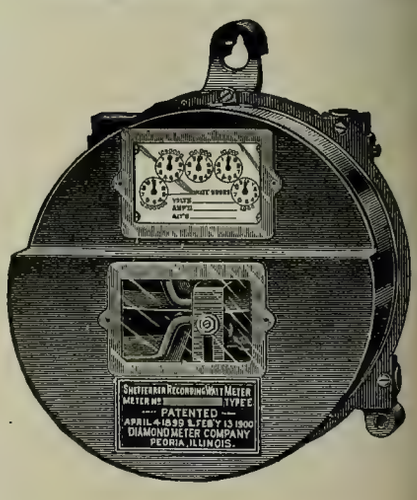

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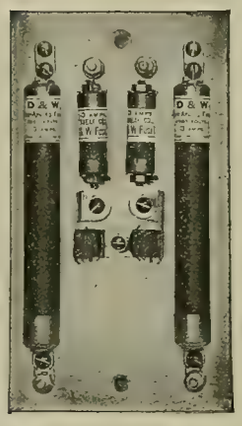

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All standard fans wound for direct arc circuits of any amperage at same price as 110 volt. All ceiling fans have blades with 60-inch sweep.

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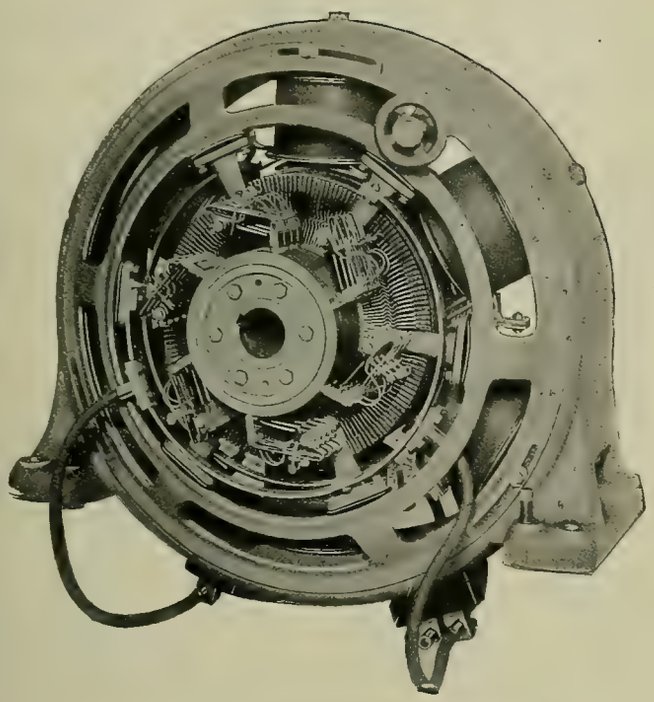

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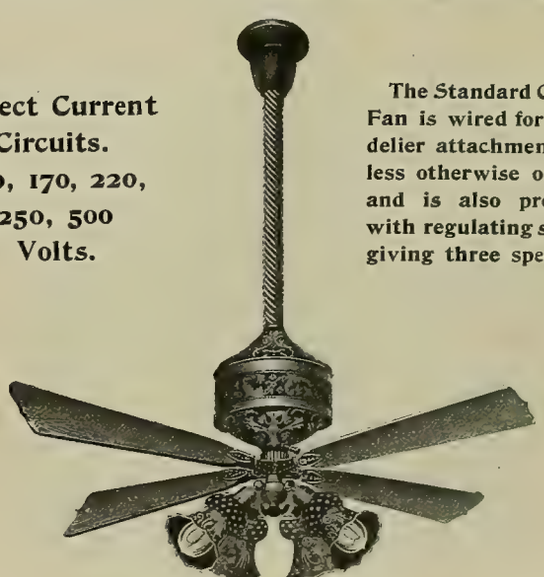

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Fitted with

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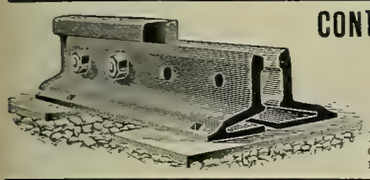

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Our Potential and Current Indicators are designed for small plants where price is an object. No feature essential to a perfect instrument is lacking; it is small, plain, accurate and durable and the price is very low.

"Aone" Portable Test Set.

Willyoung Instruments.

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X-RAY MACHINES,
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SIMPLICITY, DURABILITY, REFINEMENT OF DESIGN are the first points considered by prospective arc lamp buyers. **The Belden Arc Lamp** excels not only in the above points but in many others. Users pronounce it the most satisfactory lamp on the market.

It burns a minimum of 250 hours. No alignment necessary. Trims easier than an open arc lamp. Allows easy access to every part of lamp. Gives absolutely steady light.

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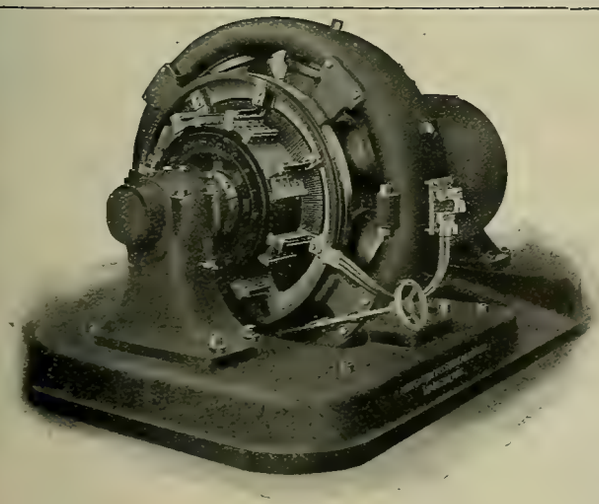
We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.



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Generators and Motors.

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Think of it! The lamp is the point of consumption of the whole energy of your lighting circuit!
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Be it little or big, it is worth saving.
You can put in Packard lamps for just a trifle more on the first cost.

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Candelabra, Series, Decorative, Battery and Miniature Lamps are the standard for the world.

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Smith's Incandescent Lamp Controller.

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Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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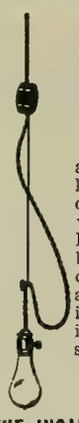

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HAIR SPRINGS
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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

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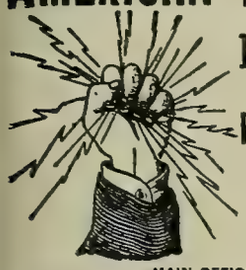

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INCANDESCENT AND FLEXIBLE CORDS,
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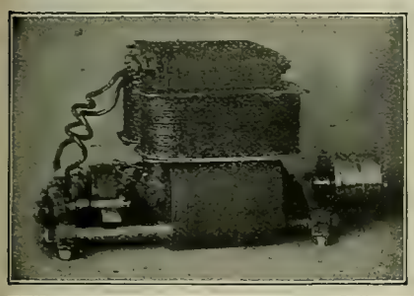

Sets of castings and material furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron contains eight slots. Pulley for round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Run as motor will drive sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 6-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with these machines. Full size detail blue prints furnished with each set of material, showing how to connect for both SERIES and SHUNT windings.

The change can be made from one winding to the other whenever desired.

Write for Dynamo Circular No. 16.

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NEW PRICE FOR 1901.

ASPHALT PAPER CONDUIT

GUARANTEED TO STAND 50 VOLTS.

UNDERGROUND AND INTERIOR.

An absolute Non-Conductor. Guarantees perfect insulation. No bonding of cables in its use. Life of cable longer, construction cheaper and more rapid, using only ordinary labor. The better service obtained through it justifies its use. **Guaranteed Absolutely Electrolysis Proof.** Made in 7 foot lengths, 3 in. internal diameter. Weight, 2 lb. to foot. Made in desired sizes from 2 to 8 inches. Price, F. O. B. destination, cheaper than any conduit on market.

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

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THE LUNDELL "SPLIT-POLE" GENERATOR

Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

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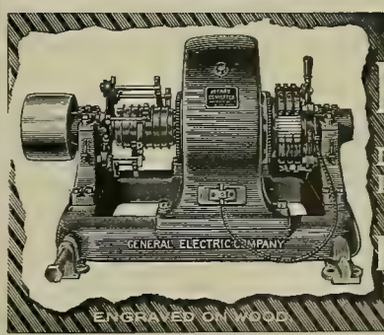

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DESIGNING AND ILLUSTRATING.
Write for specimens.
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1. EUREKA PACKING, with a RED DIAMOND LABEL, more power, lasts longer, costs less than any other good packing.
2. HINE ELIMINATOR gives dry steam to engine, keeps oil out of the boiler.
3. IMPROVED ROBERTSON-THOMPSON INDICATOR—a grand adjunct and at very moderate cost.
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Young man to assist in engineering department of concern manufacturing dynamos and motors. Good chance for young electrical engineer graduate to get started. When replying give experience, if any, and compensation expected. Address "WESTERN CONCERN," care Western Electrician, 510 Marquette Building, Chicago.

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For an electric light and ice plant, an experienced engineer capable and willing to make his own repairs. Must have from $1,500 to $2,500 to invest. Will pay a good salary to the right man. Address "G," care Western Electrician, 510 Marquette Bldg., Chicago.

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Assistant to designer of direct current dynamos and motors. Technical graduate with past experience preferred. When replying give past experience and salary desired. Address "ASSISTANT," care Western Electrician, 510 Marquette Building, Chicago.

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Good hustling agents in every large city in United States to handle our goods, which are new and novel and have no competition. Also salesmen to handle same as side line on the road. Correspondence solicited. Room 4, 116 Bedford St., Boston, Mass.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,

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WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
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We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

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WE OFFER FOR IMMEDIATE SHIPMENT

2 100 K. W., 500-volt Edison bipolars.
1 75 K. W., General Electric, 500-volt, 4 pole.
1 120 K. W., A. S. type, General Electric Alternator.
3 120 K. W., A. type, General Electric Alternators.
1 240 K. W., Stanley two-phase, 1,000 or 2,000 volts.
1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
1 65 Light, Brush Arc, 10 amperes.
1 40 Light, Western Electric Brush Arc.
1 600 H. P., Ball cross-compound engine, 20x36x18.
1 200 H. P., Ball, 12x22x15 Tandem compound, with condenser.
1 175 H. P., Ideal, 12x20x14 Tandem compound.
2 18½x18 Ideal engines.
1 14½x15 McIntosh & Seymour engine.

BOILERS, MOTORS, PUMPS.
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For use in Electric Plants and Power Stations.

Bink's Dry Non-Flame Paint.

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THE ELECTRIC COMPANY OF AMERICA,
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This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Out-Outs

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Guarantees Satisfaction

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2 12-light Edison, ¾ K. W., self-oilers.
1 25-light Wenstrom.
4 35-light Gibbs, M. P., slow speed, comp., brand new.
1 50-light Hawkeye.
1 50-light Nowotny, self-oiler.
1 50-light Card, multipolar, self-oiler, slow speed, 1150 R. P. M.
1 50-light Crocker-Wheeler, slow speed, self-oiler.
3 55-light Gibbs, M. P., compound, brand new, moderate speed.
4 55-light Gibbs, M. P., compound, brand new, slow speed, 1100 R. P. M.
1 55-light Siemens & Halske, type B., M. P., slow speed, self-oiler, brand new.
1 60-light Thomson-Houston.
1 60-light Westinghouse.
1 80-light Siemens & Halske, type L. H., self-oiler, brand new.
2 80-light Siemens & Halske, ironclad type, M. P., self-oilers, brand new.
1 100-light Bain, compound, self-oiler.
1 100-light J. & C., self-oiler.
4 110-light Gibbs, M. P., compound, self-oilers, slow speed, brand new, 1000 R. P. M.
1 110-light Siemens & Halske, M. P., Churchward type, compound, extra slow speed, brand new, 650 R. P. M.
3 150-light Gibbs, M. P., compound, self-oilers, speed 1650.
1 150-light Gibbs, M. P., shunt, self-oiler, slow speed, 825 R. P. M.
1 160-light Card, self-oiler.
2 180-light Siemens & Halske, M. P., self-oilers, brand new.
1 200-light Western Electric, self-oiler, comp.
2 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske, 12 K. W.
2 210-light Siemens & Halske, M. P., brand new, type B., self-oilers.
4 210-light Gibbs, M. P., self-oilers, very slow speed, 725 R. P. M., brand new.
1 250-light Westinghouse.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

BARGAINS--FOR SALE.

110-Volt Incandescent Dynamos.—Continued.

1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected to Case engine, compound.
2 270-light Westinghouse, M. P., slow speed, 15 K. W.
1 300-light Columbian, multipolar, comp., self-oiler, slow speed.
4 300-light Gibbs, M. P., self-oilers, slow speed, 725 R. P. M., brand new.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, compound.
1 350-light Edison, 20 K. W., self-oiler.
6 350-light Siemens & Halske, type L. H., self-oilers.
1 360-light Duplex, multipolar, self-oiler, compound, slow speed.
3 500-light Siemens & Halske, type L. H., self-oilers, brand new.
4 540-light Edison, 30 K. W., self-oilers, compound.
1 600-light Eickmeyer.
2 700-light Westinghouse, 10 pole, slow speed, 40 K. W., self-oilers, 575 R. P. M., brand new.
2 800-light Edison, 45 K. W., self-oilers.
1 1200-light Siemens & Halske, type L. H., 70 K. W., self-oiler.
1 1350-light Siemens & Halske, Type I, 80 K. W., for direct connection, 8 pole.
3 1500-light Siemens & Halske, type L. H., self-oilers, 100 K. W.
1 1500-light Siemens & Halske, 100 K. W., type I., 6 pole, for direct connection, brand new.

220-Volt Generators.

Rheostat, base-frame and pulley accompany each machine.

1 8½ K. W. Westinghouse, multipolar, self-oiler.
1 9 K. W. Lundell, self-oiler.
1 10 K. W. Lundell, self-oiler, multipolar, slow speed.
1 12 K. W. Edison, self-oiler.
1 15 K. W. Edison, compound, self-oiler.
1 30 K. W. Siemens & Halske, M. P., ironclad type, self-oiler, brand new.
1 45 K. W. Edison, compound, self-oiler, new armature.
1 50 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.
1 marble panel switchboard for above.
1 100 K. W. Siemens & Halske, M. P., Churchward type, self-oiler, brand new, for direct connection.

500-Volt Generators.

2 15 K. W. Edison, self-oilers.
1 15 K. W. T.-H., self-oiler.
1 35 K. W. Mather, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, self-oilers, very slow speed, 475 R. P. M.
1 45 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse compound engine, 14 x 24 x 14, all complete, fine.

Alternating Generators.

1 350-light Thomson-Houston, A. 18.
1 600-light Thomson-Houston, A. 6.
1 600-light Thomson-Houston, 30 K. W., two-phase.
1 600-light Thomson-Houston, 30 K. W., slotted armature.
2 600-light General Electric, A. 30, toothed armature.
2 650-light Thomson-Houston, A. 35.
2 750-light Westinghouse, 37½ K. W.
1 900-light Warren, 45 K. W., 1100 volts.
1 1000-light Wood, 50 K. W., self-oiler.
1 1000-light Siemens & Halske, 50 K. W., self-oiler, 60 cycle.
1 1200-light National, with exciter.
1 1200-light Siemens & Halske, 60 K. W., Churchward type, brand new, 60 cycle, single-phase, 1100 volts, with exciter.
1 50 K. W. Siemens & Halske, Churchward type, brand new, 60 cycle, two-phase, rotary transformer, 1100 volts, alt. to 250 volts direct, complete, with marble panel switchboard.
1 1200-light Westinghouse, 60 K. W.
1 1200-light Thomson-Houston, 60 K. W.
1 1200-light Warren, 60 K. W., self-oiler.
1 1200-light General Electric, A. 60.
2 1300-light Thomson-Houston, A. 70, 1100 or 2200 volts.
1 1500-light Wood, 75 K. W., self-oiler.
1 1500-light General Electric, monocyclic, 75 K. W., self-oiler, 60 cycle.
1 1800-light National, 90 K. W.
1 4000-light Wood, 200 K. W., self-oiler.

Arc Dynamos.

1 20-light 2000 C. P. Western Electric.
1 30-light 1200 C. P. T.-H., K. 12.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 1200 C. P. Wood No. 6.
3 40-light 2000 C. P. Western Electric, self-oilers.
2 45-light 1200 C. P. T.-H., M. 12, ball arm.
2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12.
1 50-light 2000 C. P. T.-H., M. D. 2.
2 60-light 2000 C. P. Western Electric, self-oilers.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Ball, 4 amp.
1 65-light 2000 C. P. Brush, No. 8.
2 75-light 1200 C. P. Wood, with new arm'e.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westing'se, self-oilers.
3 125-light 1200 C. P. Excelsior, latest type.

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Battery Hanging Lamps $10.00
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Genuine Electric Insoles, .25
Telegraph Outfits, - - 2.75
Battery Motors from $1 to 12.00
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Necktie Lights, 75 cts. to 3.00
Bicycle Electric Lights, 2.25
Electric Cap Lights, - 2.00
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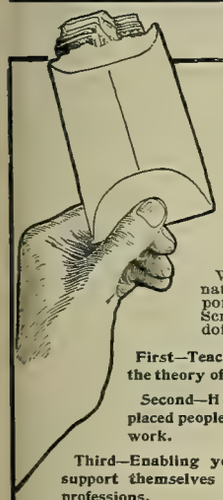

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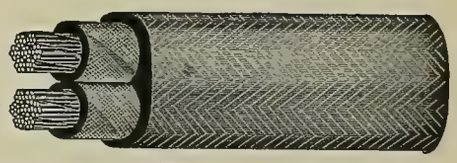

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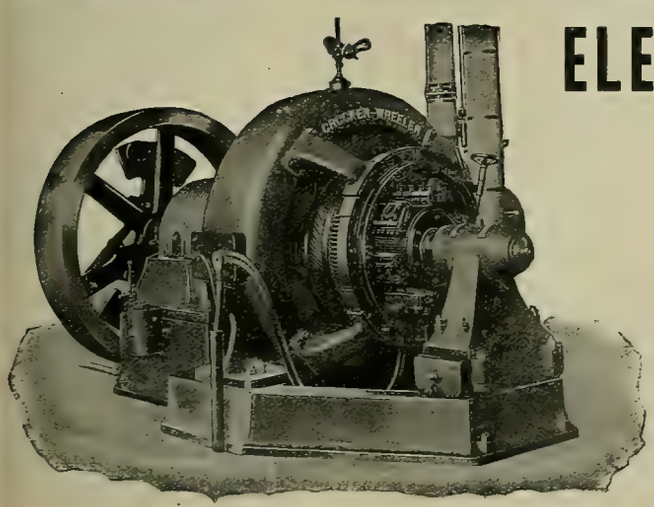

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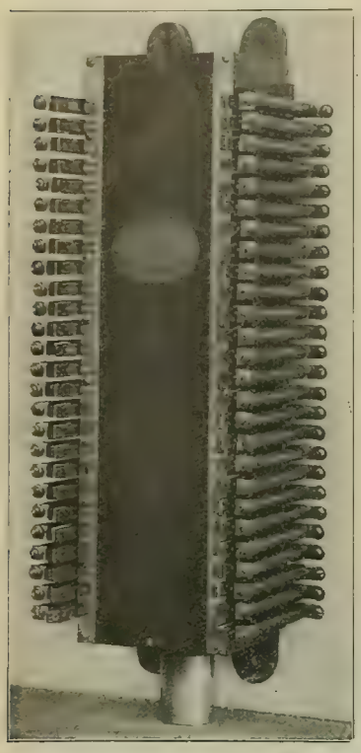

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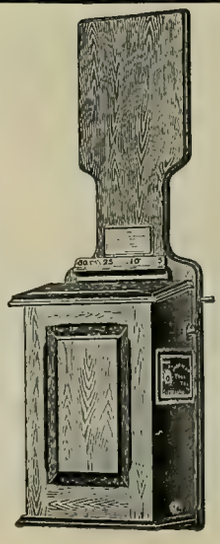

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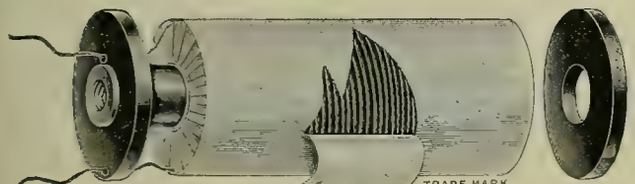

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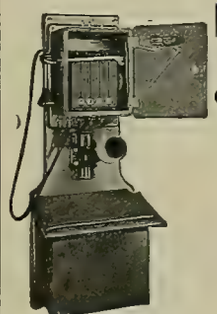

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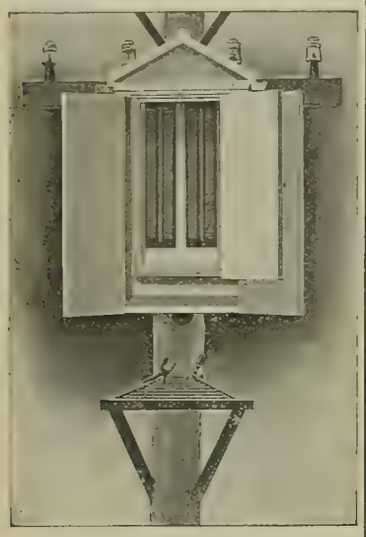

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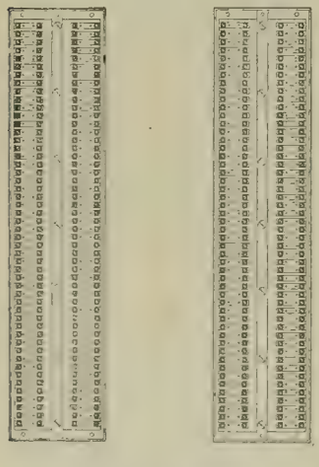

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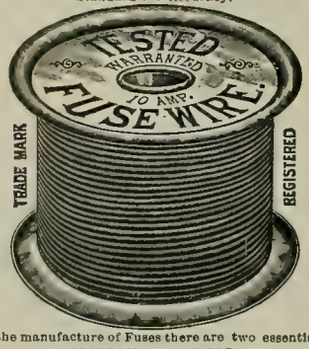

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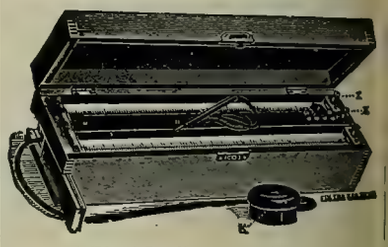

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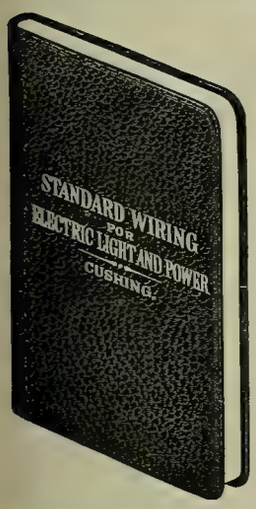

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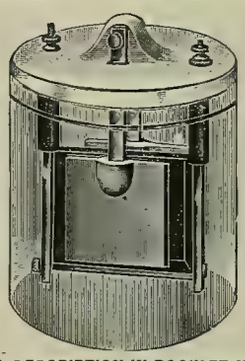

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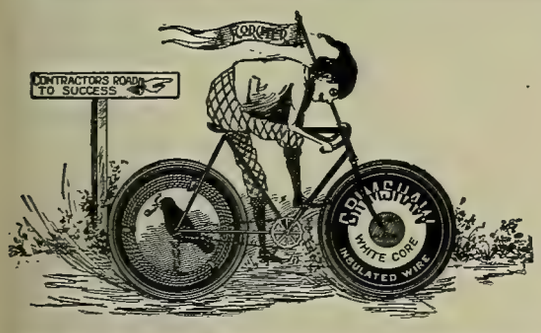

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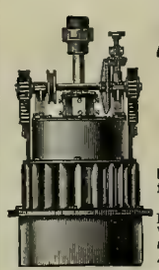

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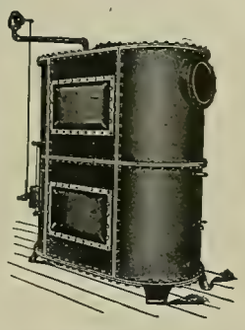

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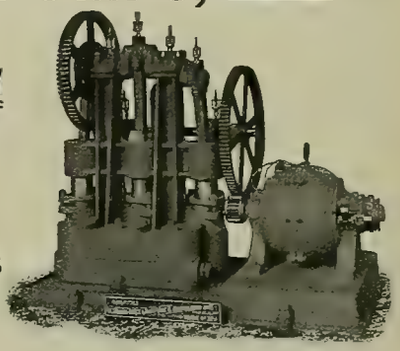

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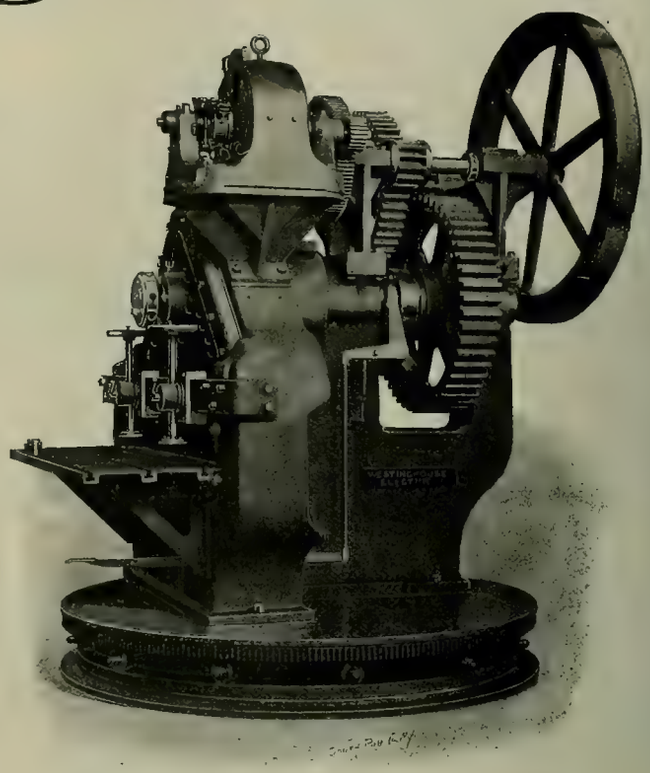

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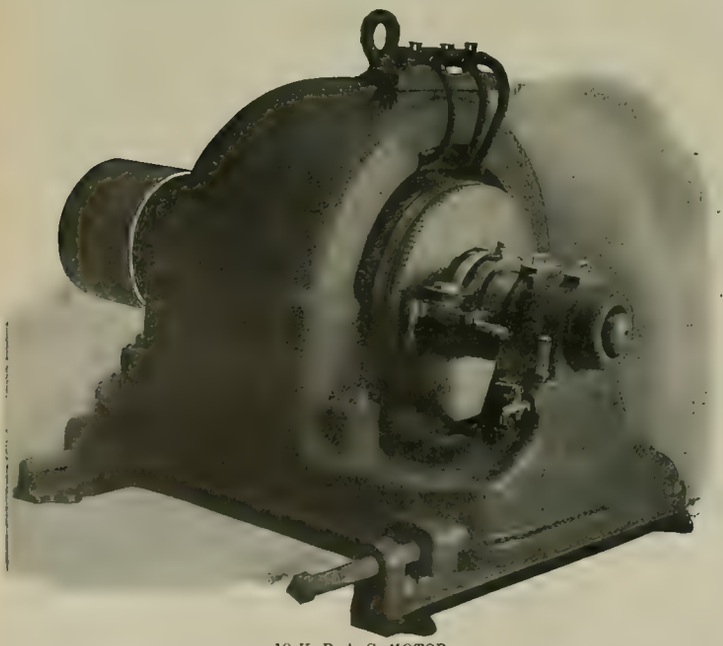

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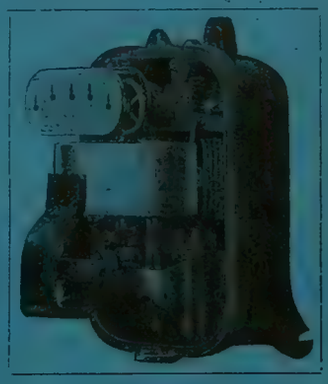

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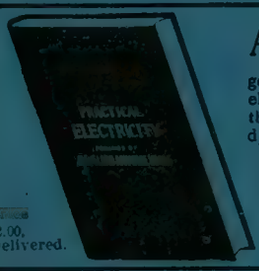

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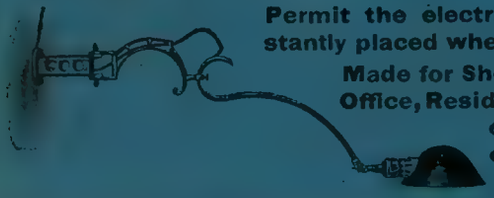
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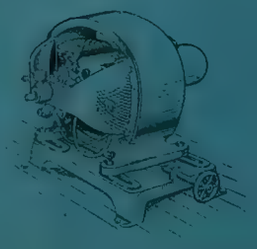

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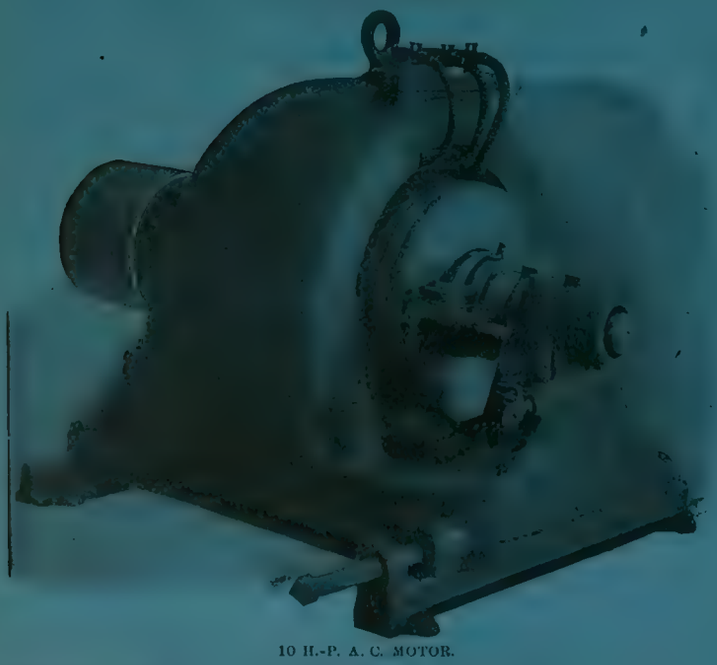

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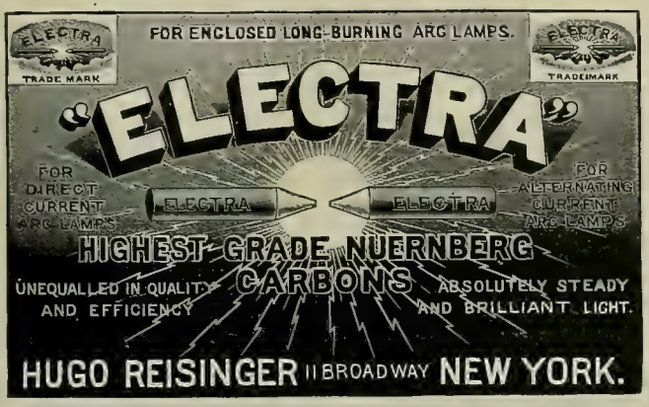

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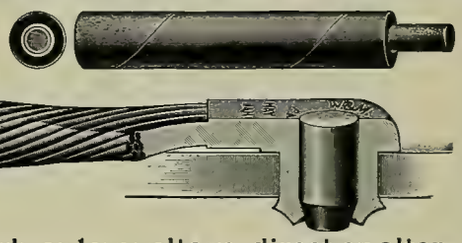

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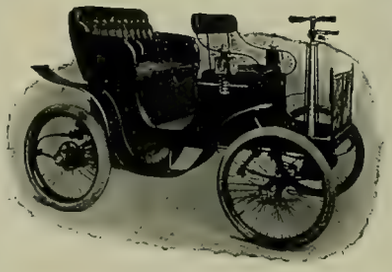

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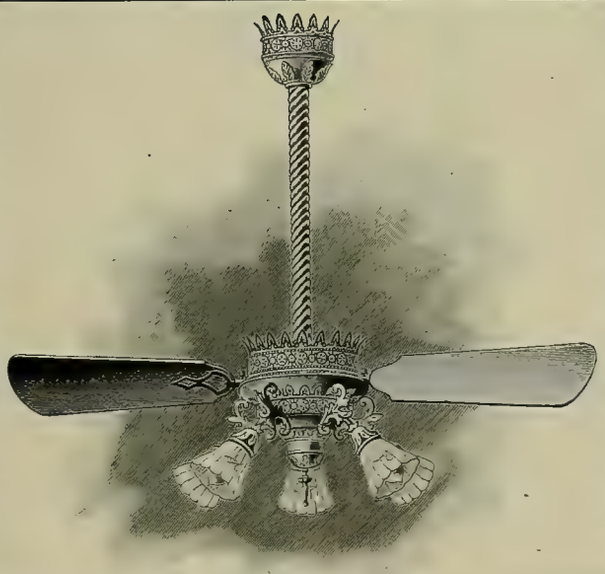

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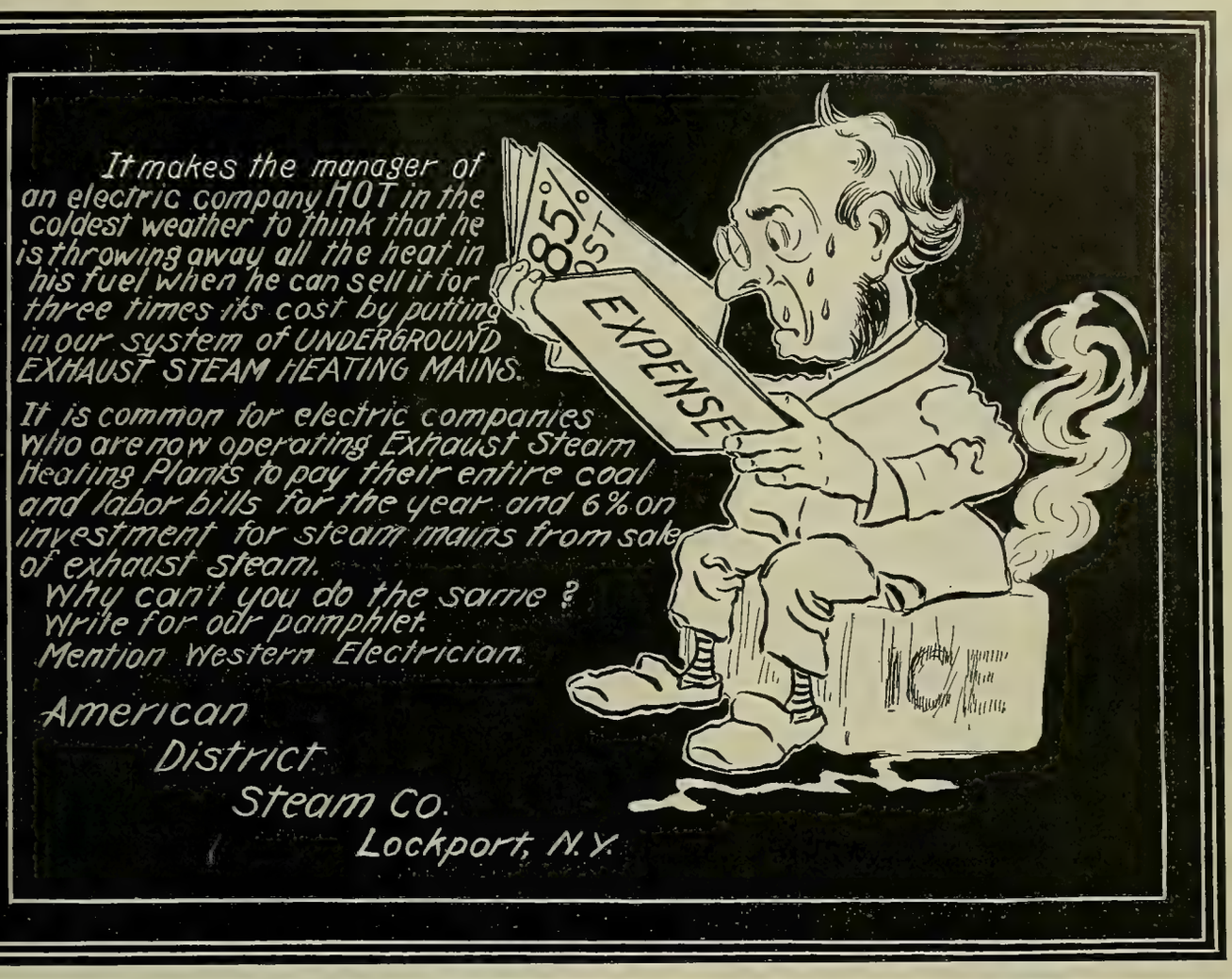

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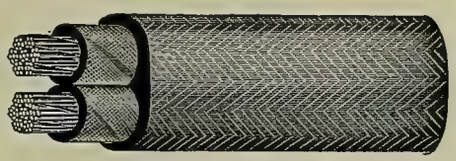

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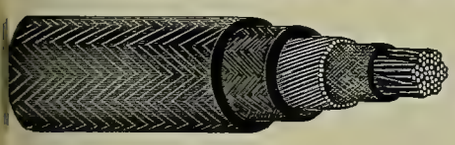

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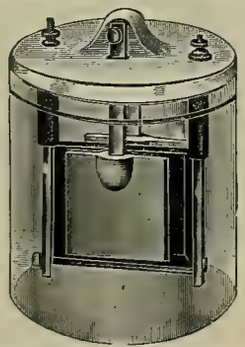

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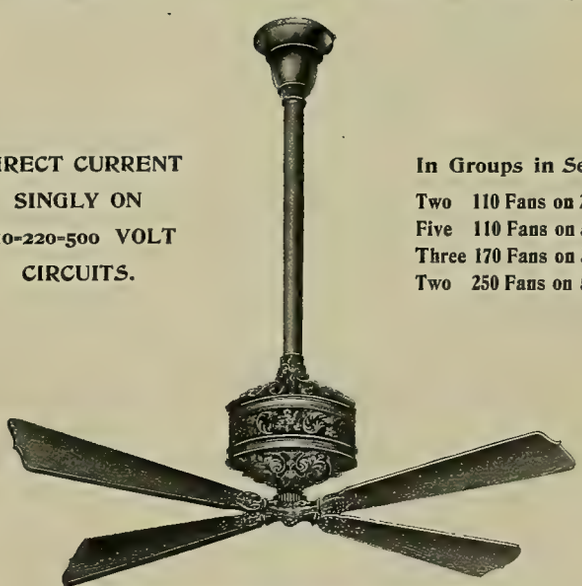

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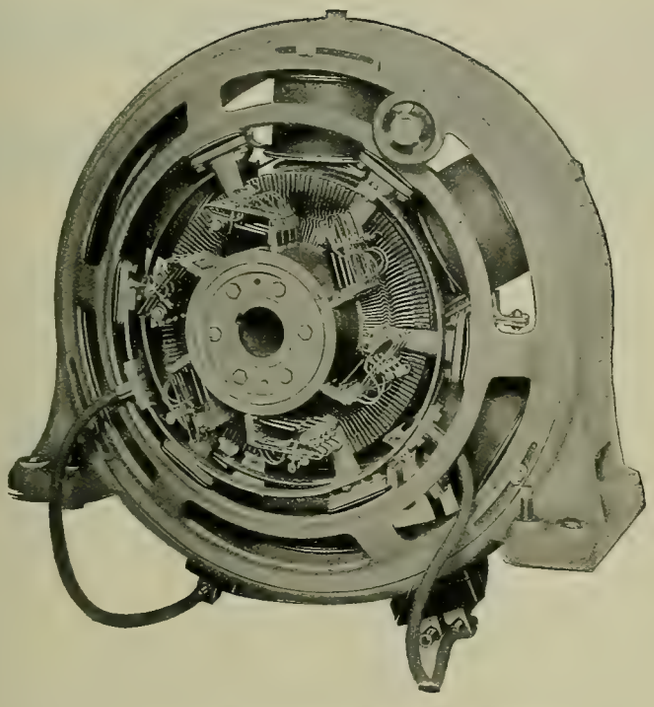

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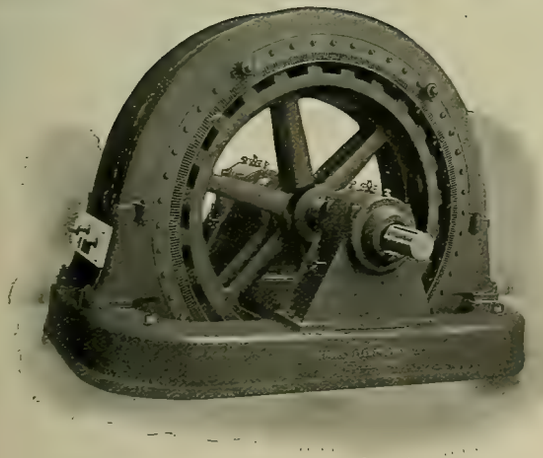

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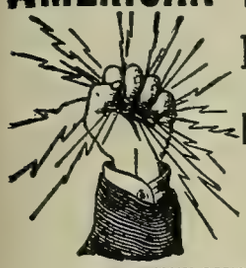

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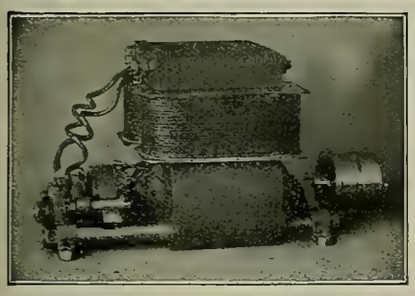

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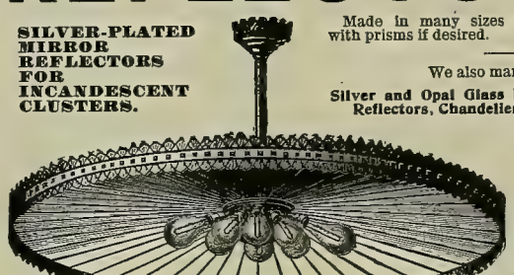

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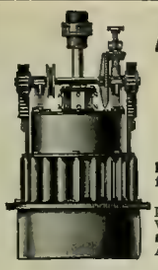

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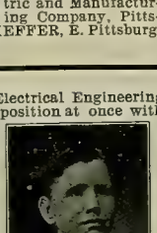

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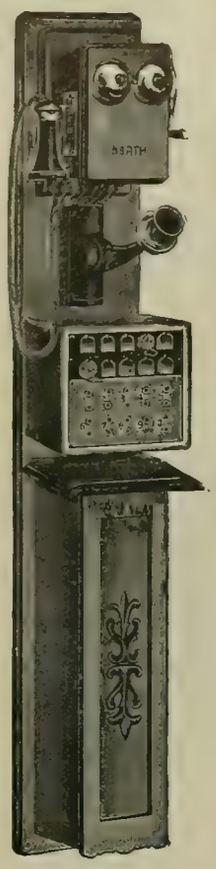

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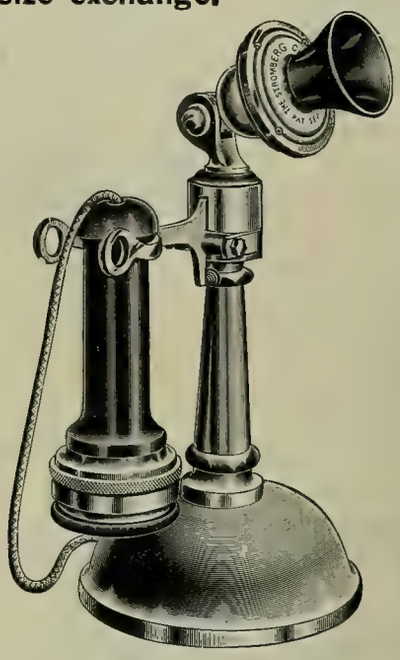

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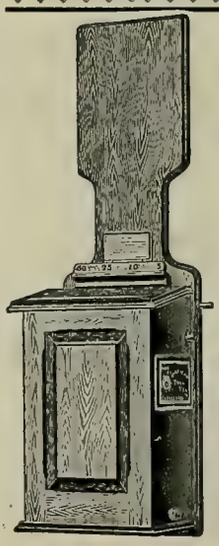

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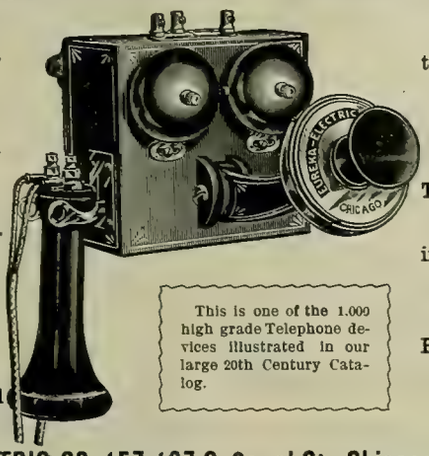

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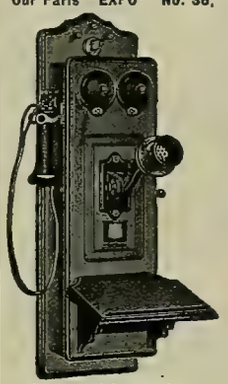

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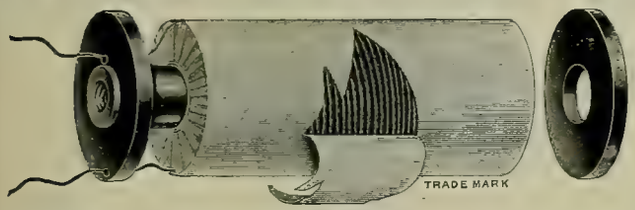

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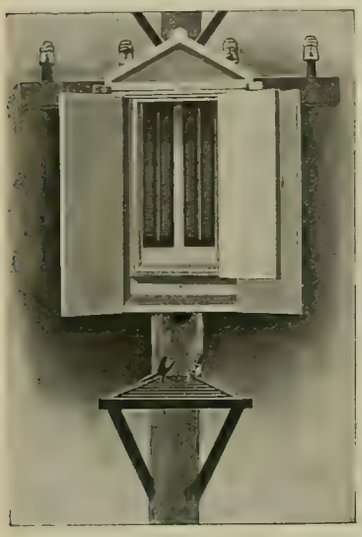

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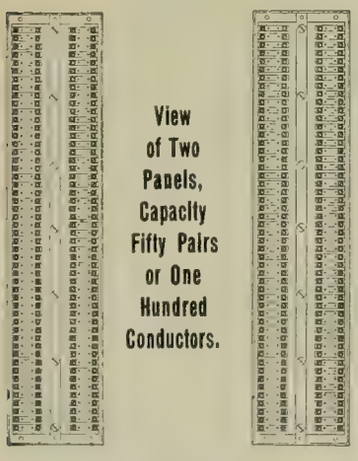

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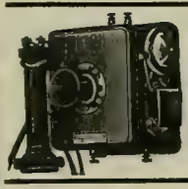

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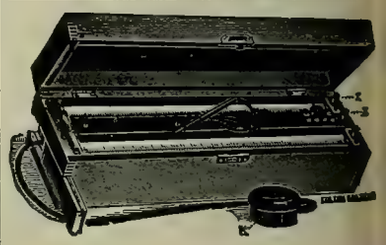

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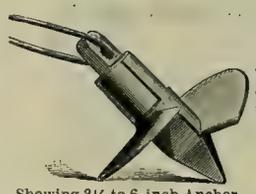

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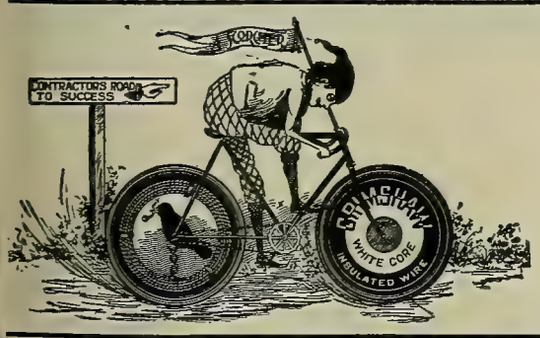

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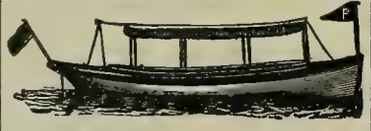

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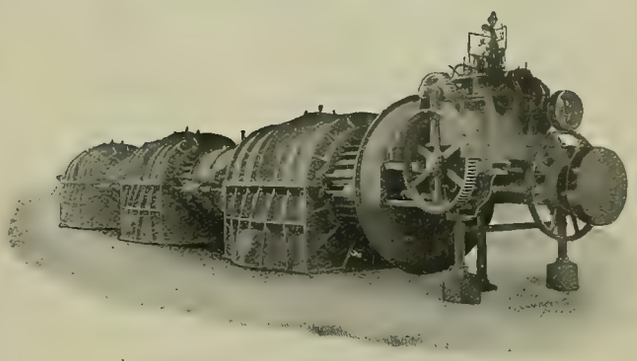

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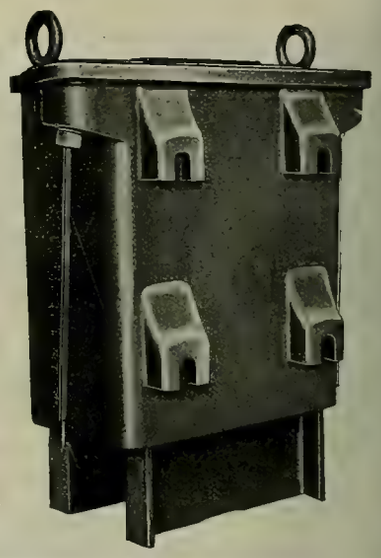

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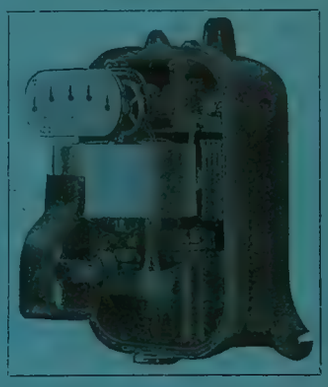

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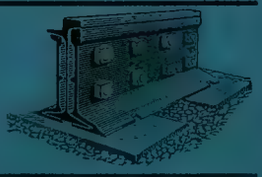

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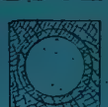
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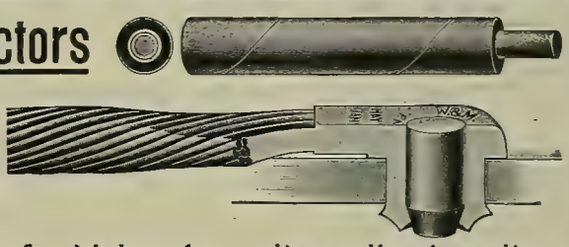

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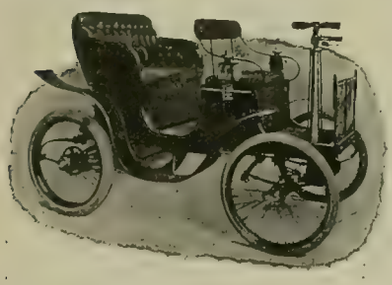

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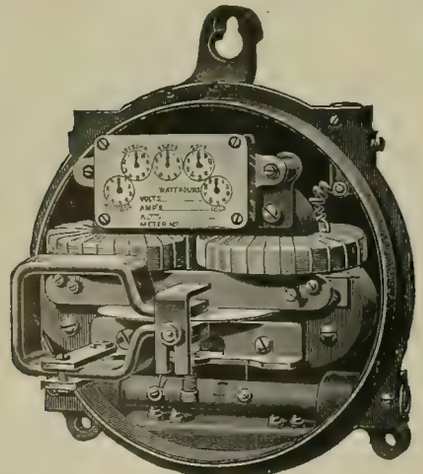

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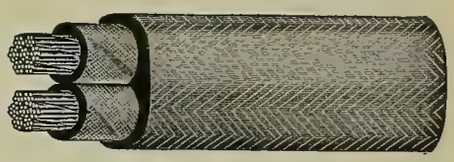

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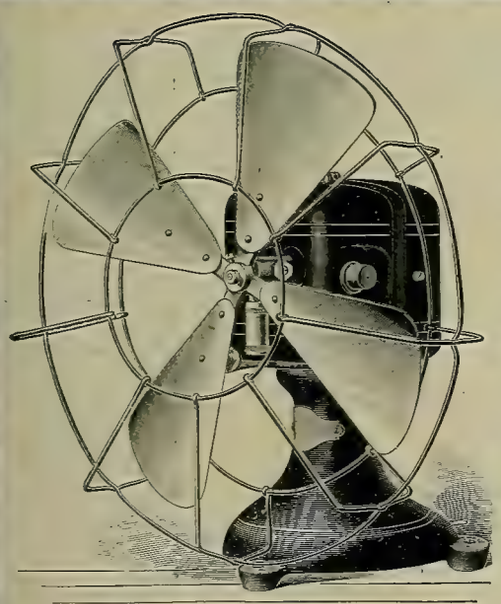

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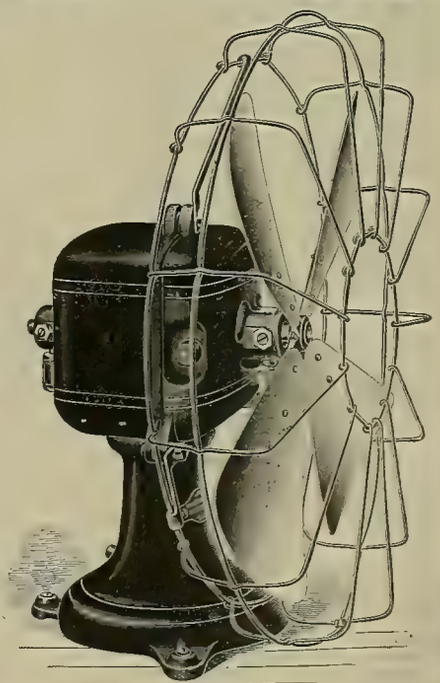

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Gregory Electric Co.
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Schureman & Hayden.
Walsh's Sons & Co.

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Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
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Cream Flux Co.

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Crest Manufacturing Co.

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Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

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Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

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Barnes Co., The Wallace.
Manross, F. N.

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Bossert Elec. Const. Co.

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American Bridge Co.

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Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
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American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Central Electric Co.
Central Tele. & Elec. Co.
Century Telephone Cons. Co.
Chicago Telephone Sup. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
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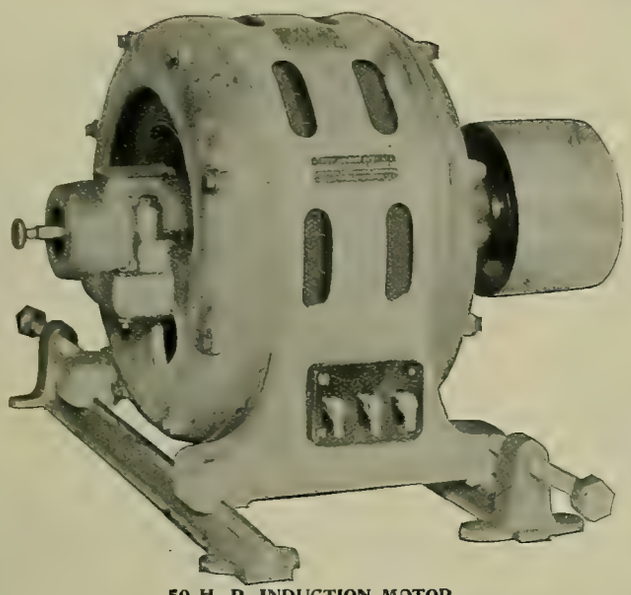
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

Woodwork, Electrical.
Noblett, E. J.

X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 3.

THE GENERAL ELECTRIC COMPANY'S
INDUCTION MOTORS



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for mining machinery, pumping plants, textile mills and factories; are sparkless, economical, and require minimum attention.

WRITE FOR BULLETIN 4209.

GENERAL OFFICE: SCHENECTADY, N. Y.

Sales Offices in all Large Cities. Chicago Office, Monadnock Building.

WE CANNOT GIVE YOU A

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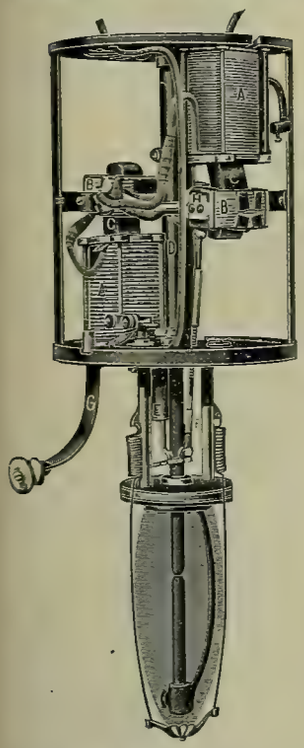

BUT WE CAN GIVE YOU AN

=Alternating= Arc Lamp Using =5 Amperes.=

We don't use an OSCILLATOR, but our new

"DIVIDED COIL" MECHANISM.

This does away with choke coils, springs and moving iron.

NATIONAL ARC LAMP CO.,
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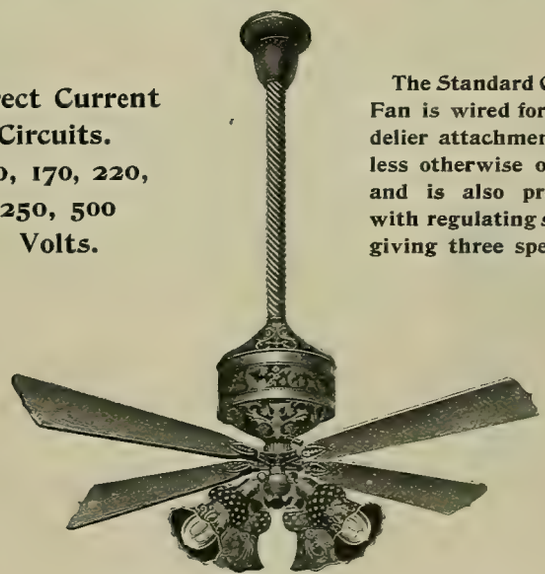
Direct Current Circuits.
110, 170, 220, 250, 500 Volts.

The Standard Ceiling Fan is wired for chandelier attachment unless otherwise ordered and is also provided with regulating switch giving three speeds.



STANDARD CEILING FAN WITH CHANDELIER ATTACHMENT.

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Stewart Patent Cord ADJUSTER.

(Patented August 21, 1900.)

Cuts illustrate two methods of adjustment.

A device everyone wants.
Can be used on any size of cord.
Can be adjusted easily.
Can be used after rosette and socket are connected.
Made of fiber.
Sold as cheap as common wood adjusters.
Order from your supply house or us.
Same price everywhere.

SAMPLES FREE.

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Manufacturers and dealers in
ALL ELECTRICAL SUPPLIES.
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MANHATTAN SERIES

A. C. Enclosed Arc Lamp System.

ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

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ALL OUR WIRES pass inspection and carry the above Trademarks on our tags. We also manufacture Grimshaw and Competition Tapes and Splicing Compounds.

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FOR ENCLOSED ARCS

Guaranteed superior to any imported Carbon in uniformity of size and straightness, or subject to return at our expense. Try us and be convinced.

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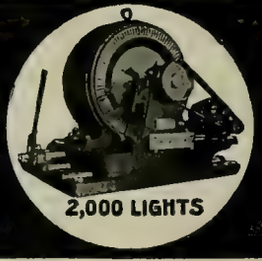
IMPROVED WARREN



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Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

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FROM 625 BROADWAY TO 447 BROADWAY, NEW YORK.

MANUFACTURERS OF THE "O. K." DRY BATTERY.

This Trade-Mark on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Out-Outs
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—MANUFACTURERS OF—

STEEL OUTLET AND JUNCTION BOXES, SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.

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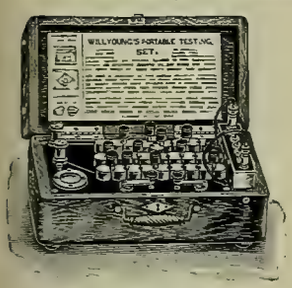
ONE OF OUR SPECIALTIES—
HERE IT IS—EVERY OTHER WEEK—
AND IT'S LITTLE STORY—ALL THE FINE POINTS—
KEYSTONE ELECTRICAL INSTRUMENT CO.

IT'S STORY—

A universally useful instrument. Designed for the measurement of voltage or power on both Direct and Alternating Current circuits. Dead-beat without the use of a mechanical brace. Reversing switch on every Volt-meter.

PHILA. PA.



"Aone" Portable Test Set.

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CONDUCTIVITY BRIDGES,
CABLE TESTING APPARATUS,
X-RAY MACHINES,
X-RAY TUBES,
FLUOROSCOPES,
STANDARD RESISTANCES.

Correspondence Invited. Circulars Free.

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SIMPLICITY, DURABILITY, REFINEMENT OF DESIGN are the first points considered by prospective arc lamp buyers. **The Belden Arc Lamp** excels not only in the above points but in many others. Users pronounce it the most satisfactory lamp on the market.

It burns a minimum of 250 hours. No alignment necessary. Trims easier than an open arc lamp. Allows easy access to every part of lamp. Gives absolutely steady light.

Our bulletins give further reasons why **The Belden** should receive your careful consideration before placing your next order.

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Fort Wayne, Ind.

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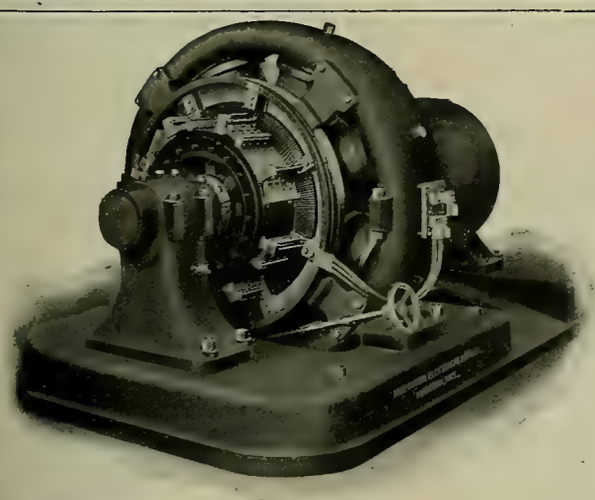
We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.



Alternating or Direct Current
Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

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ADAMS-BAGNALL arc lamps are at once simple and practical. They hold first place in every field of arc lighting. For Alternating, Direct Current, Constant Potential and Direct Constant Current Series Work and for Street Railway Circuits.

We have literature, which we will be glad to send you, describing each of the seven different styles we sell.

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ELECTRICAL SUPPLIES.

The General Electric Company's

Specially designed lamps for telephone switchboards having high efficiency and durability.

Send for Catalogue No. 1017.

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INDIA & AMBER
MICA
IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.
EMPIRE INSULATED Cloths and Papers.
M·I·C· COMPOUND UNEQUALED.
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WRITE FOR SAMPLES AND PRICES.

PERFECT
MICANITE
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ANOTHER NEW DEVICE.

Smith's Incandescent Lamp Controller.

No. 110.

The only device like it on the market. Patented October 16, 1900. Can throw reflection where you want it without a stationary fixture. Lamp adjusts up or down, or swings around a full circle.

Dealers order sample. You will find it a fast seller. More good things coming—all good sellers. Prices and circulars on application.

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YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
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"McRoy conduits once used always used."

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means, they satisfy and are never replaced.

McROY CLAY WORKS
BRAZIL, INDIANA
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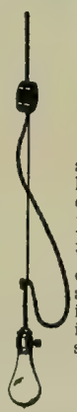
MORSE
INCANDESCENT CORD LAMP ADJUSTER.



The only (nonconductor) automatic adjuster on the market. It has the written approval of every Board of Fire Underwriters, Factory, Insurance and Electrical Experts it has ever been shown to. With its aid one can adjust any kind of a lamp and shade up or down in a second's time. Just what is needed in factories, mills, shops and offices.

Price, 50c.
Write for trade discounts.

THE INCANDESCENT ELECTRIC LIGHT MANIPULATOR COMPANY,
116 Bedford Street, Boston, Mass.

A NOVELTY!
Universal Cord Spools

Offer so many advantages that everybody wants them.
They are Cheap, Strong and Ornamental Finished in Cherry, Green, Mahogany, Black Enamel and Natural Wood.
Patented and manufactured by the
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CENTRAL LIGHTING STATIONS,
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COAL AND ASHES HANDLING
MACHINERY, SHAFTING, PULLEYS, CLUTCHES, PATENT MACHINE-MOULDED ROPE SHEAVES, ETC.
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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.

YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. ***We guarantee it and if not satisfactory money will be refunded.***

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"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
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FOR SALE BY ALL SUPPLY HOUSES OR

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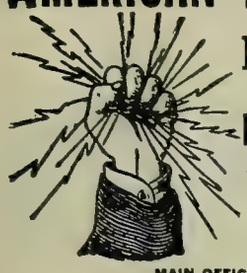
AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



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ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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Has attended to all of our patent matters continuously since 1891. Morgan & Wright, Chicago.

Six Years with General Electric Company.

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Permanent Accuracy Guaranteed.

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GASOLINE MOTORS AND SPARKING PLUGS.

ELECTRO GALVANIZED CONDUIT

INTERIOR UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

NEW PRICE FOR 1901.

ASPHALT PAPER CONDUIT

GUARANTEED TO STAND 50,000 VOLTS.

UNDERGROUND AND INTERIOR.

GUARANTEED ABSOLUTELY ELECTROLYSIS PROOF.

An absolute Non-Conductor. Guarantees perfect insulation. No bonding of cables in its use. Better service over cables enclosed in it. Construction very rapid, using only ordinary labor.

Price, F. O. B. destination, cheaper than any other Conduit.

For prompt delivery for 1901, orders should be placed now.

ELECTROLYSIS PROOF CONDUIT MFG. CO.,
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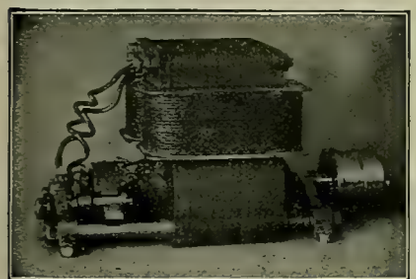
NEW FRANKLIN MODEL DYNAMO.



Sets of castings and material furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron contains eight slots. Pulley for round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Run as motor will drive sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 6-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with these machines. Full size detail blue prints furnished with each set of material, showing how to connect for both SERIES and SHUNT windings.

The change can be made from one winding to the other whenever desired.

Write for Dynamo Circular No. 16.

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NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

WE'RE AFTER YOUR TRADE—

IF we can secure it by close prices, first-class goods and efficient service. We handle a complete line of up-to-date specialties; in fact, anything you may require

IN ELECTRICAL GOODS

"Crescent" Rubber Covered INSULATED WIRES AND CABLES "Index Brand" Weatherproof.

PITTSBURG TRANSFORMERS. "L. H." ENCLOSED ARC LAMPS.

OUR HANDSOME NEW CATALOGUE WILL BE OFF THE PRESS SOON. ARE YOU ON THE LIST? A POSTAL WILL DO IT.

ALDEN ELECTRIC CO.,
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THE LUNDELL "SPLIT-POLE" GENERATOR

Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

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PARAGON REFLECTORS

Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows. Get our Catalogue and Prices.

American Reflector & Lighting Co.,

271-273 FRANKLIN ST., CHICAGO.

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TRADE G. I. MARK.
Manufacturers of HIGH-GRADE ELECTRICAL SUPPLIES.
WRITE FOR ATTRACTIVE BULLETINS.
Branch Offices:
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G. I. INCANDESCENT LAMPS.

5 MINUTES PLEASE!

1. EUREKA PACKING, with a RED DIAMOND LABEL, more power, lasts longer, costs less than any other good packing.
2. HINE ELIMINATOR gives dry steam to engine, keeps oil out of the boiler.
3. IMPROVED ROBERTSON-THOMPSON INDICATOR—a grand adjunct and at very moderate cost.
4. TIC-A-TOC GREASE CUP. Send for circular. A very successful novelty.
5. ROBERTSON FEED-WATER HEATER heats water to about boiling point with exhaust steam.

JAS. L. ROBERTSON & SONS,
198 Fulton St., New York. Branches: Boston—Philadelphia.

WANTED.

An all-around telephone man in Western town of 8,000; must be perfectly familiar with switchboard and telephone work, also outside construction. Growing system, built one year, 150 miles toll line, one exchange, 400 subscribers and three small exchanges; located in splendid independent field. Prefer young man, who must be strictly temperate and furnish good references as to industry, ability and habits, stating salary expected. Could make place for one lady operator if any object. Would sell interest in the business to the right man and give him entire charge, but don't care for that. Address W. W., care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Experienced armature winder to reconstruct surface-wound, alternating armatures into toothed-type armatures. State experience and salary wanted. Address CONSOLIDATED, care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Steam engineer and electrician to take charge of electric light plant. Must be a good, all-around man. Address GEO. W. SHRECK, York, Neb

WANTED.

Position as manager or superintendent of independent telephone exchange. Ten years' experience with Bell Company in above positions. Am with Bell Company now. Can furnish first-class references. Address "BELL," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED TO BUY.

We are in the market for good second-hand high-speed Automatic and Corliss engines. We want several such at once. Write us, giving full particulars.

CAMP ENGINEERING CO.,
18 South Canal Street, Chicago, Ill.

FOR SALE—A BARGAIN.

150 hard rubber cells, 7x7x10¼ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
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A BARGAIN IN LAMPS.

We have the following incandescent lamps:
500 New Edison Ground Glass, 16 c. p., 52 v., T.-H. Base.....@ 10c
1,000 New Edison 16 c. p., 52-v., T.-H. Base @ 8c
1,000 New Crescent 16 c.p., 52 v., T.-H. Base @ 7c
1,500 new other standard makes, 16 c. p., 52 v., T.-H. Base.....@ 6c
250 New Edison 32 c. p., 52 v., T.-H. Base..@ 15c
200 New Edison 32 c. p., 104 to 115 v., T.-H. Base.....@ 15c
150 New Edison Bung Hole 16 c. p., 52 v., Edison Base.....@ 10c
150 New Edison 32 c.p., 104 to 115 v., Edison Base.....@ 15c
6,000 slightly burnt 16 c. p., 52 v., T.-H. Base.....@ 6c

ALL LAMPS TESTED AND GUARANTEED.

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2 750-light Westinghouse, s. o., 37½ K. W.
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1 1000-light Wood, 50 K. W., toothed armt.
1 1000-light Siemens & Halske, 50 K. W., 60-cycle, single-phase, inductor type.
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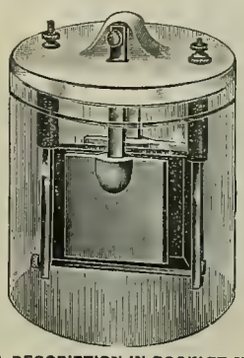

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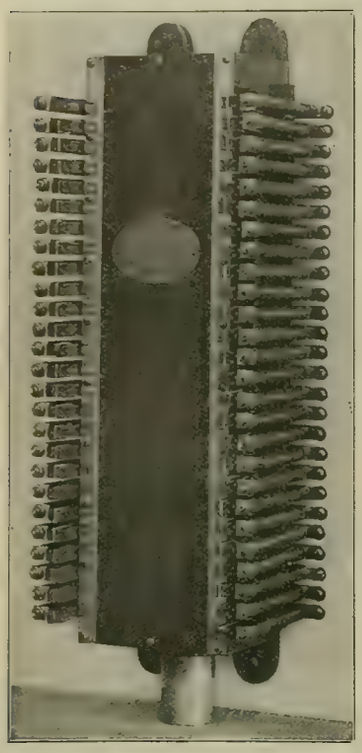

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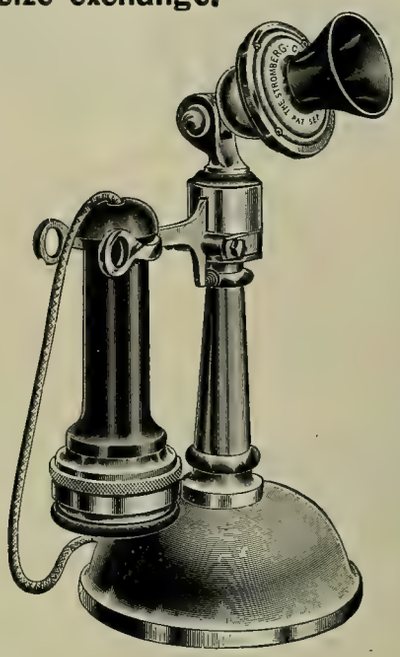

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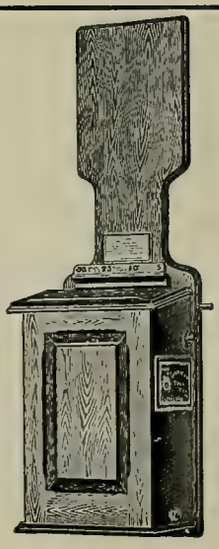

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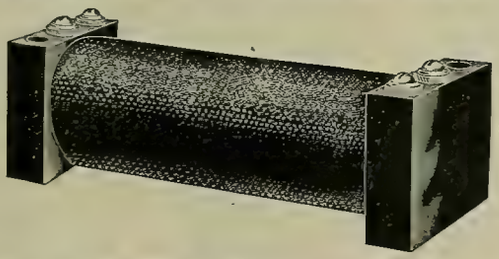

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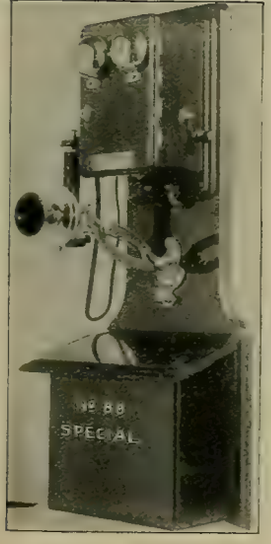

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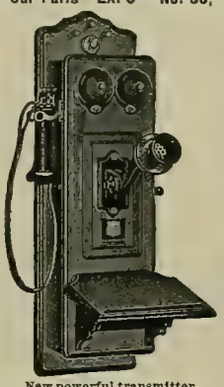

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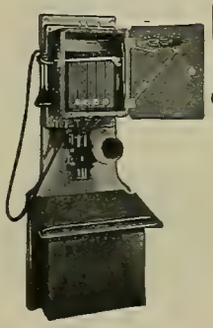

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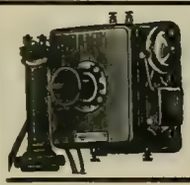

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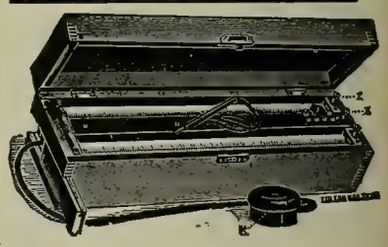

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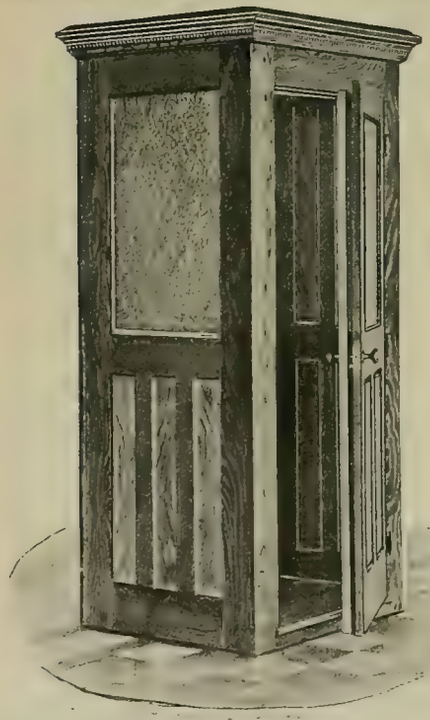

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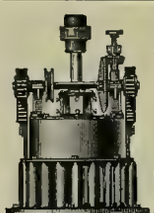

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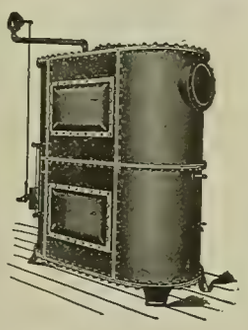

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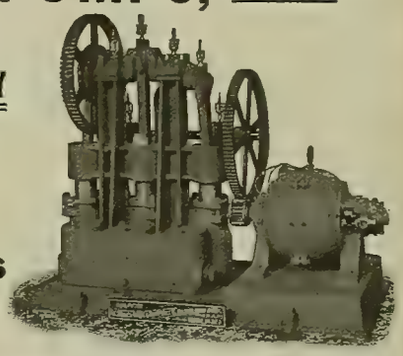

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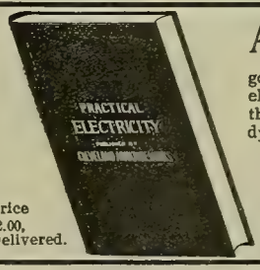

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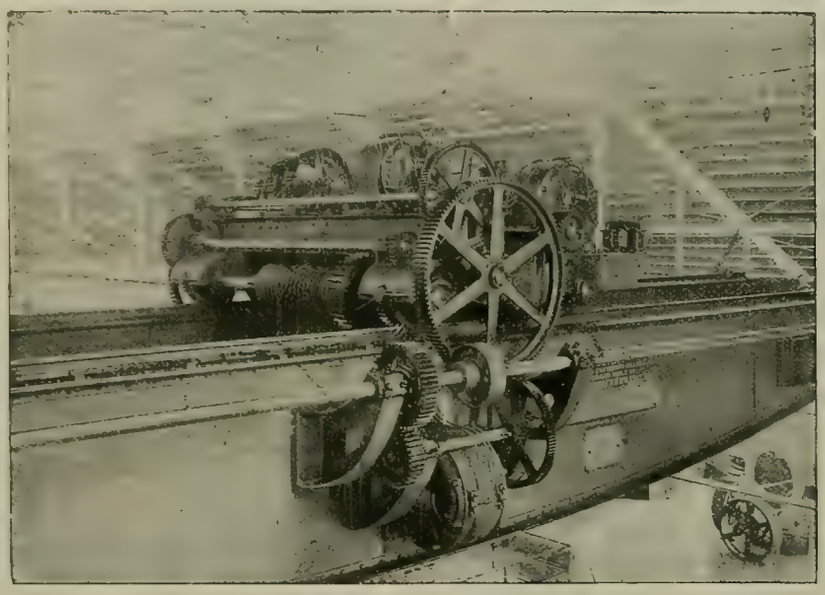

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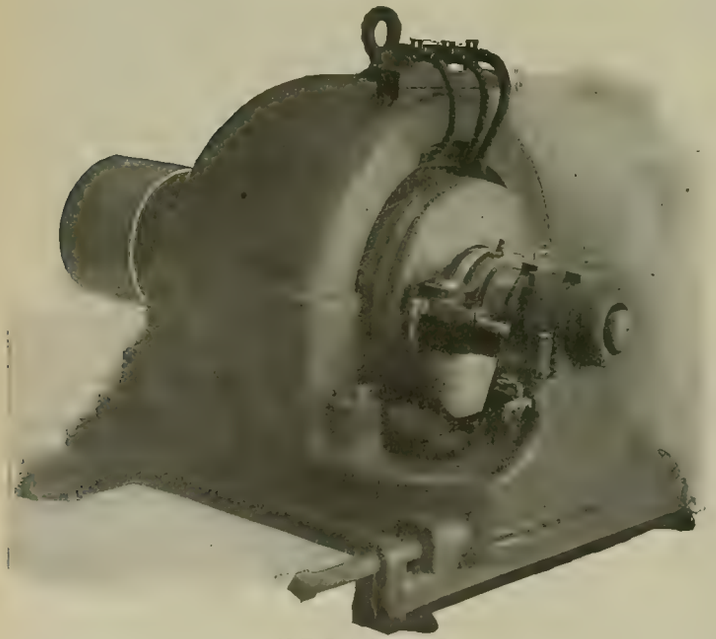

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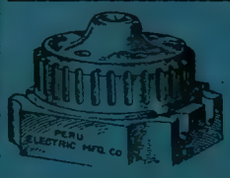

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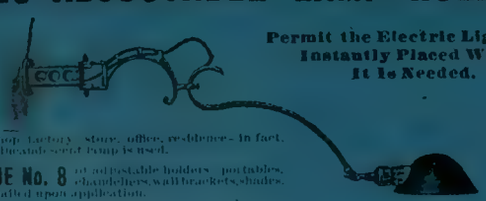
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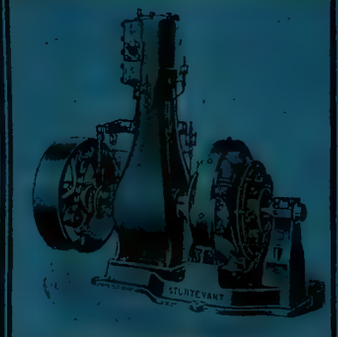
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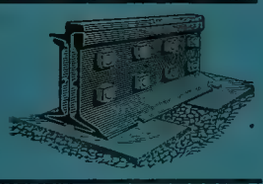

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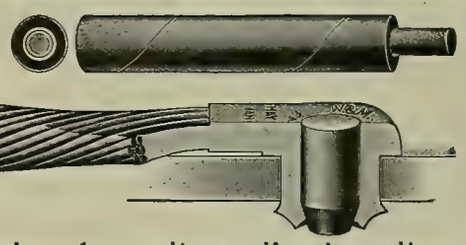

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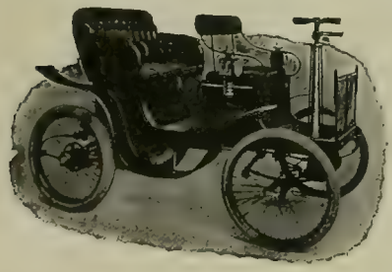
ONE OF OUR LATEST MODELS IS THE



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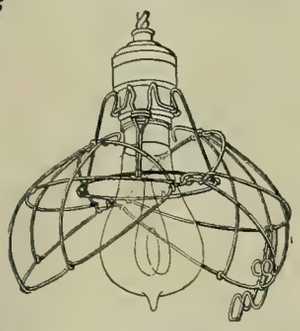
DUPLEX LAMP GUARDS

OKONITE IT NEVER DISAPPOINTS

Give Necessary Protection.



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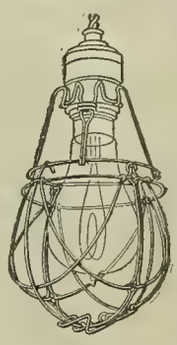

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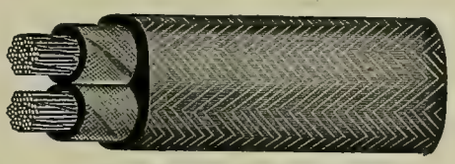

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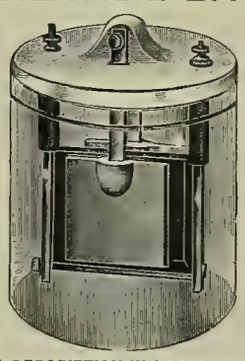

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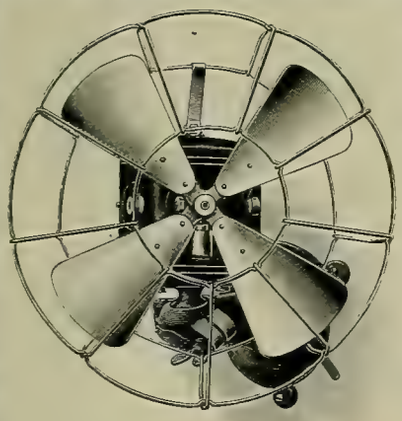

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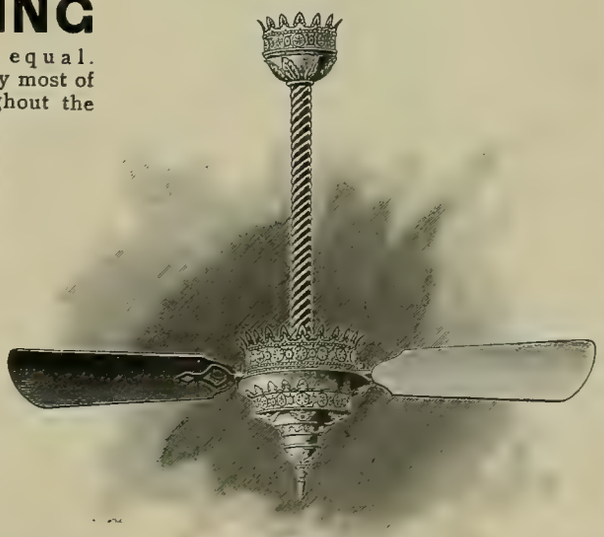

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Vulcanized Fibre Co.
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Electric Appliance Co.
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India Rubber & Gutta Percha Insulating Co.
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Miller-Knoblock El. Mfg. Co.
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Simplex Electrical Co.
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General Electric Co.
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Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G

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Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

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Structural Iron Work.
American Bridge Co.

Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
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Electric Appliance Co.
New York Insulated Wire Co.
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Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.

Telephones, Telephone Material and Switchboards.
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American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Central Electric Co.
Central Tele. & Elec. Co.
Century Telephone Cons. Co.
Chicago Telephone Sup. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Garl Electric Co.
Independent Tel. Supply Co.
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
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Thomas, Wilcox & Dietz.
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Warner Electric Co.
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Tools.
Klein & Son, Mathias.

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Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
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Wagner Elec. Mfg. Co.
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Wire, Bare.
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Driver-Harris Wire Co.
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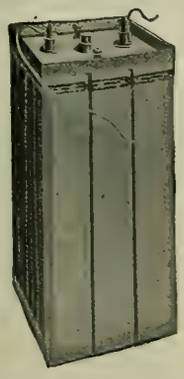
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 3.

C. S. B. Storage Batteries and Igniting Dynamos

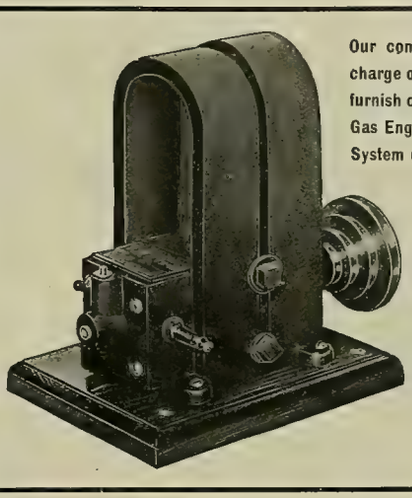


—FOR—

Telephones, Gas Engines,
Fire Alarms,
Phonographs, Annunciators.

SMALL SEALED STORAGE BATTERIES
OUR SPECIALTY.

Combinations for Special Purposes Given Attention.



Our combination of Magneto Dynamo to charge our Storage Batteries and Batteries furnish current for starting and operating Gas Engines is only reliable and flexible System of Ignition.

FOR

Automobiles,
Launches,
Stationary
Gas Engines.

Active Material in Our Plates Positively Does Not Drop Out, Even if REPEATEDLY SHORT CIRCUITED until Fully Exhausted.

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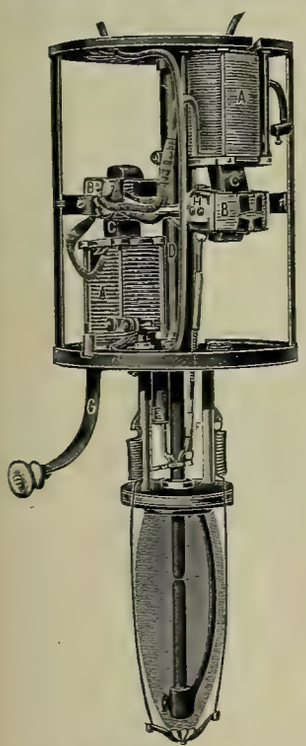

BUT WE CAN
GIVE YOU AN

Alternating Arc Lamp Using 5 Amperes.

We don't use an OSCILLATOR, but our new

"DIVIDED COIL" MECHANISM.

This does away with choke coils, springs and moving iron.

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1901.

DIRECT CURRENT CIRCUITS.

Ceiling Fan Motors

PROVIDED WITH SWITCH GIVING THREE SPEEDS.

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LOCKPORT, N. Y.

Mention Western Electrician.

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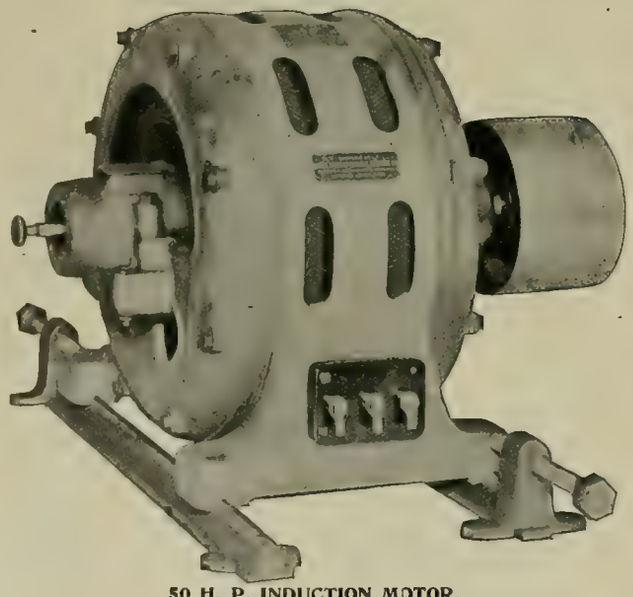

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for mining machinery, pumping plants, textile mills and factories; are sparkless, economical, and require minimum attention.

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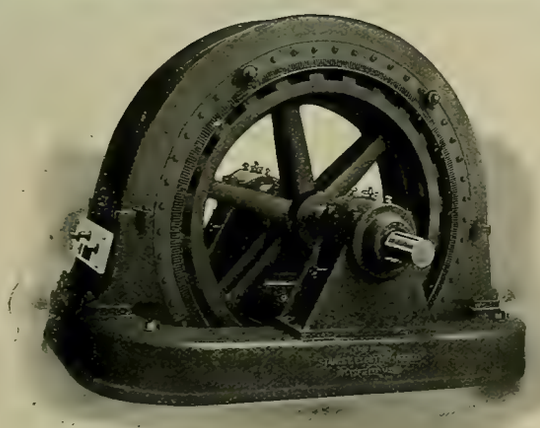
SANDUSKY OHIO



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Cheap, Good. MAGNET WIRE. Guaranteed.

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FOR ARMATURE COILS AND FIELDS.
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The only device like it on the market. Patented October 16, 1900. Can throw reflection where you want it without a stationary fixture. Lamp adjusts up or down, or swings around a full circle.

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Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

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YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

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New Double Focus Tubes have been designed for use with heavy transformer sets, giving more than 12-inch spark, and are equipped with our new adjuster, by means of which the proper degree of vacuum can be maintained.

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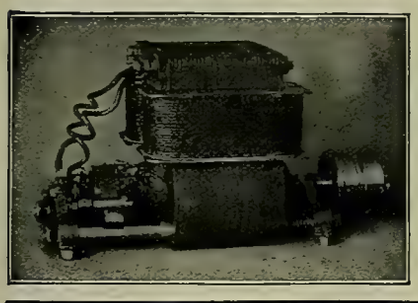

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The change can be made from one winding to the other whenever desired.

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Is so named because of the peculiar construction of the pole pieces. It is the most efficient Generator on the market. Its remarkable advantages are fully described in our Catalogue No. 03100. Free on application.

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MANUFACTURERS
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An all-around telephone man in Western town of 8,000; must be perfectly familiar with switchboard and telephone work, also outside construction. Growing system, built one year, 150 miles toll line, one exchange, 400 subscribers and three small exchanges; located in splendid independent field. Prefer young man, who must be strictly temperate and furnish good references as to industry, ability and habits, stating salary expected. Could make place for one lady operator if any object. Would sell interest in the business to the right man and give him entire charge, but don't care for that. Address W. W., care Western Electrician, 510 Marquette Bldg., Chicago.

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One 75 K. W., Fort Wayne, compound-wound generator, 1,100 volts, 14,000 alternations. Taken out on account of enlargement of plant; in elegant shape. Can be seen in operation until March 1st. Address "ALTERNATOR," care of Western Electrician, 510 Marquette Building, Chicago.

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150 hard rubber cells, 7x7x10½ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

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1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
1 65 Light, Brush Arc, 10 amperes.
1 40 Light, Western Electric Brush Arc.
1 600 H. P., Ball cross-compound engine, 20x36x18.
1 200 H. P., Ball, 12x22x16 Tandem compound, with condenser.
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will pay cash for plants in live, growing towns having a population of 25,000 or more, provided a fair return on the necessary outlay can be shown to its satisfaction.

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We can REPAIR them or will BUY them.

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1 350-light Thomson-Houston, A18.
2 600-light T.-H., A6.
1 600-light T.-H., 30 K. W., 2-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound.
2 600-light G. E., A30, toothed armature, compound wound.
2 650-light T.-H., A35, self-oilers, composite wound.
1 750-light Wood, compound, self-oiler.
2 750-light Westinghouse, s. o., 37½ K. W.
1 900-light Warren, 45 K. W., inductor type.
1 1000-light Wood, 50 K. W., toothed armt.
1 1000-light Siemens & Halske, 50 K. W., 60-cycle, single-phase, inductor type.
1 1200-light Siemens & Halske, 60 K. W., 60-cycle, single-phase.
1 50 K. W. Siemens & Halske, 60-cycle, two-phase, rotary transformer, 175 volts alt. to 250 volts direct.
1 1200-light Warren, 60 K. W., self-oiler, inductor type.
1 1200-light General Electric, A60, composite wound, toothed armt.
1 1200-light Westinghouse, 60 K. W., compound, toothed armature.
1 1200-light Westinghouse, 60-cycle, 60 K. W.
1 1300-light T.-H., A70, comp. wound.
1 1500-light General Electric, monocyclic, 75 K. W., 60-cycle.
2 1500-light Warren Medberry, 75 K. W., latest type, two-phase, new.
1 2400-light Westinghouse, 120 K. W., toothed armature, compound wound.
2 2400-light General Electric, 120 K. W., toothed armt., comp. wound.
2 2400-light Westinghouse, 120 K. W., 60-cycle, toothed armt., comp.
1 4000-light Wood, 200 K. W., self-oiler, comp. wound, slotted armt.
1 4800-light Westinghouse, 240 K. W., self-oiler, comp. wound, toothed armature.

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1 30-light 1200 C. P. T.-H., K12.
1 30-light 2000 C. P. Brush, No. 7.
2 35-light 2000 C. P. T.-H., L. D. 2.
1 35-light 1200 C. P. Wood, No. 6.
3 40-light 2000 C. P. West. Elec., s. o.
2 45-light 1200 C. P. T.-H., M12, ball ar't.
2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12, ball armature.
1 50-light 2000 C. P. Brush, No. 7½.
1 50-light 2000 C. P. T.-H., M. D. 2, ring armature.
2 60-light 2000 C. P. West. Elec., s. o.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Ball, 4 amp.
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1 60-light T.-H., compound.
1 60-light Mather.
1 65-light Crocker-Wheeler, s. o.
1 80-light Sprague.
1 100-light Bain, compound, self-oiler.
1 100-light Siemens & Halske, type L. H.
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1 110-light Edison.
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1 150-light Mather, compound, self-oiler.
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1 250-light Westinghouse, horiz. type.
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1 275-light King, self-oiler, compound.
1 300-light Columbian, multipolar.
2 300-light Gibbs, M. P., self-oilers.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, comp.
1 350-light Edison, 20 K. W., shunt.
1 350-light Western Electric.
1 350-light Fisher, M. P.
1 360-light Duplex multipolar, comp.
9 500-light Siemens & Halske, self-oilers
4 540-light Edison, 30 K. W., compound.
1 600-light Elckmeyer.
1 700-light Westinghouse, slow speed, M. P.
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1 150 K. W. Siemens & Halske, 125-volt, for direct connection.
1 60 K. W. Siemens & Halske, 250-volt, for direct connection.
1 120 K. W. Siemens & Halske, 250-volt, for direct connection.
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1 12 K. W. Edison, self-oiler.
1 20 K. W. Sprague, compound, s. o.
1 40 K. W. Eddy, M. P.
1 45 K. W. Edison, compound, self-oiler.
1 60 K. W. Siemens & Halske, M. P., s. o., for direct connection.
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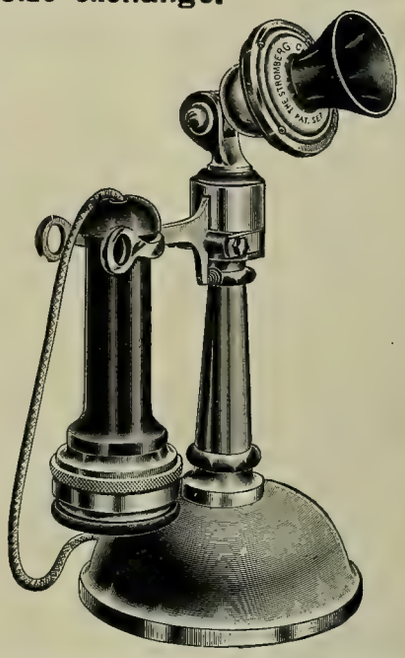

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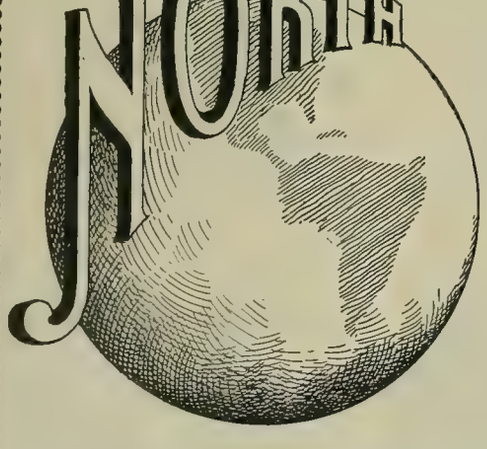

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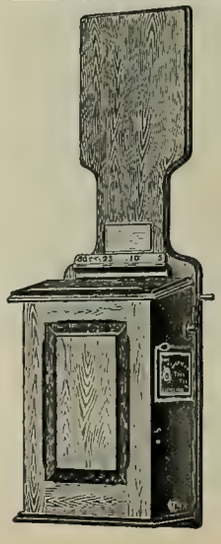

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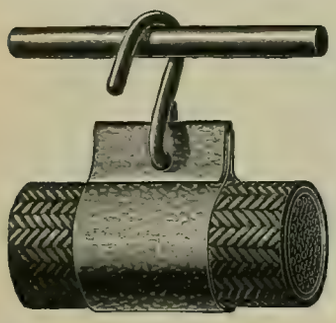

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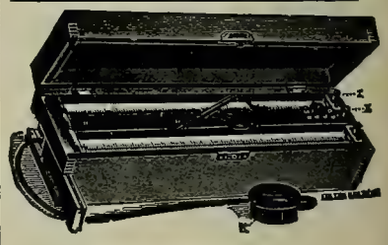

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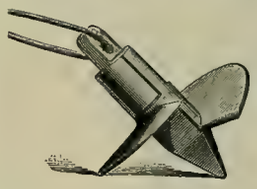

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Isenthal, A. W., and Ward, H. S. Practical Radiography. Handbook of Applications of X-Rays. Second edition, rewritten to date. 8vo, cloth. Illustrated. London, 1898.....$1.00

Kolle, Frederick S. The X-Rays: Their Production and Application. 12mo, cloth. Illustrated. New York, 1898.....$1.00

Meadowcroft, Wm. H. The A. B. C. of the X-Rays. Illustrations by H. E. Fanshawe. 12mo, cloth. New York, 1896.....$0.75

Morton, Wm. J. The X-Ray; or Photography of the Invisible, and Its Value in Surgery. Written in collaboration with Edwin W. Hammer. 12mo, cloth. 91 illustrations. New York, 1896.....$0.75

Phillips, Chas. E. S. A Bibliography of X-Ray Literature and Research, 1896, 1897. Being a carefully and accurately compiled ready reference index to the literature on the subject of Röntgen or X-Rays. With an introduction to the subject and a chapter on Practical X-Ray work. 8vo, cloth. London, 1897.....$2.00

Thompson, Edward P. Röntgen Rays and the Phenomena of the Anode and Cathode. Principles. Applications and Theories. Concluding Chapter by Professor Wm. A. Anthony. 60 diagrams. 45 half-tones. 8vo, cloth. New York, 1896.....$1.50

Trevert, Edward. X-Rays for everybody. 93 pages. 47 illustrations.....$0.25

Wright, Lewis. The Induction Coil in Practical Work. Including Röntgen X-Rays. With illustrations. 12mo, cloth. London, 1897.....$1.25

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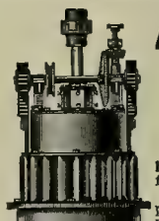

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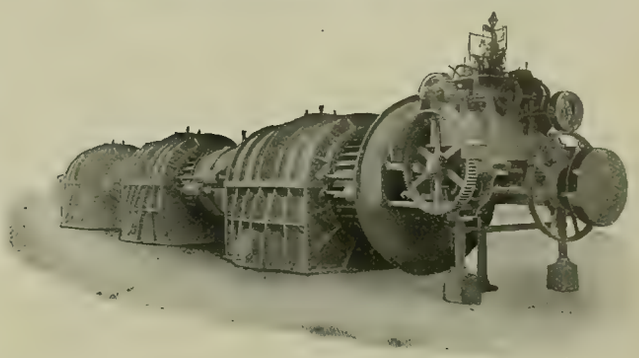

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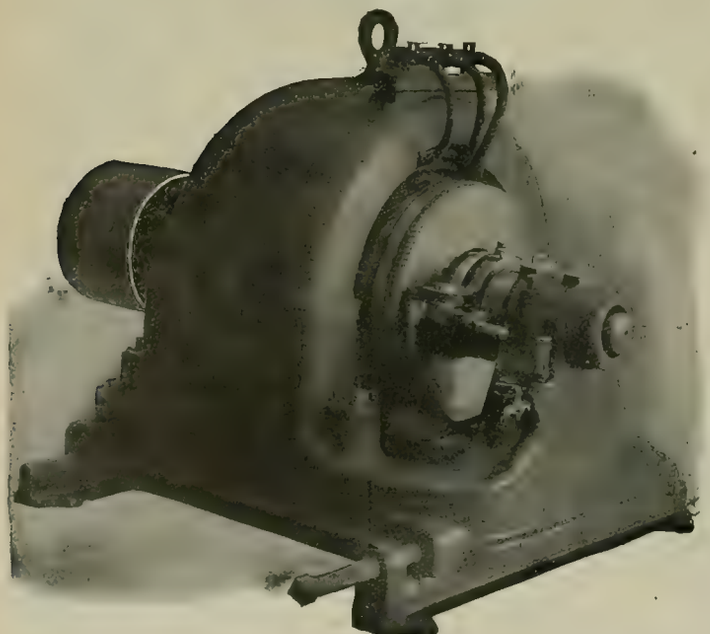

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DECISION IN BERLINER TELEPHONE CASE.

Western Electrician

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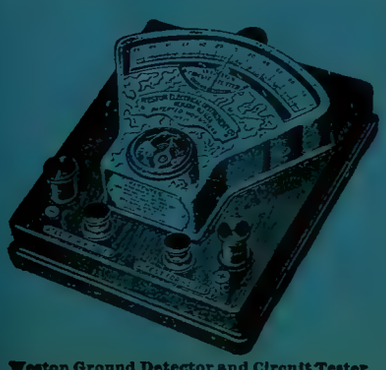
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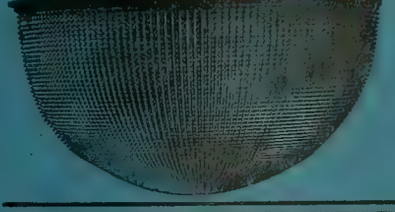
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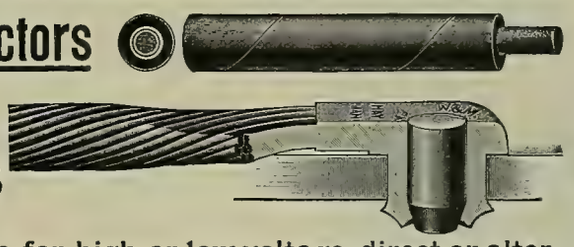

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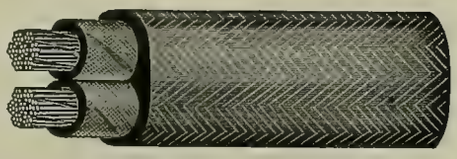

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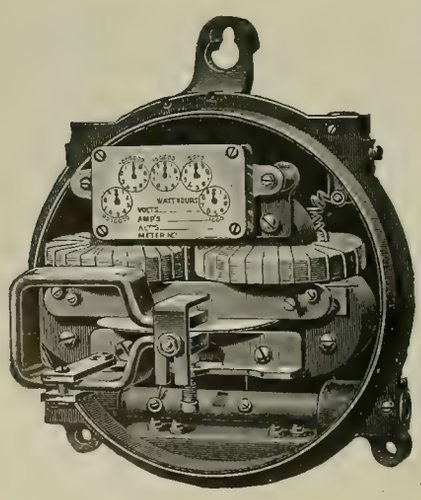

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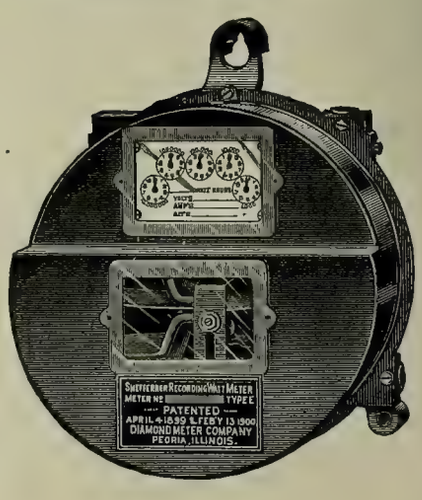

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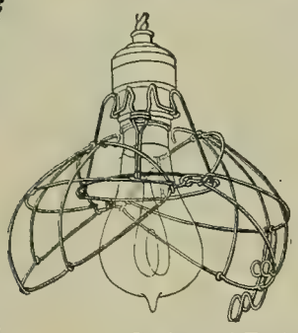

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Will clamp any standard socket without the use of a shade holder.

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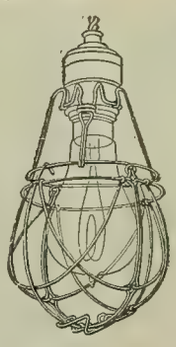

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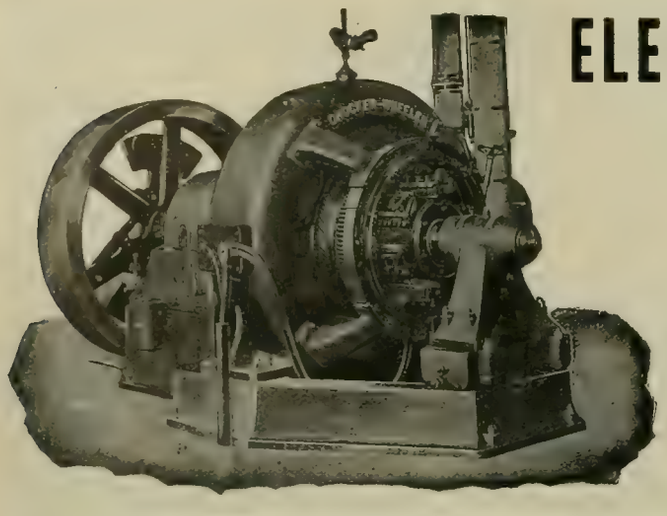

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Holmes Fibre-Graphite Co.
Sage & Bro., F. B.

Cables (See Insulated Wires.)

Cables, Electric (See Insulated Wires) **Copper, Sheet and Bar.**
American Elec. Works.
American Steel & Wire Co.
Central Electric Co.
General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.

Carbons, Points and Plates.
Central Electric Co
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
United States Carbon Co.
Western Elect. Supply Co

Castings.
Sargent Co., The.
Smith Co., S. Morgan.

Chains.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Circuit Breakers.
Cutter Elec. & Mfg. Co.

Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Coils and Magnets.
Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.

Compound.
Dearborn Drug & Chem. Wks.
McLennan & Co., K.
Western Electric Co.
Western Elect. Supply Co.

Conduit and Conduits.
Amer. Vitrified Conduit Co.
Central Electric Co.
Electric Appliance Co.
Electrolysis Proof Conduit Manufacturing Co.
McRoy, John T.
Michigan Pipe Company.
Richmondt Conduit Co.
Sprague Electric Co.
Western Elect. Supply Co.

Connectors and Terminals (Patent).
American Elec. Fuse Co.

Construction & Repairs.
Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Hodge-Walsh Elec. Eng. Co.
Western Electric Co.

Contractors and Electric Light Plants.
Bullock Elec. Mfg. Co.
Crocker-Wheeler Company.
Electric Company of America.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Northern Elec. Mfg. Co.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.

Correspondence Schools
Amer. School of Corresp.
Electrical Engineer Inst.
Int. Correspond. Schools.

Cross-Arms, Pins and Brackets.
Blake & Co., John E.
Blue Ridge Locust Pin Co.
Central Electric Co.
Central Mfg. Co
Independent Tel. Supply Co.
Indpls. Arm, Brack. & Pin Co.
Leavitt, R. H.
Michigan Pipe Company.
Tennessee Lumber Co.
Texas Arm & Pin Co.
Western Elect. Supply Co.

Cut-Outs and Switches.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
D. & W. Fuse Co.
Electric Appliance Co.
Emerson El. Mfg. Co.
Ft. Wayne Elec. Wks., Inc.
General Elec. Co.
General Inc. Arc Light Co.
Paiste Co., H. T.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Electric Supply Co.
Westinghouse El. & Mfg. Co.

Cuts.
Franklin Eng. & Electro Co.

Dynamos and Motors.
Bullock Elec. Mfg. Co.
Central Electric Co.
Chicago House Wrecking Co.
Crocker-Wheeler Company.
Ft. Wayne Elec. Wks., Inc.
Franklin Model Shop.
General Electric Co.
General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Kentucky Electrical Co.
Northern Elec. Mfg. Co.
Ohio Electric Works.
Schureman & Hayden.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Sturtevant Co., B. F.
Wagner Elec. Mfg. Co.
Warren Elec. Mfg. Co.
Western Elec Co.
Western Electric Supply Co.
Westinghouse El. & Mfg. Co.

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Darlington Electric Fountain & Supply Company.

Electric Railways.
Crocker-Wheeler Company.
General Electric Co.
Sprague Electric Co.
Westinghouse El. & Mfg. Co.

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Hodge-Walsh Elec. Eng. Co.
Humphrey, Henry H.
Illinois Maintenance Co.
Sargent & Lundy.
Wagner, Herbert A.

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Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Light Co.
Keystone Electrical Inst. Co.
Queen & Co.
Sage & Bro., F. B.
Stanley Electrical Mfg. Co.
Stanley Instrument Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.
Willyoung, Elmer G.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Engines, Gas.
Modern Gas Engine Co.
Palmer Bros.

Engines, Steam.
Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., B. F.

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American District Steam Co.

Fan Outfits.
Central Electric Co.
Crocker-Wheeler Company.
Diehl Mfg. Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
General Electric Co.
General Inc. Arc Light Co.
Ohio Electric Works.
Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Barnett Co., G. & H.

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Monarch Fire Appliance Co.

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Stow Mfg. Co.

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Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.
Electric Appliance Co.
Western Elect. Supply Co.

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Chicago Edison Co.
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Garl Electric Co.
General Electric Co.
Hodge-Walsh El. Eng. Co.
Ohio Electric Works.
Stewart & Co., Frank H.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

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Sturtevant Co., B. F.

Holders, Inc. Lamp.
Crescent Mfg. Co.
Incandescent Electric Light Manipulator Co.
Stewart & Co., Frank H.

Igniters.
Columbus Batt. & Spec. Co.

Inspection & Insurance.
Hartford Steam Boiler Inspection & Insurance Co.

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Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Canton Insulator & Clay Co.
Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Electric Appliance Co.
General Inc. Arc Light Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Mica Insulator Co.
Mogadore Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Paiste Co., H. T.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Matthews & Bro., W. N.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elec. Supply Co.

Junction Boxes.
Bossert Elect. Const. Co.
General Inc. Arc Light Co.

Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Ohio Electric Works.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Crescent Manufacturing Co.
Inc. El. Lt. Manipulator Co.
Smith, Theo.

Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.

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American Elec. Fuse Co.
Central Electric Co.
Electric Appliance Co.
Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Klein & Son, Mathias.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

Motors—See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

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Gt. West. Sm. and Refining Co.

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Davis & Stitt Co.
Lindsley Bros. Co.
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Perrizo & Sons.
Pittsburg & L. S. Iron Co.
Porter-Morse Co.
Smith, O. W.
Sterling & Son, W. C.
Torrey Cedar Co.
Worcester Co., C. H.

Porcelain.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Canton Insulator & Clay Co.
Mogadore Insulator Co.
Peru Elec. Mfg. Co.

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Jeffrey Mfg. Co.
Link Belt Machinery Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Pulleys.
Link Belt Machinery Co.
Rockwood Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Rail Bonds.
American Steel & Wire Co.

Rail Joints.
Continuous Rail Joint Company of America.

Railway Signals.
Garl Electric Co.

Refiners.
Gt. West. Sm. and Refining Co.

Reflectors.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
Smith, Theo.

Re-Winding—Repairs.
Becker Bros.
Chicago Edison Co.
Cleveland Armature Works.
General Electrical Repair Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
Schureman & Hayden.

Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Sage & Bro., F. B.
Westinghouse El. & Mfg. Co.

Second-Hand Mach'y.
Alexander, Thomas.
Chicago House Wrecking Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
Illinois Maintenance Co.
Matthews & Bro., W. N.
Schureman & Hayden.
Walsh's Sons & Co.

Shades.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
Pacific Electric Co.

Soldering Flux.
Cream Flux Co.

Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.

Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

Springs.
American Steel & Wire Co.
Barnes Co., The Wallace.
Manross, F. N.

Steel Boxes.
Bossert Elec. Const. Co.

Storage Batteries.
American Battery Co.
Columbus Batt. & Spec. Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.

Structural Iron Work.
American Bridge Co.

Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.

Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Central Electric Co.
Central Tele. & Elec. Co.
Century Telephone Cons. Co.
Chicago Telephone Sup. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Eureka Electric Co.
Farr Tel. & Cons. Supply Co.
Garl Electric Co.
Independent Tel. Supply Co.
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
National Tel. Equipm. Co.
North Electric Co.
Palmer Bros.
R. I. Telephone & Elec. Co.
Standard Construction Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Strowger Auto. Tl. Exchange.
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Viaduct Mfg. Co.
Warner Electric Co.
Western Electric Co.
Western Elec. Supply Co.
Western Tel. Const. Co.

Tools.
Klein & Son, Mathias.

Transformers.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Stanley Electric Mfg. Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbine Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

White-Washing M'ch's.
Star Brass Works.

Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 3.

PLATINUM

IS HIGHER THAN EVER.

It will be advantageous for you TO SELL your Platinum Scrap at top-notch prices.

WE BUY Platinum Scrap and should be pleased to quote you if you have any to dispose of.

A REMITTANCE WILL BE SENT SAME DATE AS SCRAP IS RECEIVED.

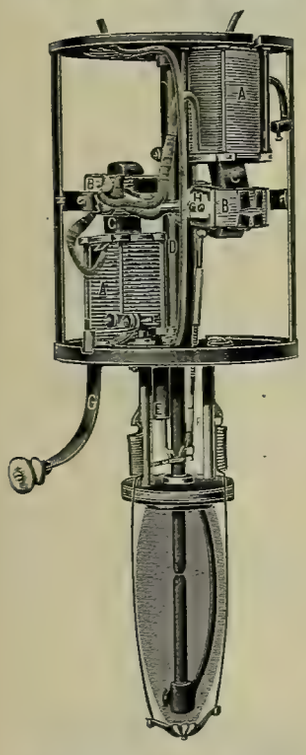
BAKER & CO., 408 N. J. R. R. Avenue, **NEWARK, N. J.**

N. Y. OFFICE, 120 Liberty Street.

If you need PLATINUM in any shape, write us.

WE CANNOT GIVE YOU A

MESSAGE FROM MARS



BUT WE CAN GIVE YOU AN

=Alternating= Arc Lamp Using =5 Amperes.=

We don't use an OSCILLATOR, but our new

"DIVIDED COIL" MECHANISM.

This does away with choke coils, springs and moving iron.

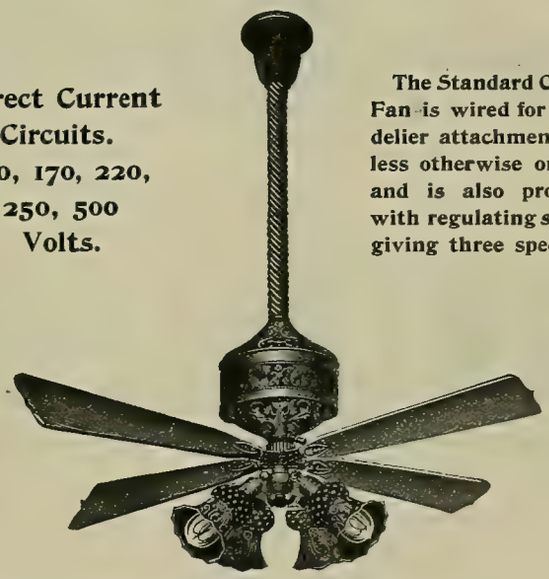
NATIONAL ARC LAMP CO.,

LORAIN, OHIO.

FAN MOTORS

Direct Current Circuits.
110, 170, 220, 250, 500 Volts.

The Standard Ceiling Fan is wired for chandelier attachment unless otherwise ordered and is also provided with regulating switch giving three speeds.



STANDARD CEILING FAN WITH CHANDELIER ATTACHMENT.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.

ST. LOUIS OFFICE, Security Building, St. Louis, Mo.

STANDARD ELECTRIC CO., Cincinnati, Ohio.

CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

ANTWERP, 32 Rue Boudewyns.

LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.

PARIS, 46 Avenue de Breteuil.

INDEPENDENTS!

THE

BERLINER DECISION

In Favor of the Independents

DEMONSTRATES CONCLUSIVELY

That Our Faith in the Stability of the

INDEPENDENT TELEPHONE BUSINESS

IN GENERAL, AND THE

"CENTRAL ENERGY" SYSTEM

IN PARTICULAR,

Has Not Been Misplaced.

THE STROMBERG-CARLSON TELEPHONE MFG. CO.,

70-82 W. Jackson Boulevard, CHICAGO, U. S. A.

CONGRATULATIONS ON THE BERLINER TRANSMITTER DECISION

THINGS TO BE PROUD OF:

We have confidently believed that the Berliner decision would go against the Bell people, and as an evidence of our convictions we invested a large amount of capital in our manufacturing plant and in an extensive series of patents of OUR OWN. Our factory is illustrated below. COME AND SEE THE PATENTS.

Our business more than trebled itself in two years in spite of the handicap of the then impending Berliner decision, and during that time we have built switchboards ranging in size from the largest in the world (not excepting any, whether Independent or Bell) down to those for the smallest villages. ALL OF THESE, WITHOUT EXCEPTION, ARE IN SUCCESSFUL OPERATION.

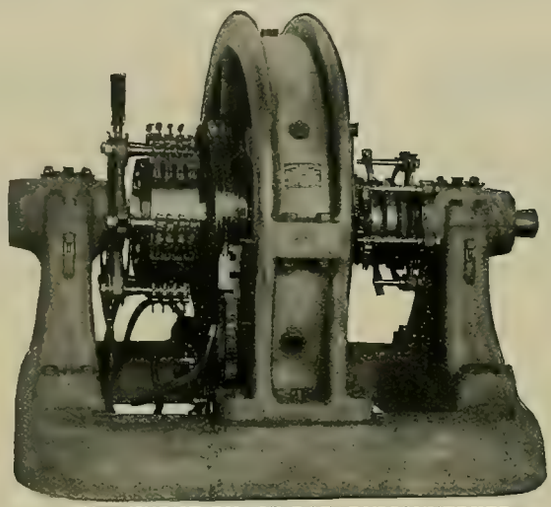
There are good reasons for our success, and they may all be summed up in the words, GOOD DESIGN, CONSCIENTIOUS WORKMANSHIP, CONTINUED EFFICIENCY, backed by ABSOLUTE PATENT PROTECTION, together with honest dealings.

KELLOGG SWITCHBOARD AND SUPPLY COMPANY,

229 SOUTH GREEN ST., CHICAGO.

THE GENERAL ELECTRIC COMPANY'S ROTARY CONVERTERS.

For Railway Power or Lighting Work.



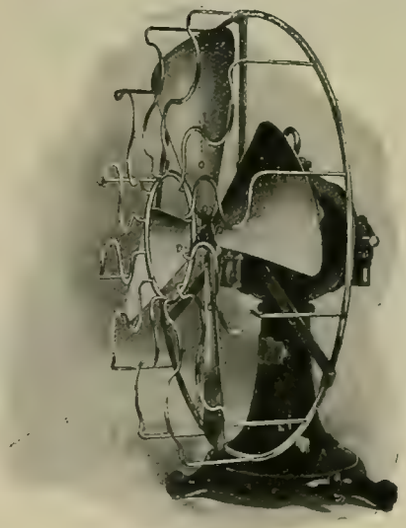
200 Kw. THREE-PHASE ROTARY CONVERTER.

Sizes from 50 to 1,000 Kw. For all voltages.

GENERAL OFFICE, SCHENECTADY, N. Y.

Chicago Office, Monadnock Building. Sales Offices in all Large Cities.

LUNDELL FANS



THE STANDARD.
THOUSANDS IN USE.

The Lundell Fans are still the favorites, owing to their superiority of design and workmanship. Dealers who handle them will find quick sales and satisfied customers. The Lundell Fans are economical in current consumption, easy in operation and graceful in appearance. They are made in a variety of sizes and styles and are adapted to all locations and to meet all requirements. Orders should be placed at once, as there will be a great demand for them this season.

CORRESPONDENCE INVITED.

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Drug and Chemical Works,
Laboratories---Water Chemists.
Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

29, 30, 31, 32 and 33 RIALTO BUILDING, CHICAGO, ILL.

EMERSON 1901 CATALOGUE

OF FAN MOTORS WILL BE SENT ON REQUEST. SEVERAL NEW TYPES DESCRIBED. SEND FOR A COPY.

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THE EMERSON ELECTRIC MFG. CO. St. Louis, Mo., U. S. A

Kentucky Incandescent LAMPS 17c

KENTUCKY ELECTRICAL CO., Owensboro, Ky.

Chicago Agent, J. W. Brooks, 605 Plymouth Bldg.

O. K. BATTERY.

ALWAYS RELIABLE.

Adopted by the Government, Railroad and Telephone Companies.

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USED FOR BELL WORK,

Grade Crossings, Telephones, Gas Engine and Automobile Work, Lighting Miniature Lamps, Etc.

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447 BROADWAY, NEW YORK CITY.

This Trade-Mark Guarantees Satisfaction

on Sockets, Receptacles, Rosettes, Mains and Branches, Edison Out-Outs

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"Aone" Portable Test Set.

Willyoung Instruments.

PHOTOMETERS,
CONDUCTIVITY BRIDGES,
CABLE TESTING APPARATUS,
X-RAY MACHINES,
X-RAY TUBES,
FLUOROSCOPES,
STANDARD RESISTANCES.

Correspondence Invited. Circulars Free.

ELMER G. WILLYOUNG
(Formerly Willyoung & Co., Philadelphia),
97-99 Fulton Street, New York.

SIMPLICITY, DURABILITY, REFINEMENT OF DESIGN

are the first points considered by prospective arc lamp buyers. **The Belden Arc Lamp** excels not only in the above points but in many others. Users pronounce it the most satisfactory lamp on the market.

It burns a minimum of 250 hours. No alignment necessary. Trims easier than an open arc lamp. Allows easy access to every part of lamp. Gives absolutely steady light.

Our bulletins give further reasons why **The Belden** should receive your careful consideration before placing your next order.

BELDEN-LARWILL ELECTRIC & MFG. CO.,
Fort Wayne, Ind.

AGENTS: M. B. AUSTIN & Co., 58 W. Van Buren St., Chicago. C. E. WILSON, 1000 Betz Bldg., Philadelphia, Pa. R. N. STEWART & Co., Denver, Colo.

We are now in a position to establish desirable agencies in all principal cities in this and foreign countries.

ONE OF OUR SPECIALTIES-

HERE IT IS- EVERY OTHER WEEK-

AND ITS LITTLE STORY- ALL THE FINE POINTS-

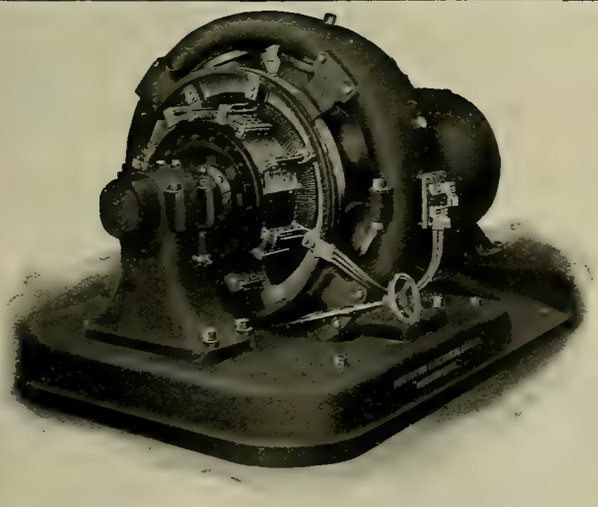
KEYSTONE ELECTRICAL INSTRUMENT CO.

Type "R."

IT'S STORY-

The most popular type of Switchboard Instrument on the market Size, appearance, system, accuracy, durability and price are right. All ranges, either series or shunt Ammeters. Particularly adapted to isolated plants and feeder panels.

PHILA. PA.



Alternating or Direct Current Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

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THE MOST PERFECT WIRE CONDUIT TUBING.

The outside is Electro-Galvanized, so that it can be effectually and permanently grounded.

The inside is reamed to a perfectly true and uniform size and is then pickled, galvanized and enameled, making a smooth, tough and non-corrosive surface.

The couplings and threads of pipe are galvanized, thus insuring a continuous joint.

Selected pipe only is used. The process has the approval not only of the underwriters, but of every contractor and user who is familiar with it.

WE SELL IT. WE SELL IT. WE SELL IT.

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92 and 94 West Van Buren St. Electrical Supplies.

DEWAR BULBS FOR LIQUID AIR

Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

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MICA
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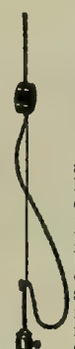

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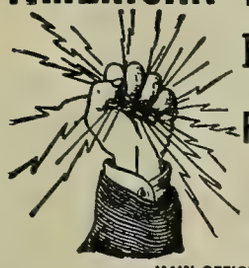

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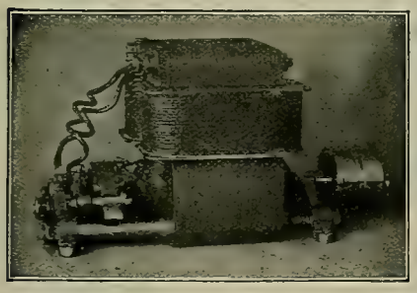

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The change can be made from one winding to the other whenever desired.

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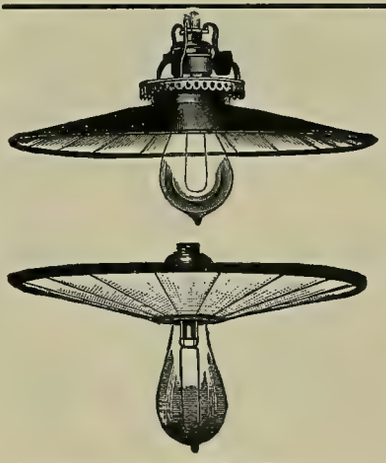

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Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

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A good, allaround, practical mechanic; must be thoroughly familiar with telephone and magneto machinist's work. Want him to act as foreman of machine department. Must be A1.

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Traveling men visiting dealers in electric supplies, etc., to sell combination and electric fixtures as a side line, on commission Address, "COMBINATION FIXTURES," care Western Electrician, 510 Marquette Bldg., Chicago.

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1 50 K. W., 2,000-volt, Siemens & Halske, 60 cycle.
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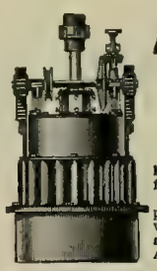

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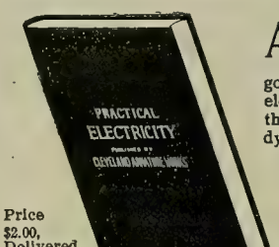

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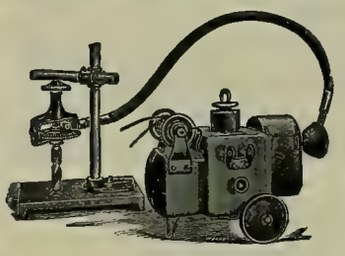

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2 750-light Westinghouse, s. o., 37½ K. W.
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1 1000-light Siemens & Halske, 50 K. W., 60-cycle, single-phase, inductor type.
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1 100-light Siemens & Halske, type L. H.
2 110-light Gibbs, compound, self-oilers.
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1 350-light National, self-oiler, comp.
1 350-light Edison, 20 K. W., shunt.
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1 350-light Fisher, M. P.
1 360-light Duplex multipolar, comp.
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1 150 K. W. Siemens & Halske, 125-volt, for direct connection.
1 60 K. W. Siemens & Halske, 250-volt, for direct connection.
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1 20 K. W. Sprague, compound, s. o.
1 40 K. W. Eddy, M. P.
1 45 K. W. Edison, compound, self-oiler.
1 60 K. W. Siemens & Halske, M. P., s. o., for direct connection.
1 120 K. W. Siemens & Halske, M. P., s. o., for direct connection.

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1 25 K. W. T.-H., self-oiler.
1 25 K. W. General Electric, M. P.
1 25 K. W. Commercial, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, s. o., very slow speed, 475 r. p. m.
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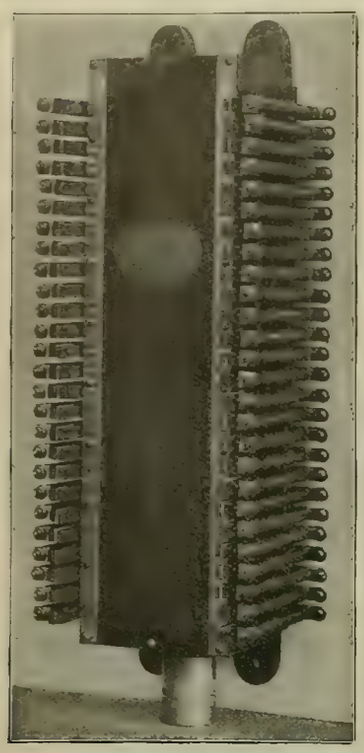

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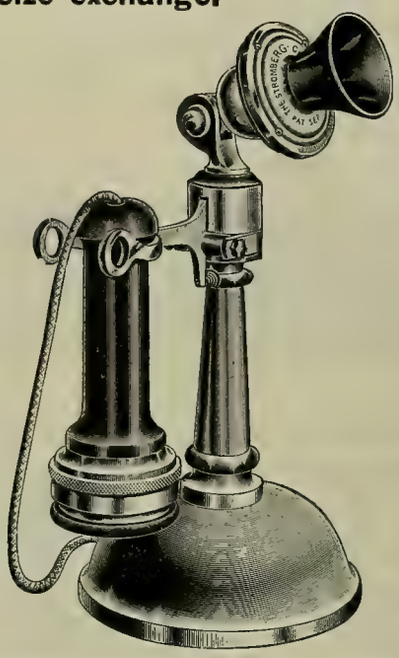

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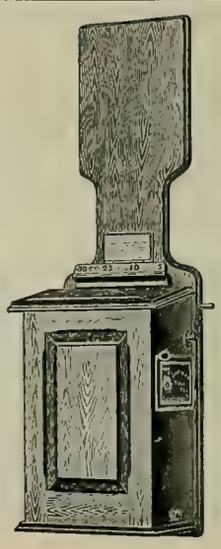

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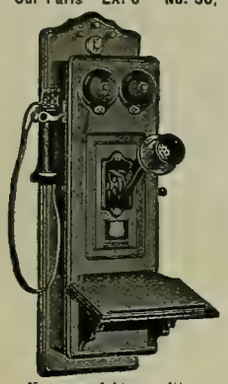

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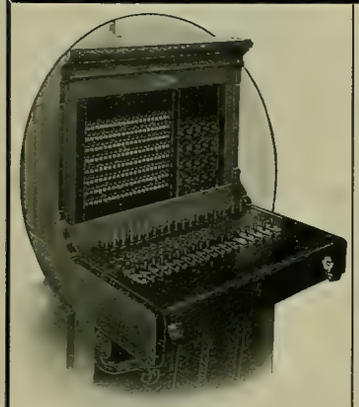

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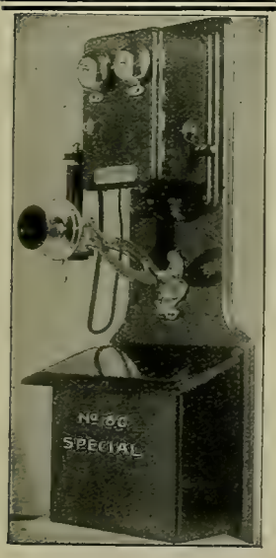

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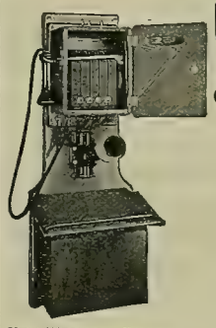

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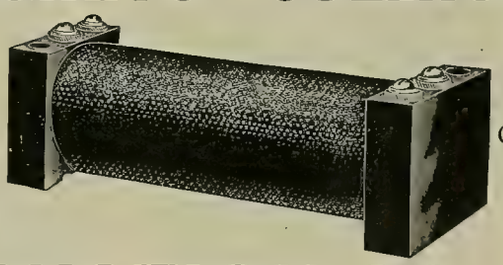

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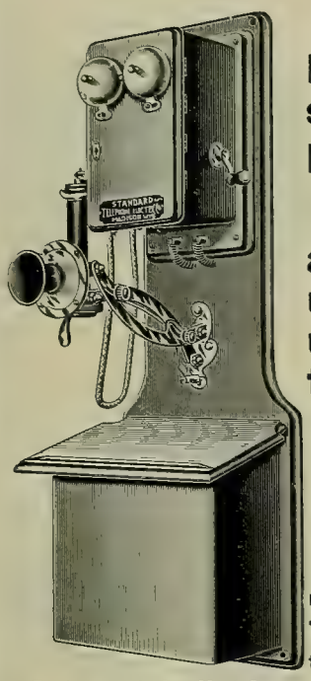

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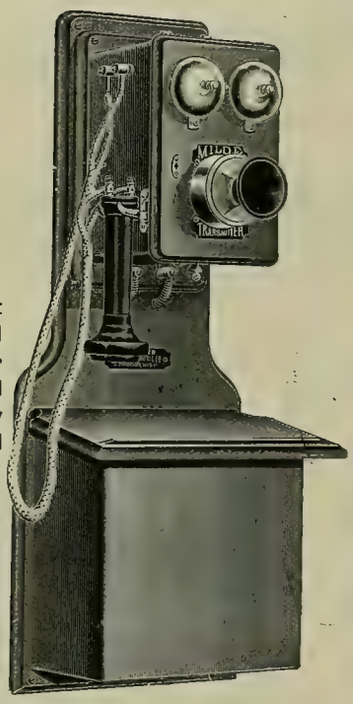

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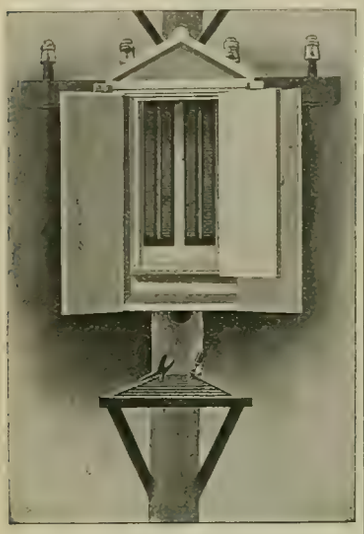

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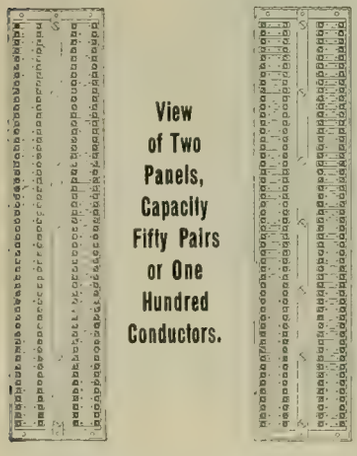

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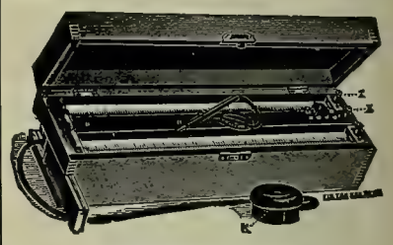

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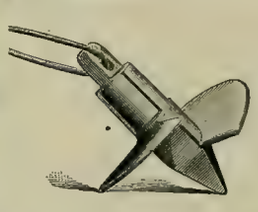

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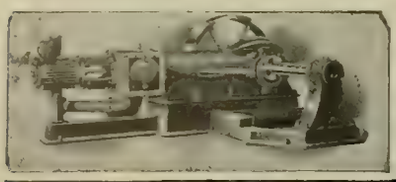

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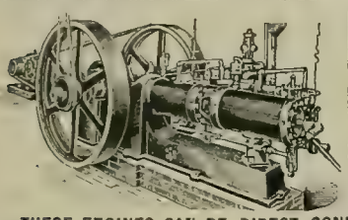

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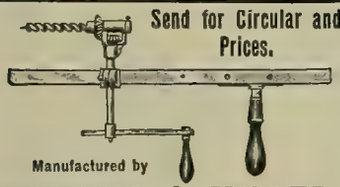

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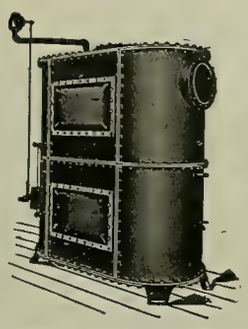

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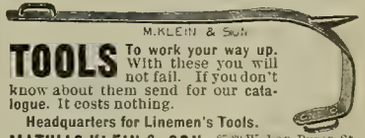

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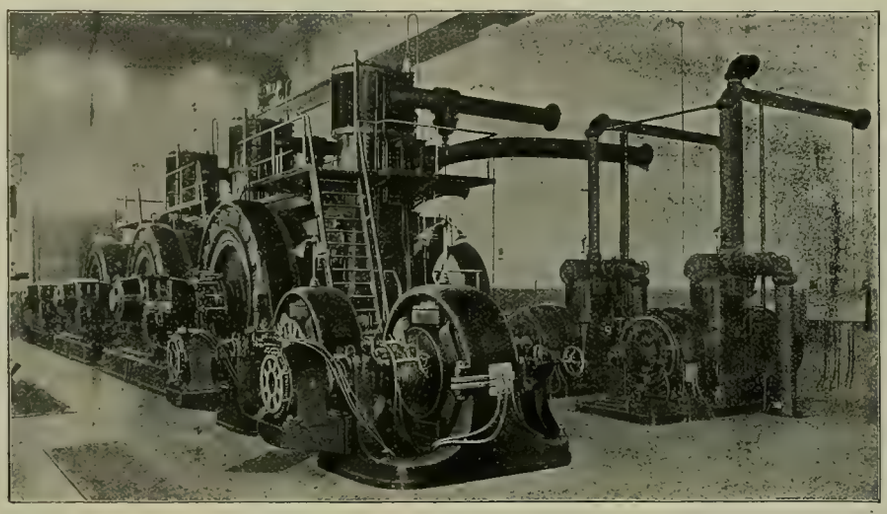

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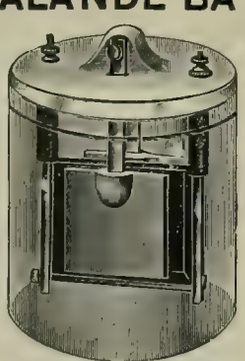

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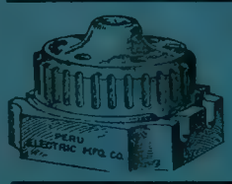

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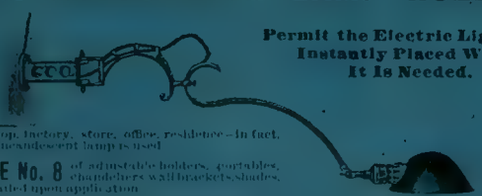

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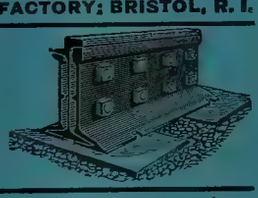

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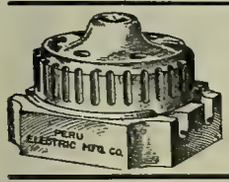


READY FOR THE MARKET.

"PEMCO," the new style Creole rosette. Insulation perfect, long fuse, superior in every detail.

Peru Electric Mfg. Co., Peru, Ind.

Kilfyre DRY POWDER COMPOUND

IDEAL FIRE PROTECTION

FOR SWITCHBOARDS AND ALL ELECTRICAL APPARATUS.

Monarch Fire Appliance Co.,
27 WILLIAM STREET, NEW YORK.

NEW PRICE FOR 1901.

ASPHALT PAPER CONDUIT

GUARANTEED TO STAND 50,000 VOLTS.

UNDERGROUND AND INTERIOR.

GUARANTEED ABSOLUTELY ELECTROLYSIS PROOF.

An absolute Non-Conductor. Guarantees perfect insulation. No bonding of cables in its use. Better service over cables enclosed in it. Construction very rapid, using only ordinary labor.

Price, F. O. B. destination, cheaper than any other Conduit.

For prompt delivery for 1901 orders should be placed now.

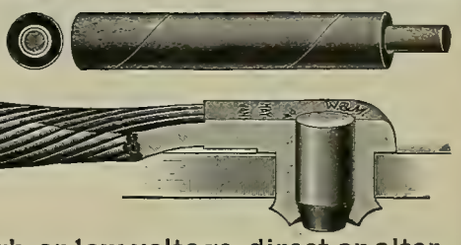
ELECTROLYSIS PROOF CONDUIT MFG. CO.,
605 MANHATTAN BLDG., CHICAGO.

ELECTRO GALVANIZED CONDUIT

INTERIOR UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.
MILWAUKEE U.S.A.

"CROWN" Insulated Conductors AND Rail Bonds



"Crown" wires are the perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

"Crown" bonds are the perfection of simplicity and economy in rail bonding, together with perfection of contact.

In "CROWN" WIRES or "CROWN" BONDS you secure the best attainable results, electrically and mechanically.

Solid or stranded bare copper conductors; also lead-encased and armored for aerial, underground and submarine work.

American Steel and Wire Co., Chicago, Ill.

NEW YORK, WORCESTER, DENVER, SAN FRANCISCO; LONDON, ENG.

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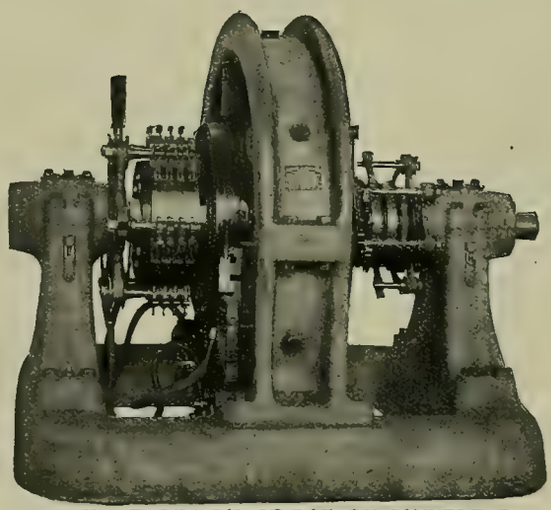
ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

THE GENERAL ELECTRIC COMPANY'S ROTARY CONVERTERS.

For Railway Power or Lighting Work.



200 Kw. THREE-PHASE ROTARY CONVERTER.

Sizes from 50 to 1,000 Kw. For all voltages.

GENERAL OFFICE, SCHENECTADY, N. Y.

Chicago Office, Monadnock Building. Sales Offices in all Large Cities.

There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

J. W. GODFREY, Manager Sales, 15 Cortlandt Street, NEW YORK.

YONKERS, N. Y.

(10928)

The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade-mark "ELECTRA."

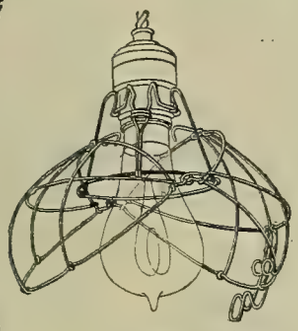
Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

DUPLEX LAMP GUARDS

OKONITE IT NEVER DISAPPOINTS

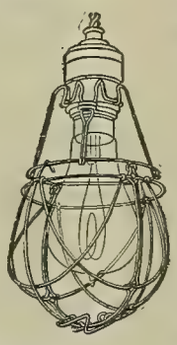
Give Necessary Protection.



From its peculiar shape will enclose either a ***16 c. p. or a 32 c. p.*** incandescent lamp.

Will clamp any standard socket without the use of a shade holder.

The use of Duplex Guards prevents needless breaking of lamps.



CENTRAL ELECTRIC COMPANY, SALES AGENTS,
264-266-268-270 Fifth Avenue, CHICAGO.

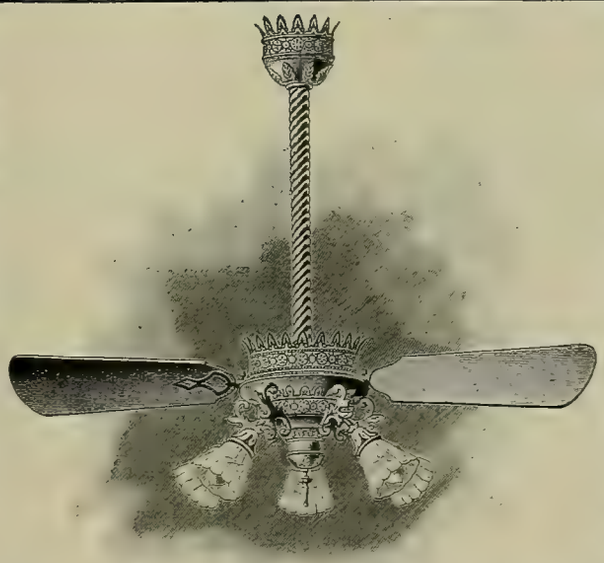
DIEHL DIEHL DIEHL DIEHL

ELECTROLIER CEILING FANS.

Specially suitable for the finest restaurants, cafes, club houses, and all other places where only the best fans are desired.

The handsomest fan ever offered to the public. During the winter blades can be removed, making an ornamental and serviceable lighting fixture. Can be run successfully with motors on arc circuits and lights on alternating system, as the two currents are kept entirely separate throughout and are thoroughly insulated.

We carry the largest line of fans ever offered—all finishes, special designs, two or four blades. Our fans meet *all* requirements.



PATENTS SUSTAINED

March 8th and December 5th, 1900.

Our Ceiling and Electrolier fan patents have been sustained by U. S. court decision. The use or sale of infringements stopped by injunctions.

DIEHL FANS

are **STANDARD OF THE WORLD.** Mechanically and electrically perfect. Neat, attractive, noiseless, highly efficient. We are the pioneers in the manufacture of ceiling fans.

DIEHL MANUFACTURING CO.,

SHOW ROOMS { NEW YORK, 561-563 Broadway. CHICAGO, 192-194 Van Buren St. BOSTON, 128-132 Essex St. PHILADELPHIA, W. Irwin Cheyney & Co.

MAIN OFFICE AND WORKS:
ELIZABETHPORT, N. J.

DIEHL DIEHL DIEHL DIEHL

HELIOS-UPTON STORAGE BATTERIES

FOR STREET RAILWAYS, POWER AND LIGHTING PLANTS, FOR ELECTRICAL VEHICLES, TELEGRAPH, TELEPHONE AND ELECTRIC ELEVATORS.

BATTERY SUPPLIES AND REPAIRS.

We make very low prices for repairs of batteries manufactured by the **Electric Storage Battery Company.** Send us dimensions of plates required and the number and **we will make you a quotation that will save you money.** We will guarantee that our plates can be used with better results in installations of the Electric Storage Battery Co. than the plates of their own manufacture. To sustain our claims we refer you to the Kansas City Electric Light Company, who have a large installation, manufactured and installed by this Company.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA. CHICAGO, ILL. PEABODY, MASS.

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Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
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Phillips, Eugene F.
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Chicago Edison Co.
Edison Decorative & Miniature Lamp Dept.
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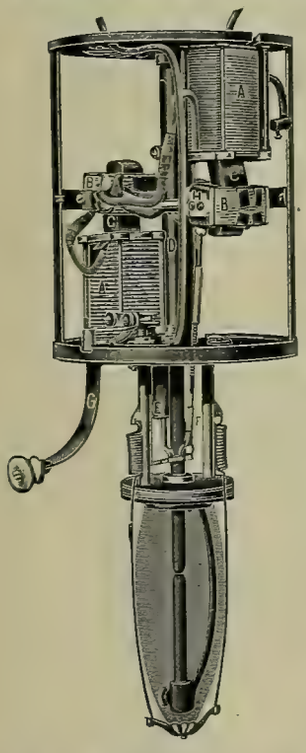

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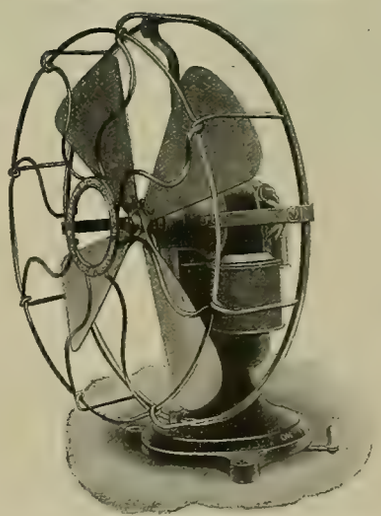

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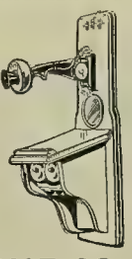

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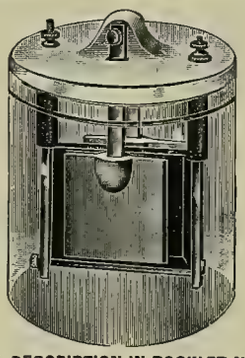

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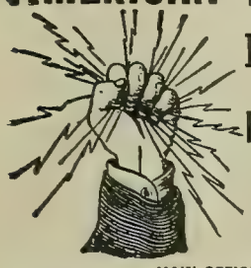

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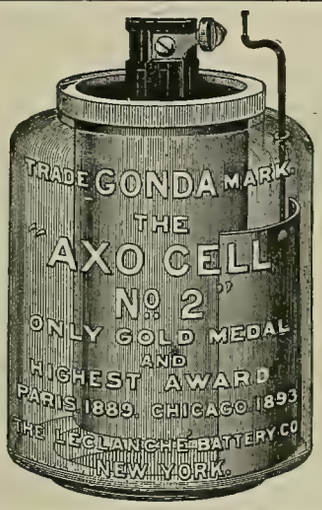

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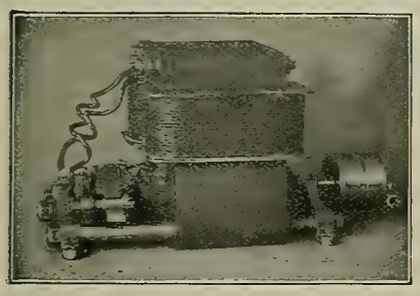

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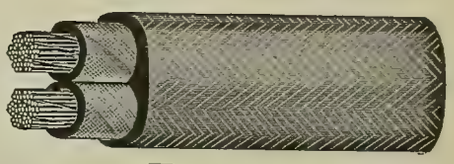

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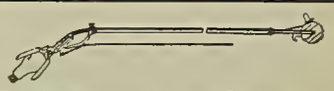

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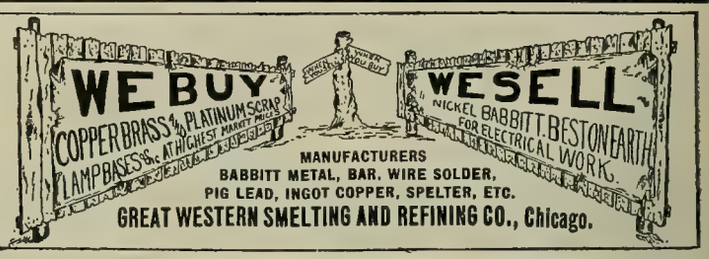

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1 900-light Warren, 45 K. W., inductor type.
1 1000-light Wood, 50 K. W., toothed armt.
1 1000-light Siemens & Halske, 50 K. W., 60-cycle, single-phase, inductor type.
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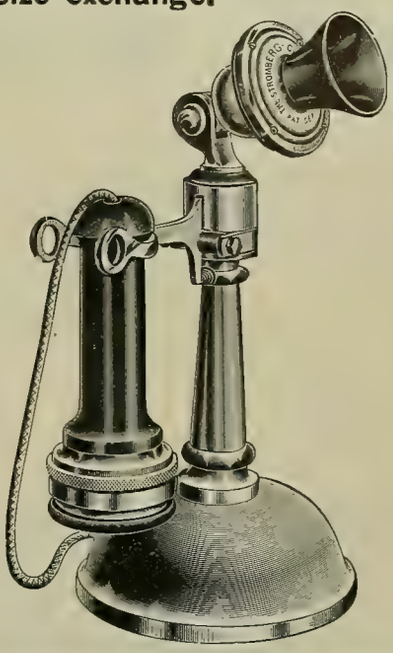

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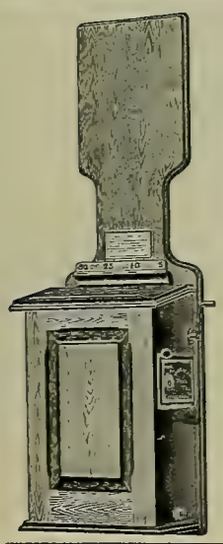

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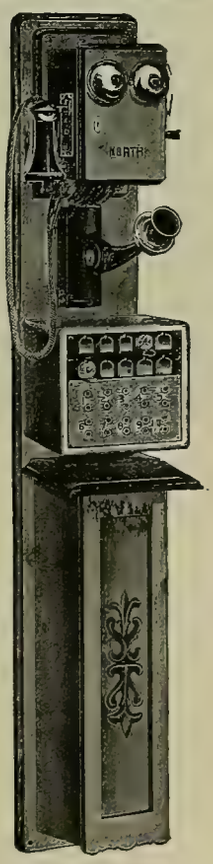

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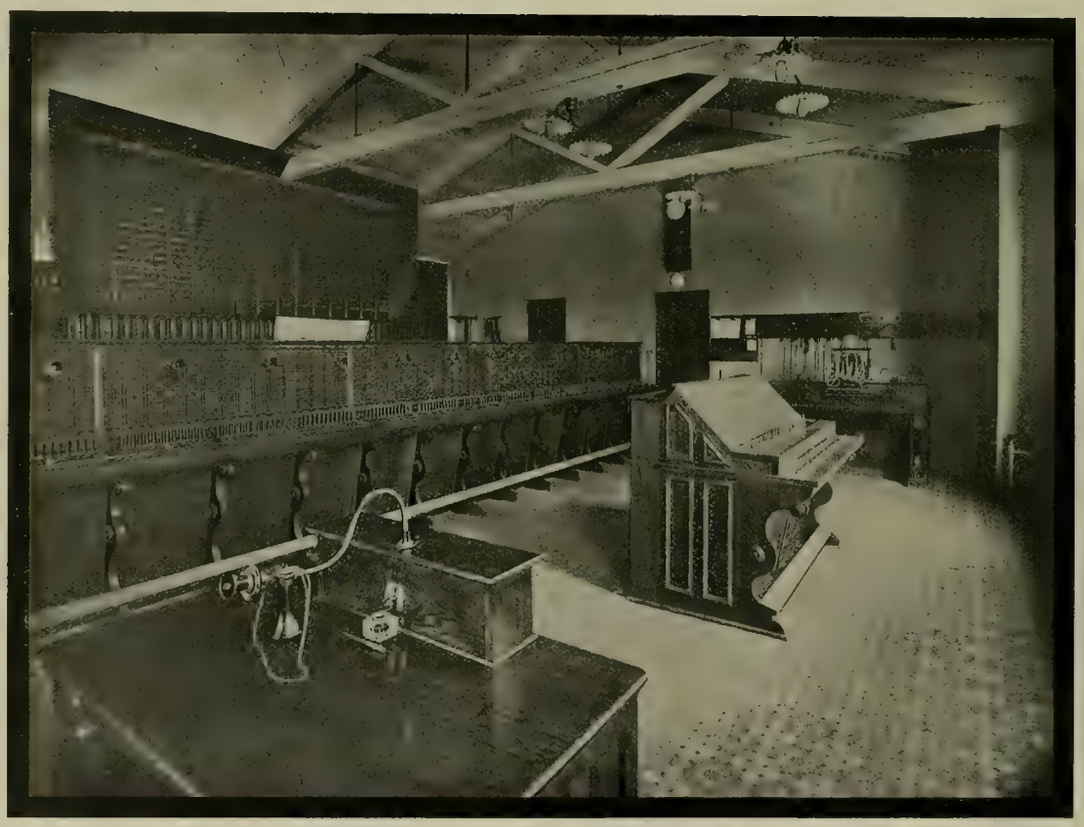

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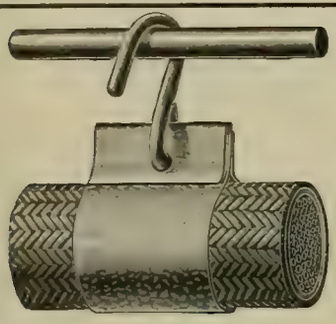

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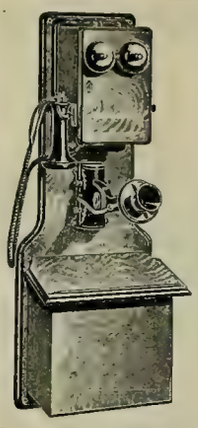

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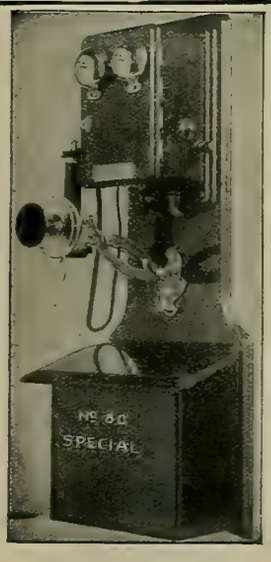

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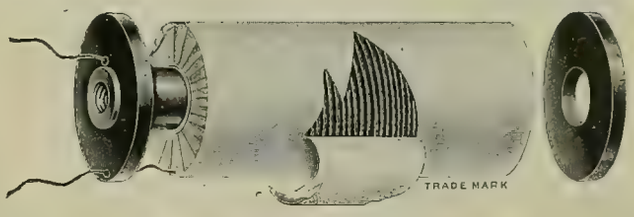

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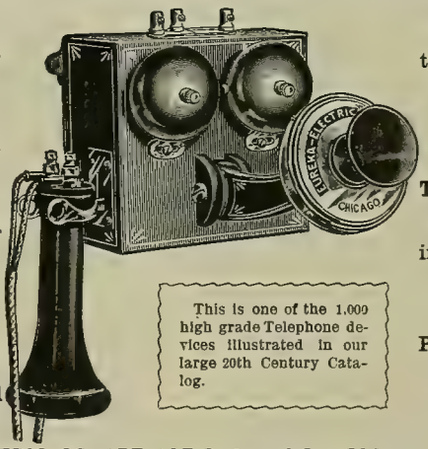

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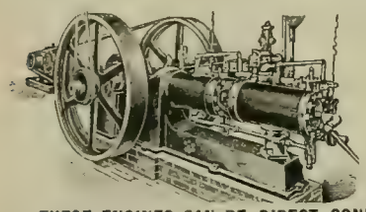

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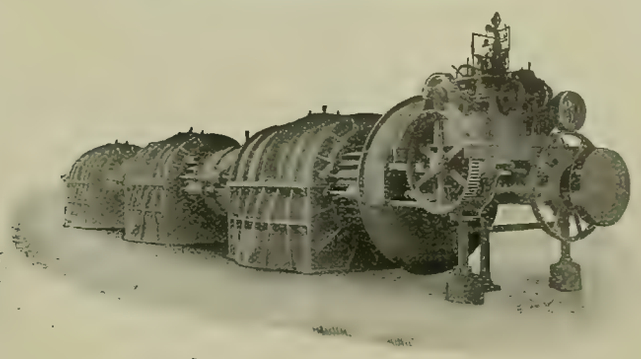

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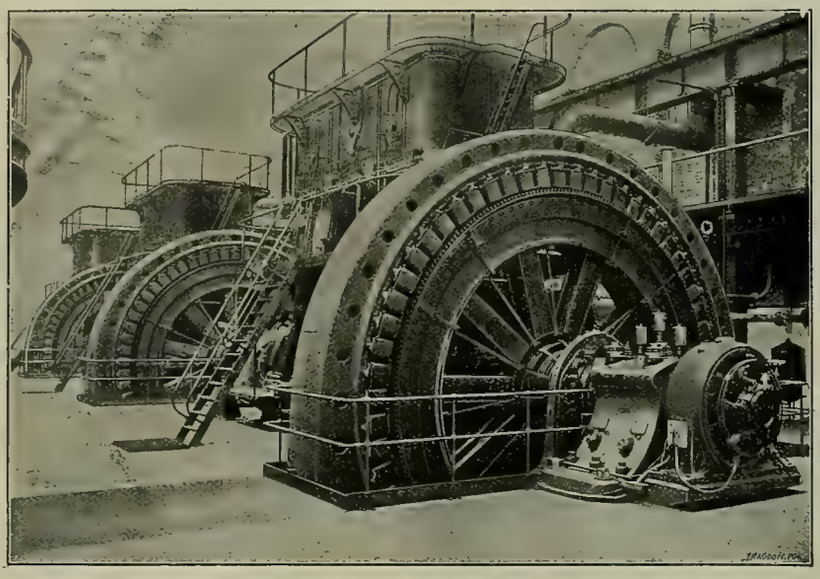

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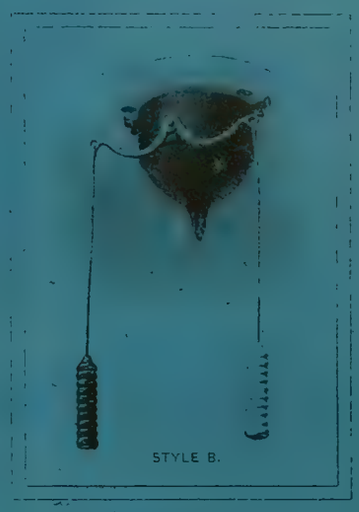

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CREOSOTED WOOD CONDUITS.

Our Process Prevents Vegetable Growths from Reaching Conduits.

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SOMETHING NEW!

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COVERED CUT-OUTS

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JUST THE THING FOR 500-VOLT FAN CUT-OUTS.

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7th AND CLARK AVE., ST. LOUIS.

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IT SAVES COAL AND COPPER AND IMPROVES SERVICE.

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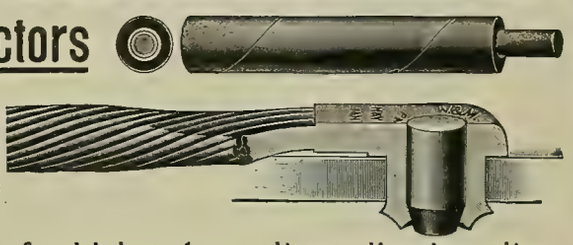

"Crown" wires are the perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

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ARC LAMPS, KNIFE SWITCHES, GLOBES, FLUSH PUSH, AND SNAP SWITCHES, SHADES, CARBONS, RUBBER COVERED WIRES, CORDS AND CABLES, ELECTRIC LIGHTING SUPPLIES OF ALL KINDS.

WRITE FOR PRICES.

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A. C. Enclosed Arc Lamp System.

ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

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ESPECIALLY ADAPTED FOR

STREET RAILWAY POWER PLANTS.

ALSO CENTRAL STATIONS AND ELECTRIC VEHICLES.

Electric Elevators, Railroad Signal Apparatus, Telegraphs, Telephones, Electric Fire Alarms.

Send for Description and Catalogue.

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THE CARBON QUESTION

TO BE A SOURCE OF WORRY TO YOU WHEN WE GUARANTEE

COLUMBIA CARBONS

(FOR ENCLOSED ARCS)

TO BE SUPERIOR TO ANY IMPORTED CARBON IN UNIFORMITY OF SIZE AND STRAIGHTNESS, OR SUBJECT TO RETURN AT OUR EXPENSE? THE LARGEST CARBON CONSUMERS IN THE U. S. ARE SATISFIED WITH "COLUMBIAS." A TRIAL ORDER WILL MAKE YOU A STEADY CUSTOMER. LET US SEND YOU CONVINCING PROOF OF THEIR SUPERIORITY.

NATIONAL CARBON COMPANY,

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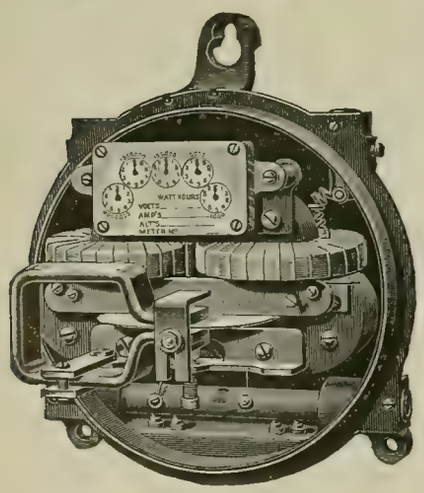
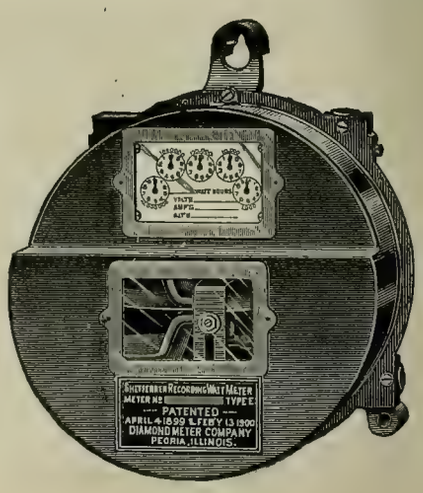


Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.

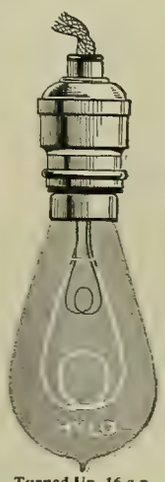


DIAMOND METER CO.

PEORIA, ILL., U. S. A.

OKONITE IT NEVER DISAPPOINTS

THE HYLO BABY FILAMENT LAMP.



Turned Up, 16 c.p.

THE HYLO LAMP can be turned up and down from 1 to 16 c. p. It has two light-giving filaments—a big one like a common lamp, giving 16 candlepower, and a Baby Filament giving one candlepower. Unscrewing the lamp slightly from the socket turns out the Big Filament and lights the Baby.

The mechanism which makes the change is a part of the lamp itself and is so extremely simple that derangement is nearly impossible.

1. **Can be turned up and down—a simple twist of the wrist does it.**
2. **Saves five-sixths of the light bill when turned down.**
3. **Goes into any socket like a common lamp.**
4. **Takes up no more room than a common lamp.**
5. **Can be used with any kind of shade or reflector.**
6. **May be moved from one socket to another.**
7. **Lasts from two to five times as long as a common lamp.**
8. **Eliminates danger of fire.**
9. **You don't pay for too much light.**
10. **Made with either of three bases—Edison, T.-H. or S.-M. (Westinghouse).**

Turned Down, 1 c. p

SALES AGENTS,

CENTRAL ELECTRIC COMPANY,

264-70 Fifth Avenue, CHICAGO, ILL.

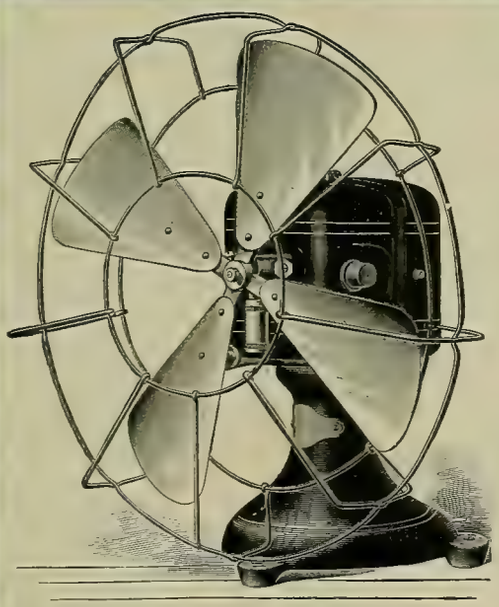
OKONITE IT NEVER DISAPPOINTS

USE OR SALE OF

Infringements stopped by Injunctions.

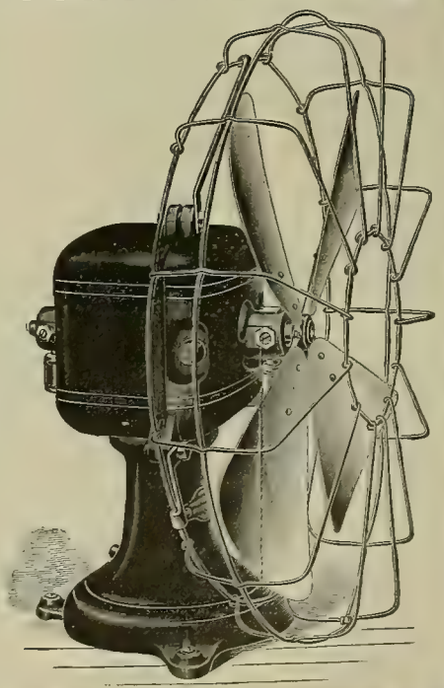
Our ceiling and electrolier fan patents sustained by U. S. court decision. Use or sale of Infringements stopped by injunction March 8th and December 5th, 1900.

DIEHL DESK FAN MOTORS.



The enviable reputation we have established in the manufacture of high grade ceiling fans has been fully maintained in our production of ***DESK FANS.*** They are acknowledged by users to be the best ever produced. Following are some of the important features they possess:

Silk insulation on armature wires,
Hard-drawn copper commutator bars,
Self-aligning bronze bearings,
Improved self-oiling oil cup,
Unbreakable three-speed switch base,
Very strong guards—no solder used,
Body of fan richly enameled and embellished with fine gold stripes.
Absolutely the highest efficient fans on the market.



Endorsed and approved by thousands of users throughout the world. 14 years in the manufacture of fans assures perfection in all respects.

DIEHL MFG. CO.,

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SHOWROOMS:

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BOSTON, 128-132 Essex St. PHILADELPHIA, W. Irwin Cheyney & Co.

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FOR STREET RAILWAYS, POWER AND LIGHTING PLANTS, FOR ELECTRICAL VEHICLES, TELEGRAPH, TELEPHONE AND ELECTRIC ELEVATORS.

BATTERY SUPPLIES AND REPAIRS.

We make very low prices for repairs of batteries manufactured by the **Electric Storage Battery Company.** Send us dimensions of plates required and the number and **we will make you a quotation that will save you money.** We will guarantee that our plates can be used with better results in installations of the Electric Storage Battery Co. than the plates of their own manufacture. To sustain our claims we refer you to the Kansas City Electric Light Company, who have a large installation, manufactured and installed by this Company.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA. CHICAGO, ILL. PEABODY, MASS.

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Bridgeport Brass Co.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
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Central Mfg. Co
Independent Tel. Supply Co.
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General Inc. Arc Light Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Kentucky Electrical Co.
Northern Elec. Mfg. Co.
Ohio Electric Works.
Schureman & Hayden.
Sprague Electric Co.
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General Electric Co.
General Inc. Arc Light Co.
Keystone Electrical Inst. Co.
Queen & Co.
Sage & Bro., F. B.
Stanley Electrical Mfg. Co.
Stanley Instrument Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Weston Electrical Inst. Co.
Willyoung, Elmer G.

Electro-Plating Mach'y.
Besly & Co., Chas. H.
Crocker-Wheeler Company.
General Electric Co.

Elevators-Conveyors.
Jeffrey Mfg. Co.
Link Belt Machinery Co.

Engines, Gas.
Modern Gas Engine Co.
Palmer Bros.

Engines, Steam.
Ball Engine Co.
Camp Engineering Co.
Chicago House Wrecking Co.
Sturtevant Co., B. F.

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American District Steam Co.

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Crocker-Wheeler Company.
Diehl Mfg. Co.
Edison Mfg. Co.
Emerson El. Mfg. Co.
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Ohio Electric Works.
Sprague Electric Co.
Sturtevant Co., B. F.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Monarch Fire Appliance Co.

Flexible Shafts.
Stow Mfg. Co.

Forges.
Sturtevant Co., B. F.

Fuses and Fuse Wire.
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Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.
Electric Appliance Co.
Western Elect. Supply Co.

Gears.
Besly & Co., Chas. H.

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Bissell Company, The F.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Garl Electric Co.
General Electric Co.
Heath Electric Company.
Hodge-Walsh El. Eng. Co.
Ohio Electric Works.
Stewart & Co., Frank H.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.

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Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co.

Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

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Sturtevant Co., B. F.

Holders, Inc. Lamp.
Crescent Mfg. Co.
Incandescent Electric Light Manipulator Co.
Stewart & Co., Frank H.

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Columbus Batt. & Spec. Co.

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Hartford Steam Boiler Inspection & Insurance Co.

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Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Canton Insulator & Clay Co.
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Chicago Edison Co.
Chicago Mica Co.
Electric Appliance Co.
General Inc. Arc Light Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Mica Insulator Co.
Mogadore Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co
Ohio Electric Works.
Okonite Co., The.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.

Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Miller-Knoblock El. Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elec. Supply Co.

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Bossert Elect. Const. Co.
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General Inc. Arc Light Co.

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Central Electric Co.
Chicago Edison Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Ohio Electric Works.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.

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Crescent Manufacturing Co.
Inc. El. Lt. Manipulator Co.
Smith, Theo.

Lamps, Incandescent—Replacers & Cleaners.
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Central Electric Co.
Electric Appliance Co.
Eureka Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Linemen's Climbers.
Anderson & Sons, W. H.
Klein & Son, Mathias.
Smith & Hemenway Co.

Magnet Wires.
(See Insulated Wires.)

Mechanical Machinery.
Besly & Co., Chas. H.
Chicago House Wrecking Co.
Robertson & Sons, Jas. L.
Stilwell-Bierce Smith-Vaile.

Meters.
Diamond Meter Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.

Mica.
Chicago Mica Co.
Munsell & Co., Eugene.

Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

Motors—See Dynamos and Motors.

Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.

Patent Attorneys.
Johnston, Thomas J.
Page, Chas. G.

Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

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Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.

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Porter-Morse Co.
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Worcester Co., C. H.

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Bowers Manufacturing Co.
Canton Insulator & Clay Co.
Mogadore Insulator Co.
Peru Elec. Mfg. Co.

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Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

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Continuous Rail Joint Company of America.

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Garl Electric Co.

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Westinghouse El. & Mfg. Co.

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Bartlett & Co., A. F.
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Cream Flux Co.

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Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.

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Barnes Co., The Wallace.
Manross, F. N.

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Columbus Batt. & Spec. Co.
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Gould Storage Battery Co.
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Simplex Electrical Co.
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Western Elec. Supply Co.

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American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
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Central Tele. & Elec. Co,
Century Telephone Cons. Co.
Chicago Telephone Sup. Co.
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Eureka Electric Co.
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Star Brass Works.

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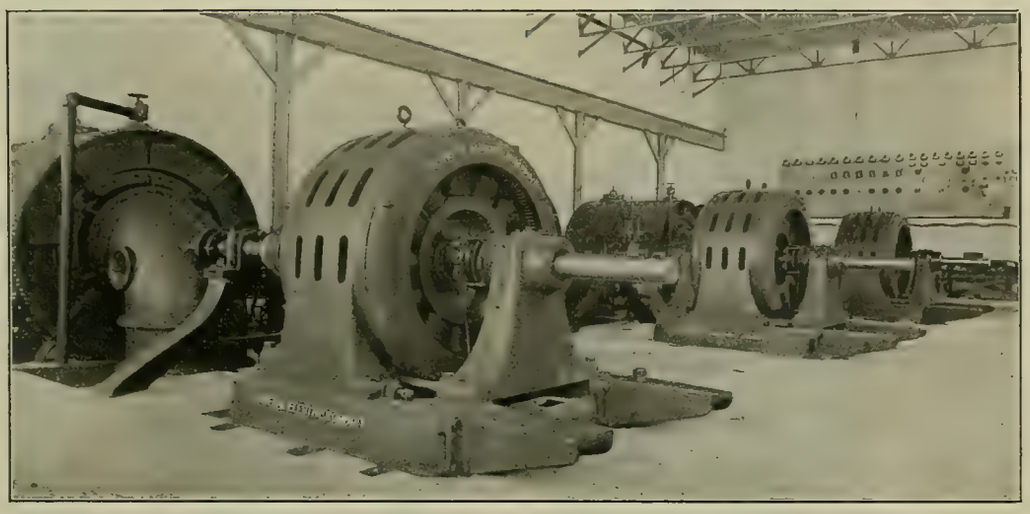
Besly & Co., Chas H.
Central Electric Co.
Driver-Harris Wire Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 3.

THE GENERAL ELECTRIC COMPANY'S

INSTALLATIONS.



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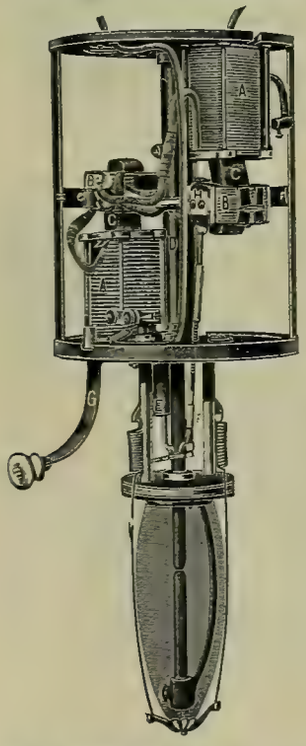

BUT WE CAN GIVE YOU AN

Alternating Arc Lamp Using 5 Amperes.

We don't use an OSCILLATOR, but our new

"DIVIDED COIL" MECHANISM.

This does away with choke coils, springs and moving iron.

NATIONAL ARC LAMP CO.,

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DIRECT CURRENT SINGLY ON 110-220-500 VOLT CIRCUITS.

In Groups in Series.
Two 110 Fans on 220 V.
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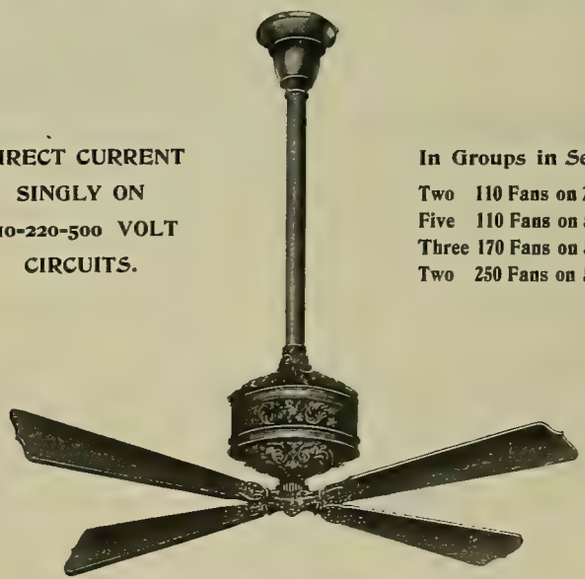

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WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.

ST. LOUIS OFFICE, Security Building, St. Louis, Mo.

STANDARD ELECTRIC CO., Cincinnati, Ohio.

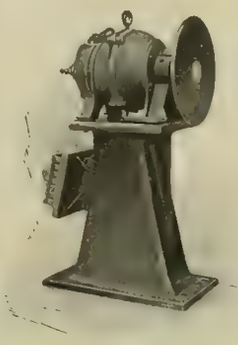
CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

ANTWERP, 32 Rue Boudewyns.

LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.

PARIS, 46 Avenue de Breteuil.

The Western Electrician's ANNUAL TELEPHONE NUMBER, to be Dated March 23, will go to press March 20. Advertising Copy and Cuts intended for that issue should be in our office Monday, March 18.



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The most serviceable power apparatus to-day is the Lundell Motor. It is adapted to all kinds of machine-driving. It has a strong starting torque and an accurate adjustment of speed. It is compact, economical and durable. Send for our Illustrated Bulletin No. 03205.

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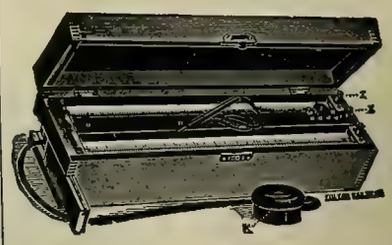

A Direct Reading Ohmmeter.

Ohmmeters, Ammeters, Voltmeters.

Special Electrical Machinery.

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Successors to American Electric Specialty Co., 123 Liberty St., New York City.

New York Agents Wirt Electric Co. Rheostats and Brushes.

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Write for our new free circular:

Salaried Positions

For Learners

It shows how we prepare young men and women to earn good salaries in positions that require special knowledge. It tells how you can obtain a salaried position in your chosen profession, trade or business, and support yourself while learning how to earn more. You can become a

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250,000 students and graduates in Mechanical, Electrical, Steam, Civil and Mining Engineering; Architecture; Drawing and Designing; Lettering; Chemistry; Telegraphy; Telephony; Teaching; Stenography; Book-keeping; English Branches. When writing, state subject in which interested.

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Vegetable Boiler Compounds.

ALL KINDS OF ANALYSES. WATERS FREE. OILS A SPECIALTY.

10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

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STEWART CORD ADJUSTER.

(PATENTED AUG. 21, 1900.)

Can be wrapped or looped. Can be adjusted after lamp is suspended.
Made of red or black fibre.

Price, delivered by mail, $1.10 per hundred.

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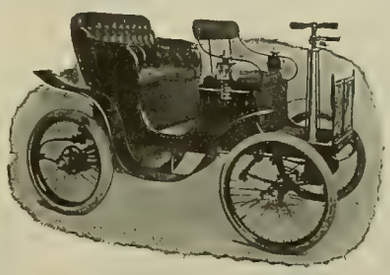
ONE OF OUR LATEST MODELS IS THE



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Standard the World Over.

THEY ARE UP-TO-DATE—ORIGINAL—ACCURATE.
THEY SAVE TIME—MISTAKES—MONEY—CUSSWORDS.

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It burns a minimum of 250 hours. No alignment necessary. Trims easier than an open arc lamp. Allows easy access to every part of lamp. Gives absolutely steady light.

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AND ITS LITTLE STORY—ALL THE FINE POINTS—

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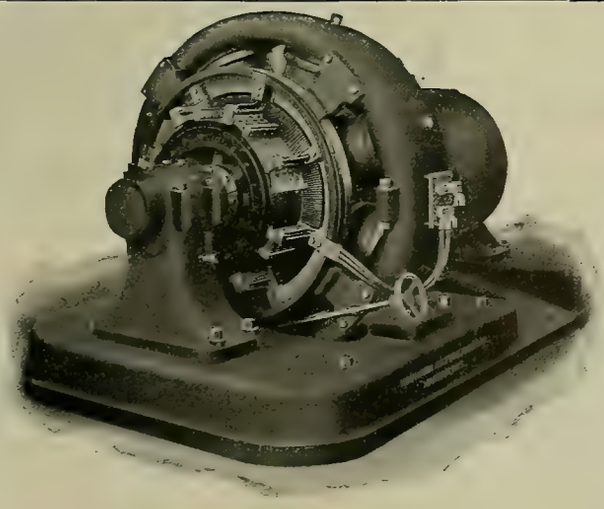
Our Portable Voltmeters and Ammeters for use on direct-current circuits meet every possible requirement. They are absolutely accurate and are designed as standards, yet are strong and durable.



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A Shade Holder Not Required.
Easy to Attach.
Practical.
Grips Socket Firmly.
Saves Cost of Shade Holder.
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THE ATTACHMENT ACTUALLY TAKES PLACE OF SHADE HOLDER.

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Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

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FOR COMMUTATOR SEGMENTS.
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For Testing Batteries and Battery Circuits, Locating, Faults, Grounds, etc.
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The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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FOR SALE BY ALL SUPPLY HOUSES OR
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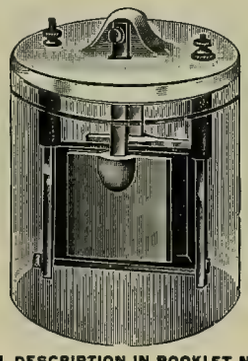

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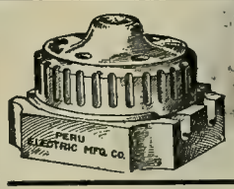

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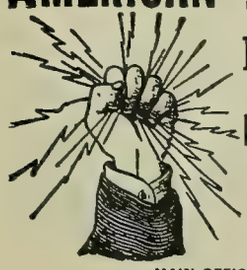

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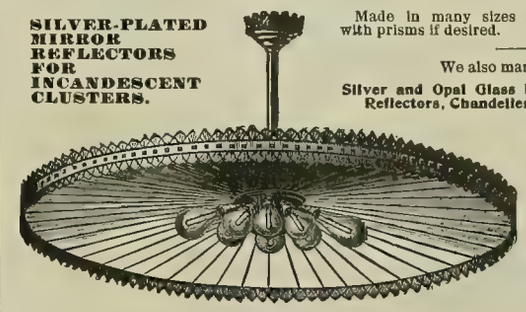

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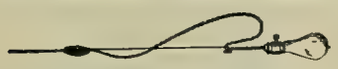

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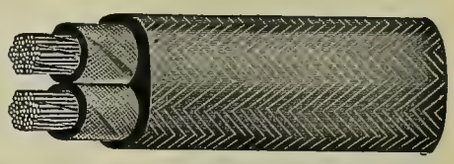

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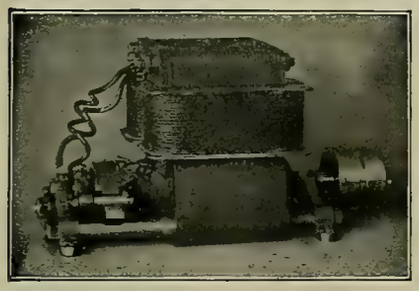

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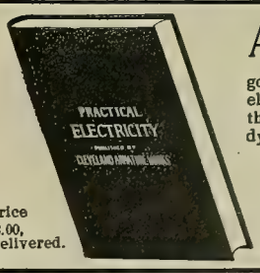

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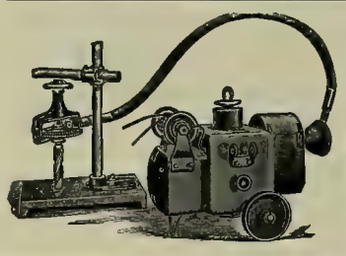

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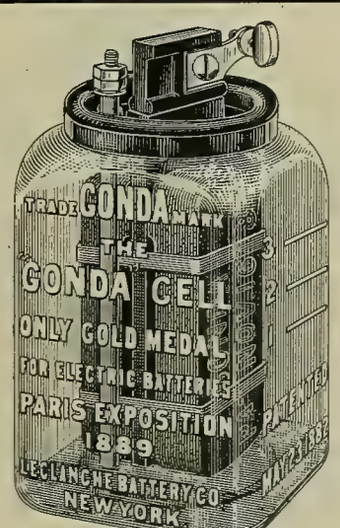

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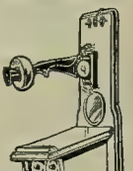

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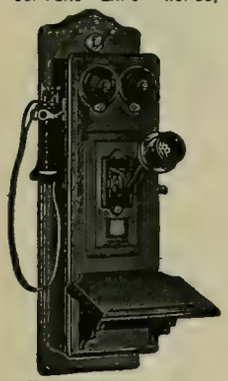

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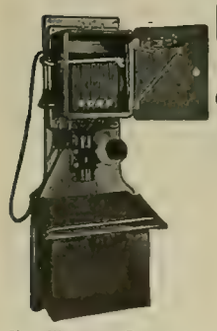

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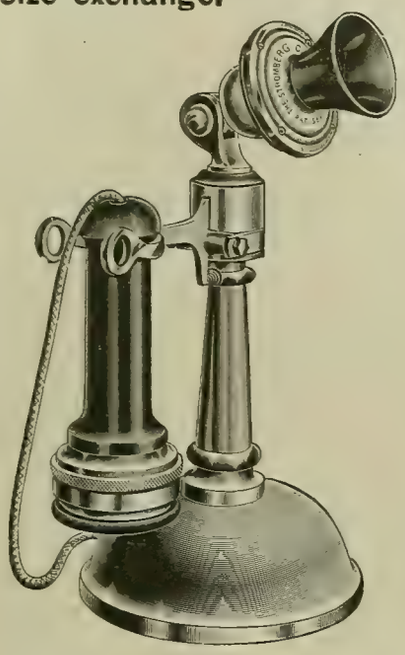

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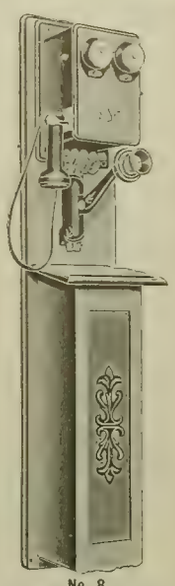

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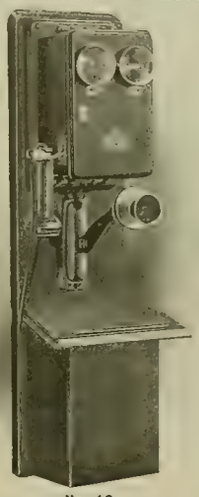

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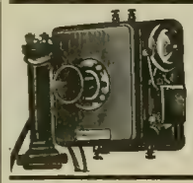

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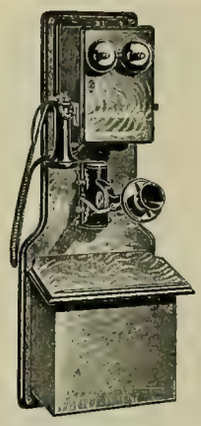

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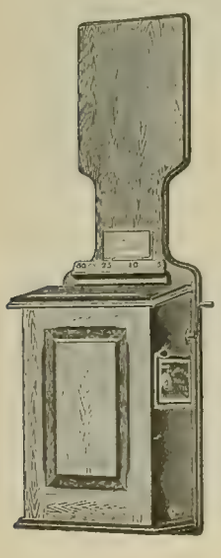

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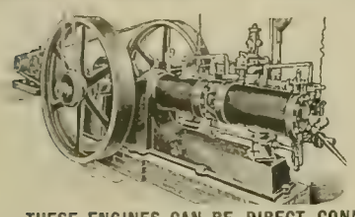

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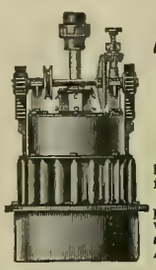

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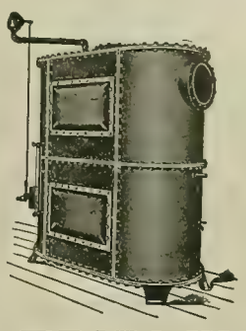

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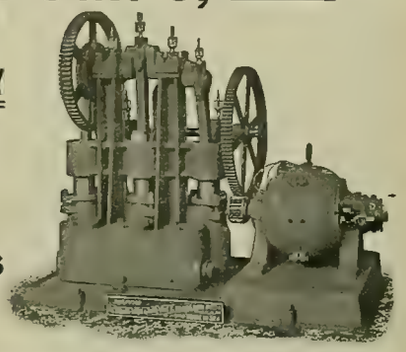

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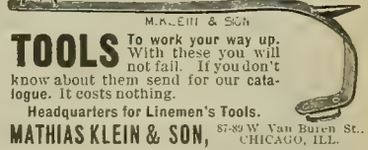

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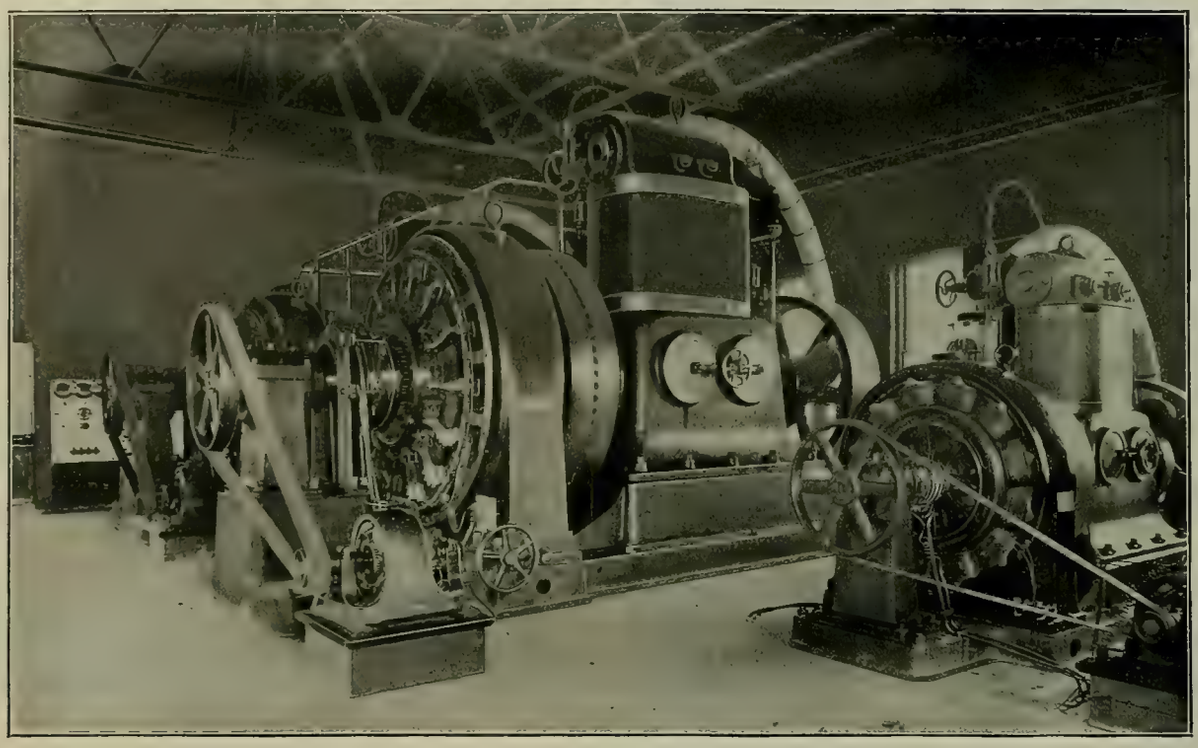

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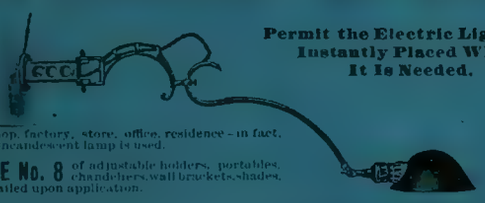

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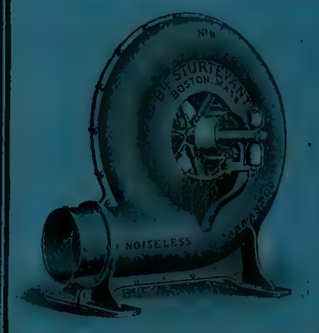

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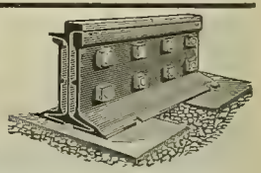

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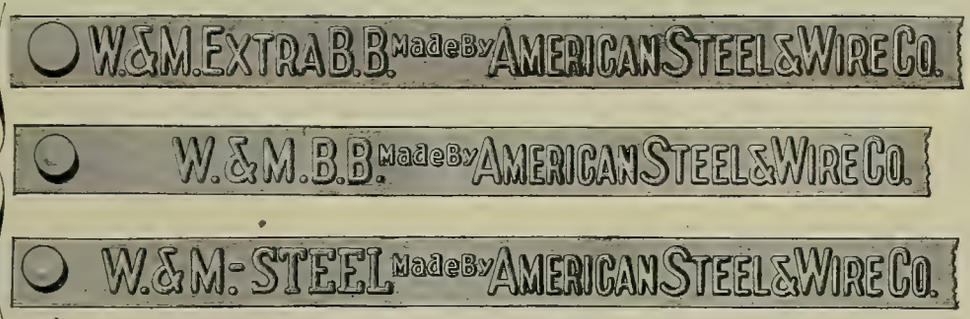

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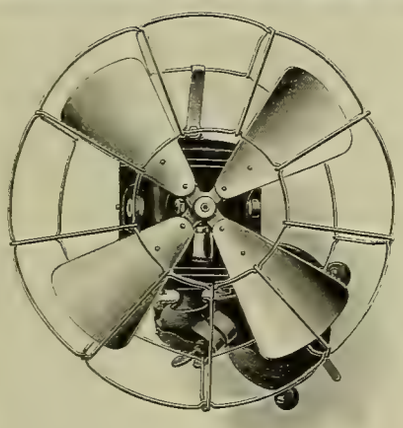

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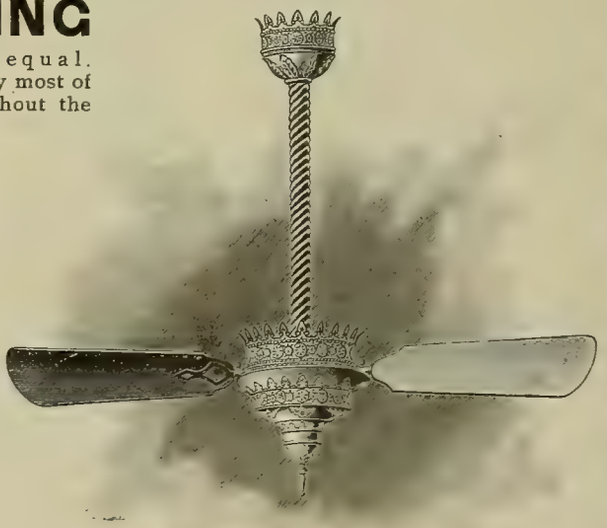

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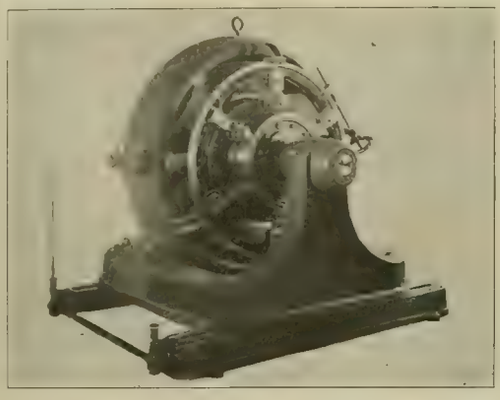

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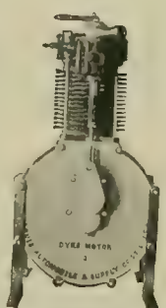

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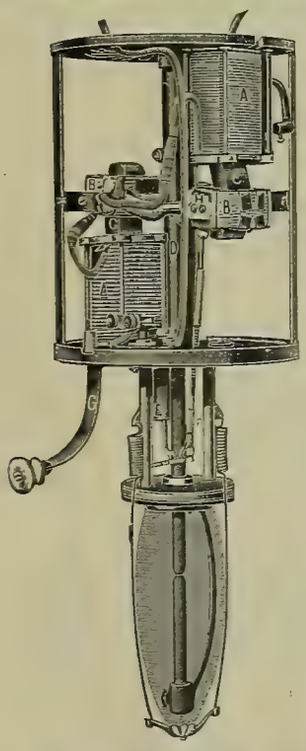

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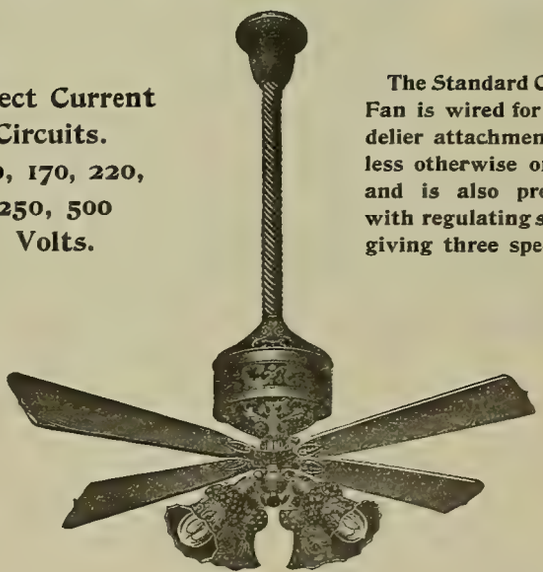


STANDARD CEILING FAN WITH CHANDELIER ATTACHMENT.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.
MERCANTILE ELECTRIC CO., 810 Spruce St., St. Louis, Mo.
STANDARD ELECTRIC CO., Cincinnati, Ohio.
CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.
LONDON,
ANTWERP, 32 Rue Boudewyns.
Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.
PARIS, 46 Avenue de Breteuil.

"CENTRAL ENERGY"

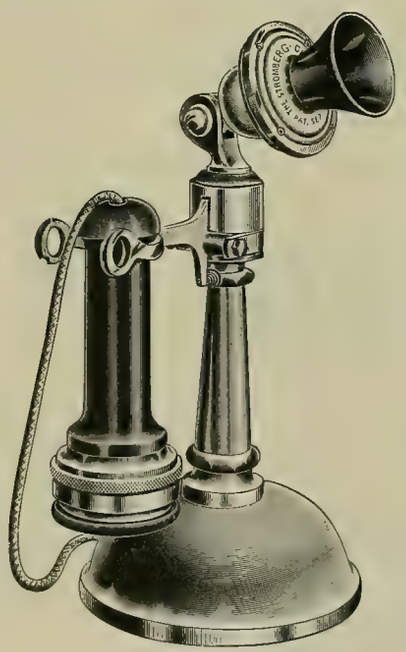
"The System of the Future"

Has been thoroughly demonstrated in actual exchange operation for a sufficient period to warrant its general adoption.

MULTIPLE SWITCHBOARDS

For any size exchange for "Central Energy" or individual generator and local battery systems. Trunking boards for large and small, public or private exchanges.

Telephone Supplies.
Copper Wire.
Iron Wire.
Brackets.
Pins.
Insulators.
Insulated Wire.
Cables, Cross Arms.
Etc., Etc.



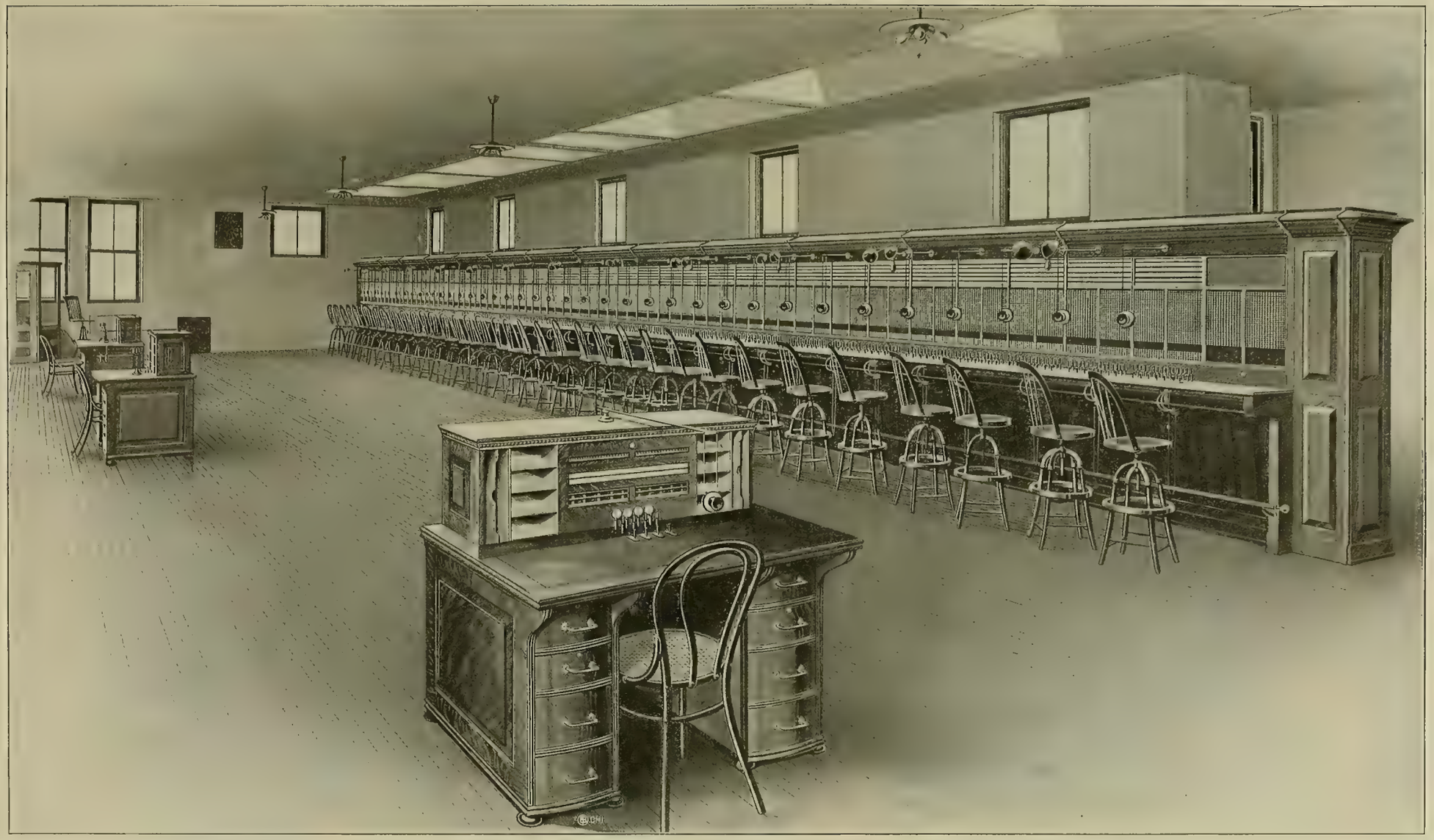
DESK TELEPHONE.

Central Office Protection.
Terminal Boxes.
Cable Arresters.
Distributing Boards.
Power Plants.
Repeating Coils.
Condensers.
Power Generators.
Etc., Etc.

TOLL LINE APPARATUS A SPECIALTY.

The Stromberg-Carlson Tel. Mfg. Co.,

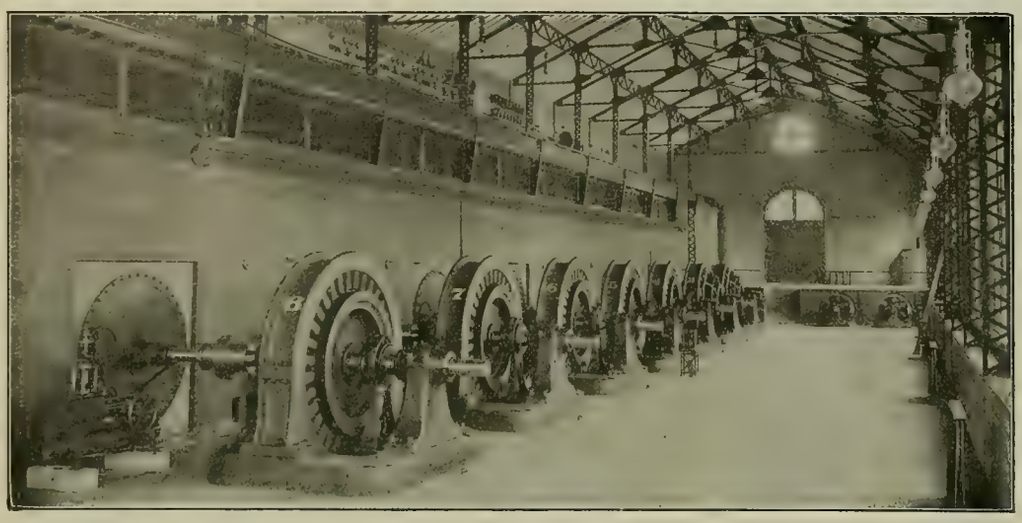
70-82 W. Jackson Boul., CHICAGO, U. S. A.



3,600 Line Central Energy Multiple Switchboard, Rochester Telephone Company, Rochester, N. Y.

THE GENERAL ELECTRIC COMPANY'S

INSTALLATIONS.



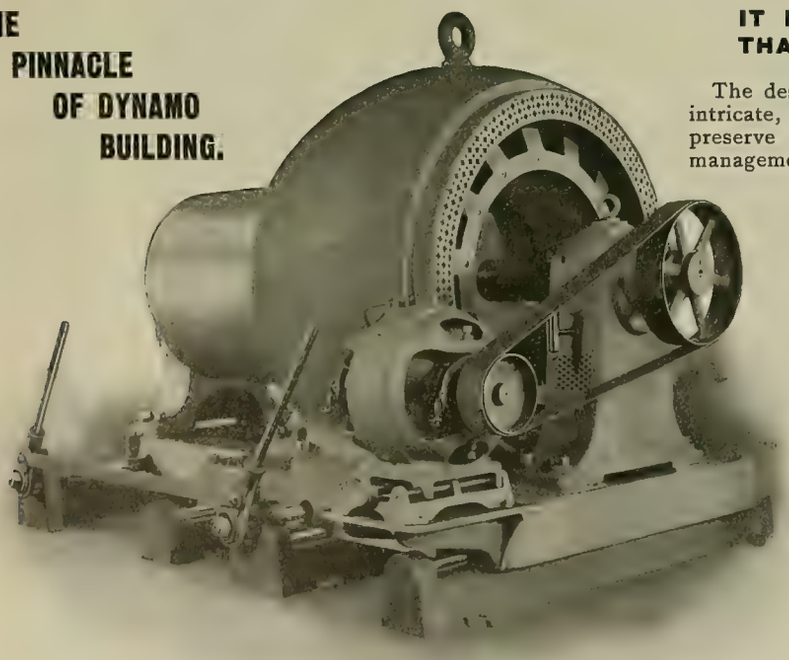
GENERATOR ROOM OF THE ST. ANTHONY FALLS POWER COMPANY, MINNEAPOLIS, MINN.

GENERAL OFFICE, SCHENECTADY, N. Y.

New York Office, 44 Broad Street. Sales Offices in all Large Cities.

THE IMPROVED WARREN ALTERNATOR.

THE PINNACLE OF DYNAMO BUILDING.



IT IS EASIER TO INVENT COMPLICATIONS THAN TO PRESERVE PRACTICAL SIMPLICITY.

The designers of the Warren Alternator have studiously avoided intricate, delicate and costly parts, endeavoring in every way to preserve simplicity, reliability, durability, efficiency and ease of management.

The absence of moving wire, collector rings, commutator and brushes makes the Warren peculiarly well fitted for the exacting conditions of long, continuous service. No attention required except the occasional refilling of oil reservoirs.

RUMSEY ELECTRICAL MF'RS CO.,
1217 Filbert St., Philadelphia.

H. B. WARREN,
Sandy Hill, New York, for Northern and Western New York and New England States.

WESTERN ELECTRICAL SUPPLY CO.,
St. Louis, Mo.

NORTHWEST ELECTRICAL ENGINEERING CO.,
Portland, Ore.

FESSENDEN & RIDINGER,
410 Penn Av., Pittsburg, Pa

C. W. HOBSON,
Waco, Tex.

SMITH-COURTNEY CO.,
Richmond, Va.

H. B. COHO,
149 Broadway, New York.

THOS. MUIR & SON,
Detroit, Mich.

J. HOLT GATES & CO.,
13-15 Monadnock Blk., Chicago.

JOHNSON LAW CO.,
Jacksonville, Fla.

WARREN ELECTRIC MFG. CO.

SANDUSKY, OHIO.

What is it that is the most essential thing to the successful working of the Telephone? Wire.

THEN USE THE BEST.

The Standard for Rubber Insulation.

253 BROADWAY, NEW YORK.

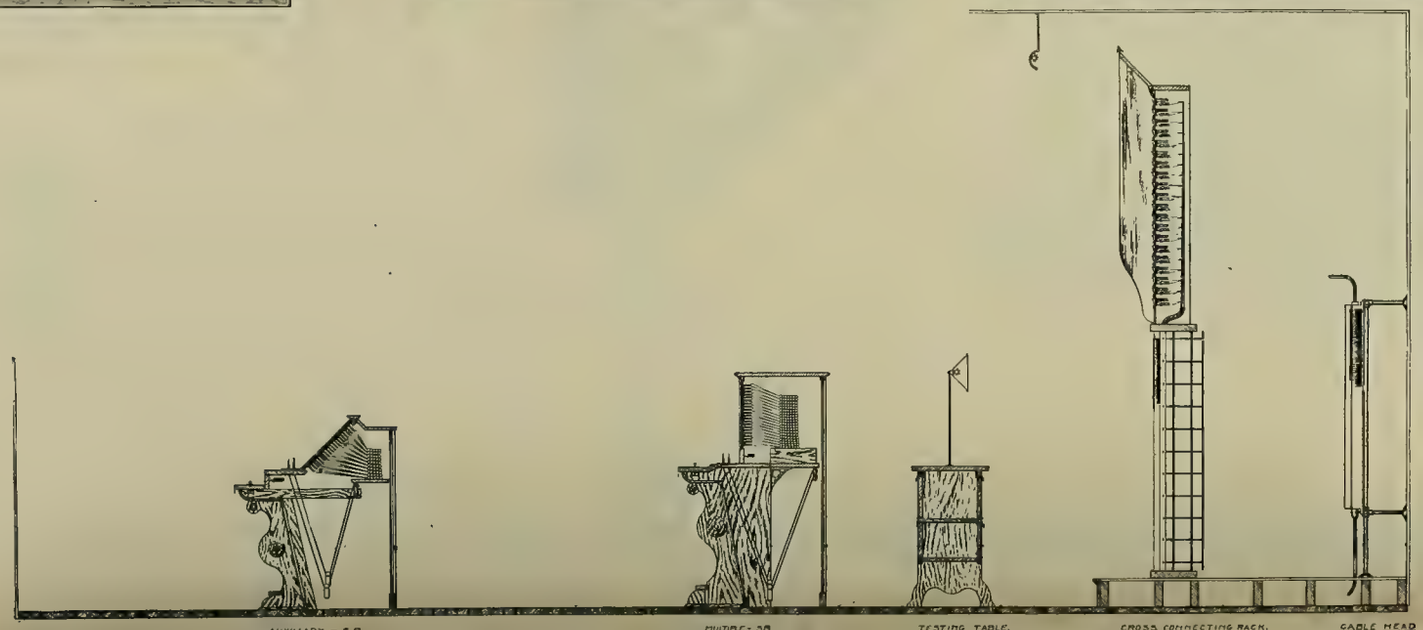
Central Electric Company,

264-266-268-270 FIFTH AVENUE,

Western Agents. CHICAGO.

IN THE "WESTERN ELECTRICIAN" OF MARCH 9, 1901, WAS DESCRIBED THE UNION SWITCHBOARD CO.'S SYSTEM, AND WE SHOWED YOU PHOTOGRAPHS OF OUR 21 EXCHANGES.

WE NOW SHOW YOU, BELOW, SOME OF THE MOST VALUABLE AND NOVEL FEATURES OF ONE OF OUR MODEL EXCHANGES.



This cut shows in diagram the arrangement of the switchboard elements in the exchange of the Mutual Telephone Company, Erie, Pa. The board and its operation are entirely new and worthy of a careful consideration. Briefly, the operation of the system is this:—

A call is indicated on the drop frame, shown at the right, by the uncovering of a white number. The operator on whose section the call comes in, but seated before the multiple board shown at the left of center, is immediately notified of the fact by the lighting of a pilot lamp on the multiple board before her. She sees the number on the rack and plugs in on the corresponding jack on the multiple board, to answer. This act not only extinguishes the pilot lamp on the multiple board, BUT CHANGES THE COLOR OF THE DROP ON THE RACK TO RED; likewise, the act of plugging in on the multiple board, on the line called for, causes that number to show red on the rack. In the showing of the red numbers lies the "busy" signal, which is visual. All numbers showing red indicate "line in use," and the first care of the operator when a number is called for is to notice if that number shows red. Thus a quick glance of the eye is the only motion required on the part of the operator to make the "busy test." When a connection is taken down the numbers disappear entirely and the drops are ready for another call.

What is the AUXILIARY BOARD? This is something (original with us) by means of which IMMEDIATE ANSWERS TO ALL CALLS can be given. We will describe this in the near future on these pages.

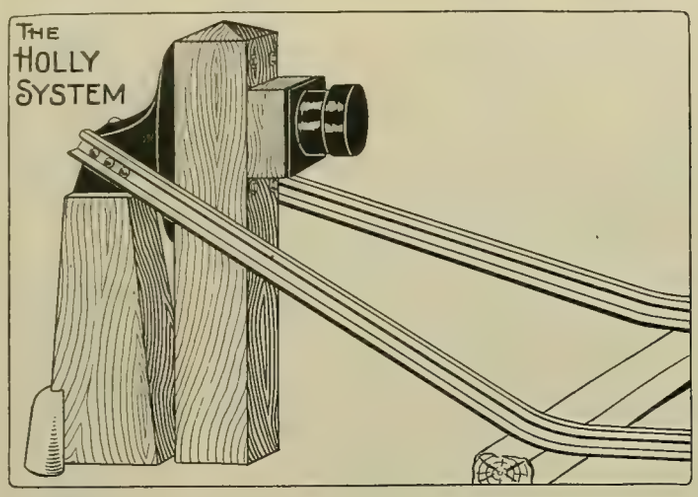
NOW, WHY SHOULD YOU USE OUR APPARATUS?

We have something new, but have no experiment to try on you; our apparatus has been in successful operation at the Erie (Pa.) exchange since October, 1900. : : We have no line signals on our switchboard; therefore, they do not have to be crowded in small compass and consequently do not easily get out of order, but are easily repaired. : : There are no make and break contacts in the line circuits excepting at the jacks; no relays, no transformers, no condensers, no boosters. : : All the apparatus works with positive action; there are no fine adjustments. : : The "busy test" is the quickest—no motion of the hand is required. : : All line signals are in plain view of all the operators. : : Facility for making tests and repairs. : : Freedom from interference to business. : : Minimum number of operators to give first-class service. : : Comparatively small original cost. : : Economy of operation. : : Immunity from switchboard trouble. : : Extreme simplicity of circuits. : : Self-restoring drops. : : Lack of complication. : : Swiftness of service. : : Flexibility of system.

REMEMBER: WE ARE TELEPHONE CONTRACTORS as well as MANUFACTURERS, and stand ready to build your SWITCHBOARDS and ALL YOUR LINES; IN FACT, WE CONTRACT to build COMPLETE TELEPHONE SYSTEMS. As to date WE HAVE BUILT as many as TWENTY-ONE EXCHANGES and HUNDREDS OF MILES OF LINE, WE THINK WE KNOW SOMETHING ABOUT THE "TELEPHONE CONTRACTING BUSINESS."

THE UNION SWITCHBOARD CO.,

ERIE, PA.



A Sure Stop.

If you are contemplating the installation of an underground heating plant, stop and investigate the HOLLY SYSTEM, the original and only successful system of underground steam distribution which has proved a mechanical and financial success.

We were the first to install the underground heating plants, and as we have had over fifteen years of experience, we can guarantee results.

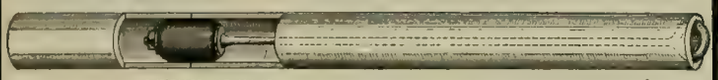
Electric Companies who are operating our system report that they are paying all their fuel and station expenses and interest on the investment for steam mains from the sale of their exhaust steam. Write for our new pamphlet.

AMERICAN DISTRICT STEAM CO.,
LOCKPORT, N. Y.

Mention Western Electrician.

STONE CONDUIT.

15 to 20 per cent. Less than Tile Construction.



PATENTS PENDING.

Outside diameter, 4½ inches. Length, 6 feet. Bore, 3, 3½ and 3¾ inches.
Pipe are easily sawed to any desired length or angle.

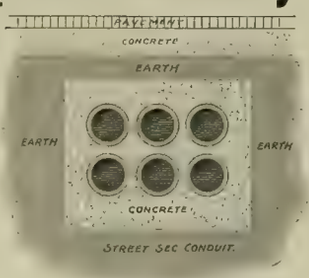
No Inspection of Pipe Required. All Pipe Are Perfect. We Stand Loss by Breakage.

PORTLAND CEMENT and CRUSHED STONE are the only materials entering into the construction of our

Underground Subway System.

INDESTRUCTIBLE.

A SOLID BLOCK OF STONE WITHOUT JOINTS, AND A GOOD NON-CONDUCTOR.



EVERLASTING.

CONSTRUCTION IS VERY RAPID, USING ONLY ORDINARY LABOR IN THE ENTIRE WORK.

WATER AND GAS PROOF. It is the strongest of CONDUIT STRUCTURES, as the concrete unites with the exterior of the pipe. Pipe are manufactured by a new process of subjecting the material to an IMMENSE PRESSURE from the INTERIOR of the pipe, which gives a bore of PERFECT DIAMETER and POLISHED SMOOTHNESS, the whole having a uniform strength and density. Such pipe when laid in concrete with our RUBBER MANDREL, under EXPANSION, have perfect ALIGNMENT without chance of error in construction.

WE BUILD COMPLETE UNDERGROUND SUBWAY SYSTEMS.

AMERICAN STONE CONDUIT CO.,
WEST 18TH AND SOUTH LINCOLN STS.,
Write for Sample or Other Information. **CHICAGO, ILL., U. S. A.**

"ELECTROLYSIS PROOF"

HIGH VOLTAGE SPECIALTY. **ASPHALT PAPER CONDUIT** GUARANTEED TO STAND 50,000 VOLTS.

Made in 7-foot lengths. Bore, 3 and 3¼ inches. Weight, 2 lbs. to foot.
Made in sizes from 1½ to 8 inches.

AN ABSOLUTE NON-CONDUCTOR.

GUARANTEES PERFECT INSULATION.

INDESTRUCTIBLE.

Composed principally of asphalt, it is impervious to moisture; water and dampness cause it to become almost as hard as iron.

BETTER SERVICE

Obtained over wires enclosed in it.

NO SCRATCHING

Of cables in hauling. Entirely free from grit.

Made with male and female joint. Joints are coated with asphalt in laying, making conduit one solid body of asphalt from manhole to manhole. Sawed to any desired length or angle. Laid without concrete protection where the traffic is of the ordinary order. Cheapest of conduits to lay, using only ordinary labor. Cheapest to ship, as it weighs but two pounds to the foot. Guaranteed absolutely ELECTROLYSIS PROOF.

ORDERS SHOULD BE PLACED AT ONCE, TO INSURE DELIVERY FOR THE SEASON.

Electrolysis Proof Conduit Mfg. Co.,
605 Manhattan Building, CHICAGO.

"NATIONAL EQUIPMENT"

Has good qualities in the highest degree; most good; most advanced; most correct or complete; beyond all others; is

THE BEST.

"National" Apparatus The Ideal System To Install.

300 Line Magneto Type Switchboard.

"National" Metallic Circuit Multiple Switchboards Are Best.

The National Telephone Equipment Co.,

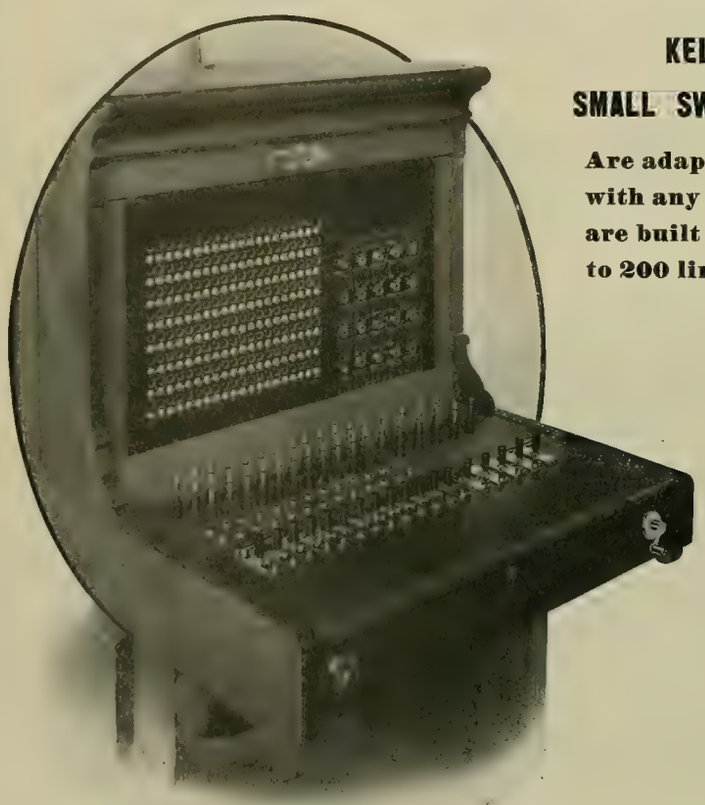
330-332 LAFAYETTE AVE., DETROIT, MICH.

KELLOGG SWITCH

MANUFAC

TELEPHONES, SWITCHBOARDS

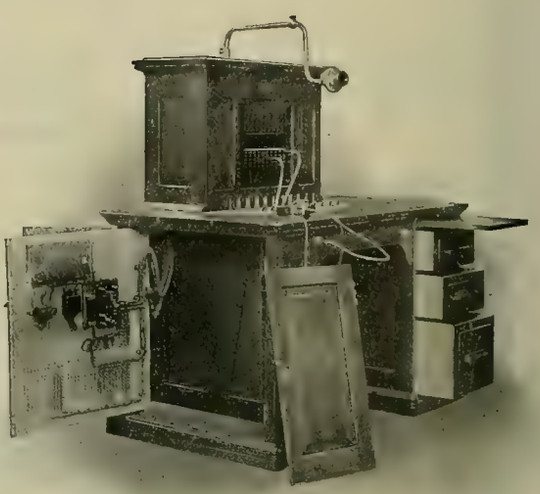
FOR SMALL OR



KELLOGG

SMALL SWITCHBOARDS

Are adapted for use with any system and are built in sizes up to 200 lines.

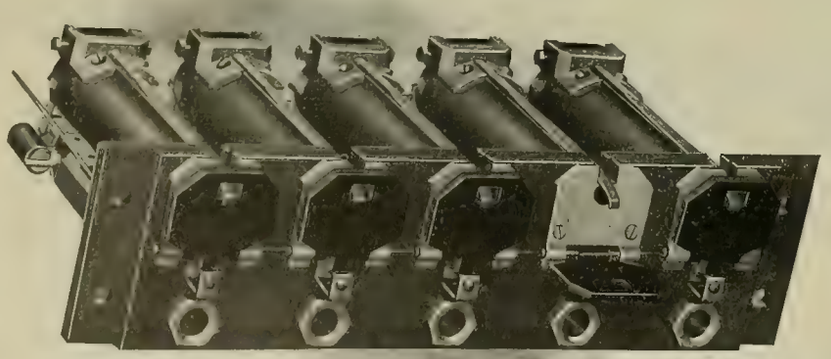


DESK STYLE BRANCH EXCHANGE SWITCHBOARD.

COMBINATION CENTRAL ENERGY AND MAGNETO SWITCHBOARD.

Capacity: 160 Central Energy Lines and 20 Magneto Lines. Has Lamp Line Signals, Lamp Double Supervisories, Self-restoring drops, Tubular Clearing-out drops, combination ringing and listening keys.

SEND FOR BULLETIN No. 2 ON Small Switchboards.



STRIP OF COMBINATION SELF-RESTORING DROPS AND JACKS.

Drops have but two contact springs, one of which projects through the mounting plate and restores the shutter upon the insertion of the plug into the jack, at the same time cutting the drop out of the talking circuit.

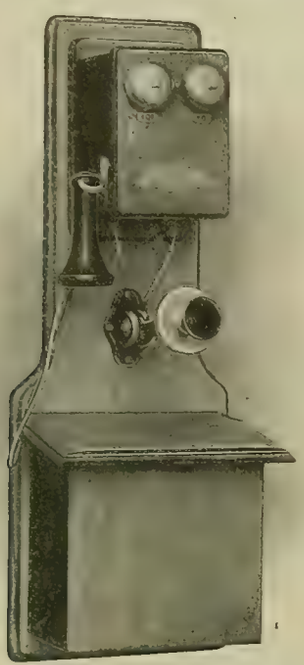
150-LINE MAGNETO SWITCHBOARD.

BOARD & SUPPLY CO.

TURERS OF

AND COMPLETE EQUIPMENTS

LARGE EXCHANGES.



SERIES WALL TELEPHONE.

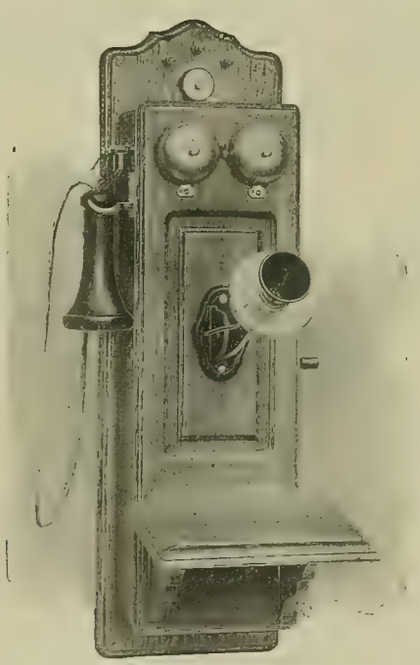
It is the aim of the Kellogg Company to produce the finest telephone apparatus in the world, finest in design, finest in workmanship and finish, finest in quality, and, as a natural consequence, finest in results secured. In our line of telephone instruments we are confident that we have not fallen short of this purpose. The instruments will *speak for themselves.*

CENTRAL ENERGY TELEPHONE.

FACTORY AND GEN. OFFICES:

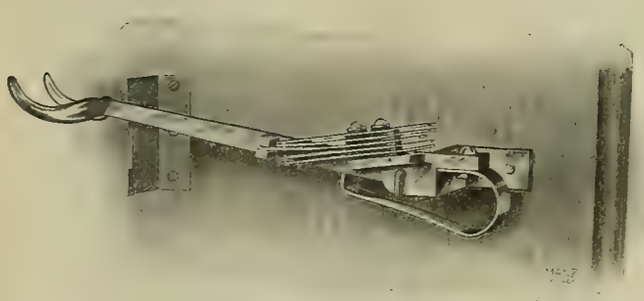
229 S. GREEN ST., CHICAGO.

NEW YORK OFFICE: 346 BROADWAY.



COMPACT DRY CELL TYPE TELEPHONE.

We are not afraid of comparison. ARE YOU? Call and let us show you our apparatus. Examine it for yourself.



KELLOGG SWITCH-HOOK.

German silver springs, hard rubber insulating strips, pure platinum contact points, hook lever Independent of Telephone Circuits.

PORTABLE DESK TELEPHONE.

GLOBE IS THE NAME

TRADE MARK

TRADE MARK

NO OPERATORS REQUIRED.

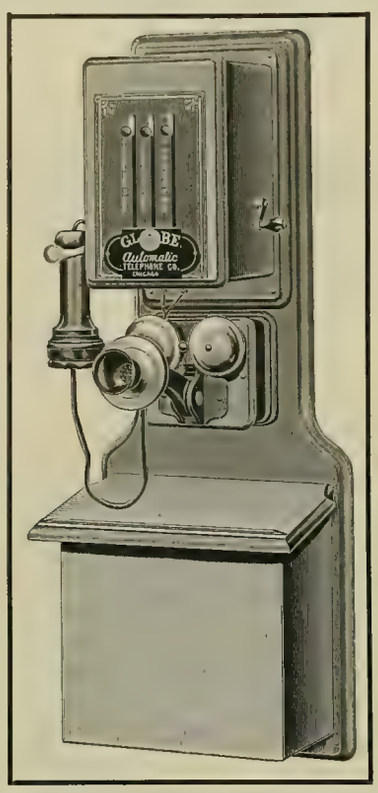
REDUCES ALL OTHER EXPENSES.

IMPROVES THE SERVICE.

INCREASES BUSINESS.
SAVES TIME.

SUPERIOR TO ALL OTHER

SYSTEMS OF THIS OR ANY OTHER CLASS.



WE WILL ESTIMATE THE COST

Of replacing your present apparatus with the

GLOBE SYSTEM

And convince you that after the change is made the profits on the whole investment will be from 25 per cent. to 75 per cent. larger than before.

Do not fail to investigate if you contemplate any new exchanges.

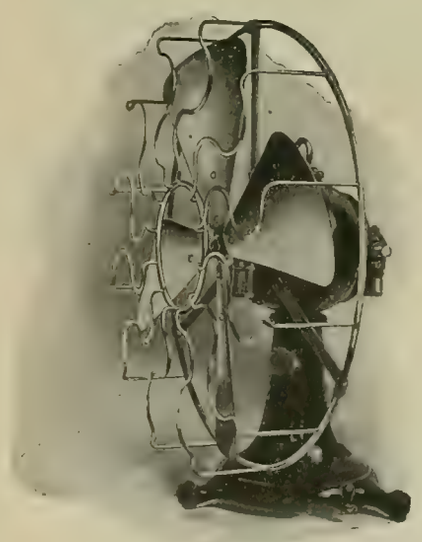
TRADE MARK

TRADE MARK

GLOBE AUTOMATIC TELEPHONE CO.,

FACTORY: 31-45 W. Randolph St. CHICAGO, U. S. A. OFFICES: 59 Dearborn Street.

LUNDELL FANS



ARE COPIED BUT NEVER EQUALED.

THE STANDARD. 100,000 IN USE.

The Lundell Fans have always had a higher efficiency and a greater durability than any other fan on the market by reason of superior design and construction. They have a strong torque and give a greater amount of breeze than any other make of fan consuming the same amount of power. Every piece of material is carefully examined and each fan is thoroughly tested before leaving the factory. They are made in different styles and sizes to meet every requirement, and dealers who want quick sales and satisfied customers should handle the Lundell Fans. There is a big demand for Lundell Fans and dealers should send in their orders at once.

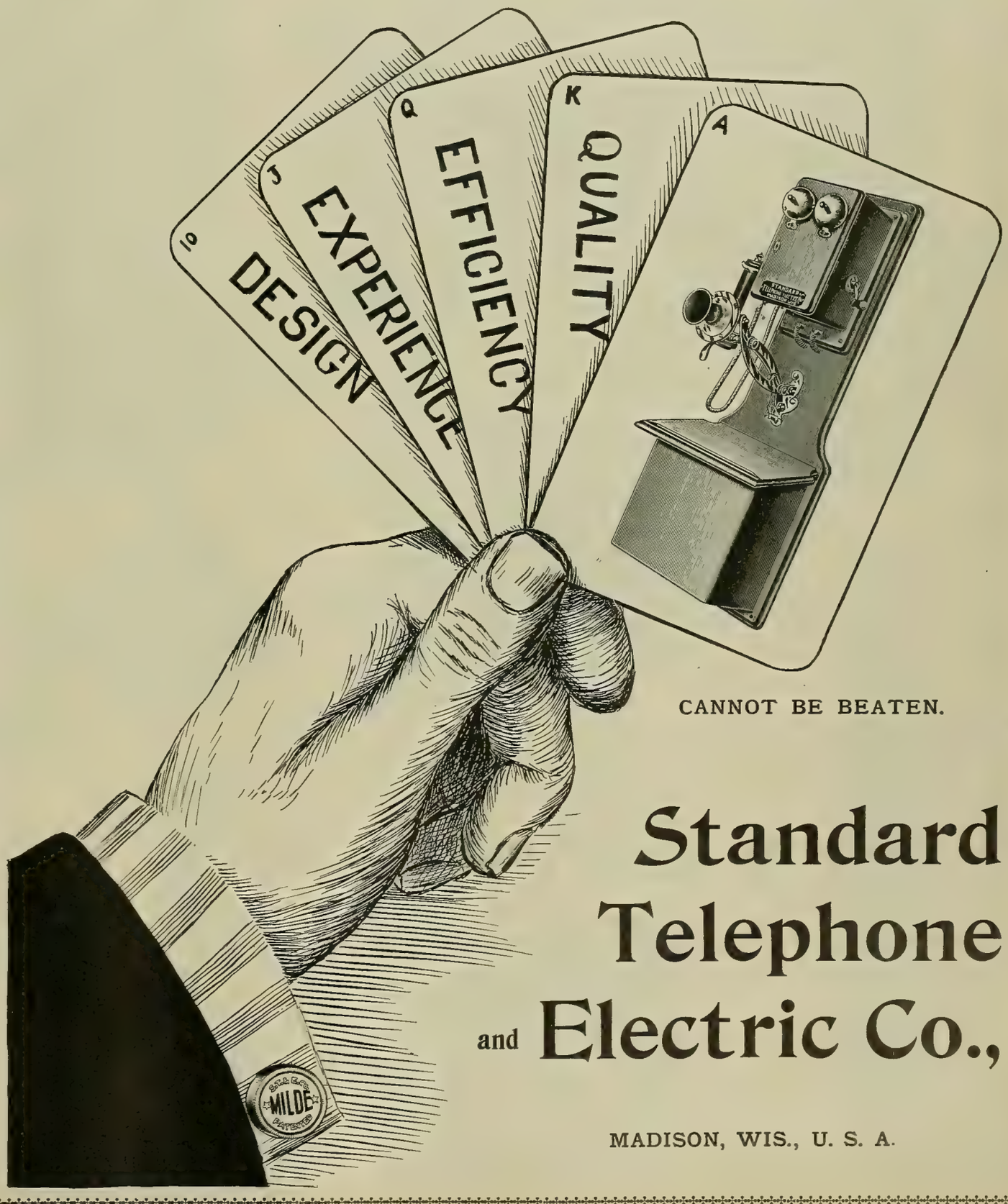
SEND FOR CATALOGUE No. 03303.

SPRAGUE ELECTRIC COMPANY,

General Offices: 527=531 West 34th St., New York.

CHICAGO, Fisher Building. BOSTON, 275 Devonshire Street. ST. LOUIS, Security Building. BALTIMORE, Guardian Trust Building.

A ROYAL FLUSH



CANNOT BE BEATEN.

Standard Telephone and Electric Co.,

MADISON, WIS., U. S. A.

STOMBAUGH GUY ANCHORS.

Stombaugh Guy Anchors are made in 6 sizes: 3½, 5 and 6 inches, with and without rods; 8, 10 and 12 inches only with rods.

A 5-inch or 6-inch Stombaugh Guy Anchor will hold the strain of any ordinary Electric Light, Railway, Telephone or Telegraph Pole. Where heavy strains come, use 8, 10 or 12 inch. We always recommend using the smaller sizes with rods, not deeming it good practice to bury guy wires.

ANCHOR YOUR SMOKESTACK.

W. N. MATTHEWS & BRO.,

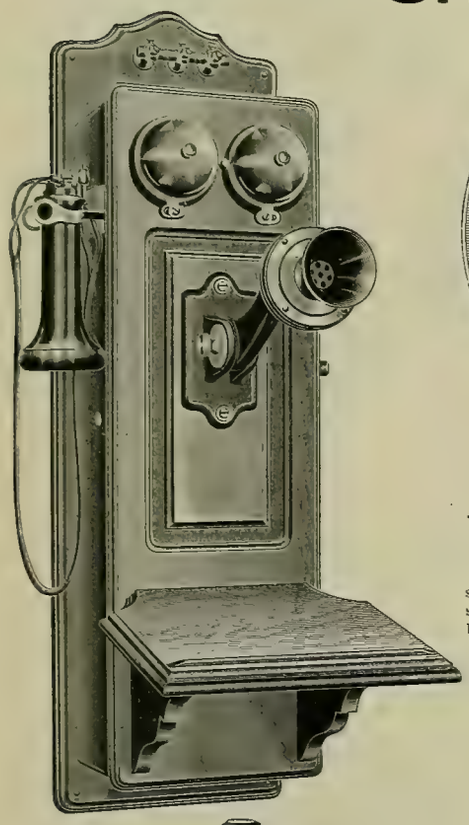
EXCLUSIVE AGENTS,

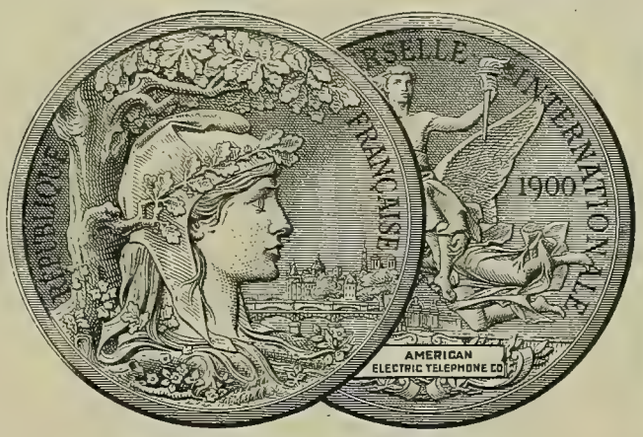
603 CARLETON BUILDING,

ST. LOUIS.

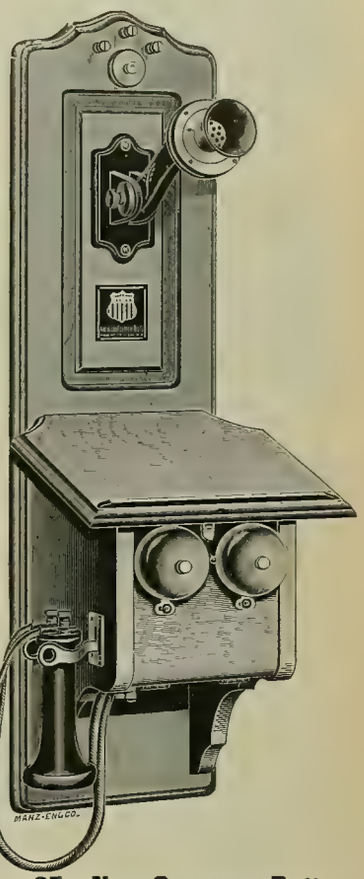
Complete catalog sent on application.

AMERICAN
ELECTRIC TELEPHONE CO.,
CHICAGO, ILL., U. S. A.





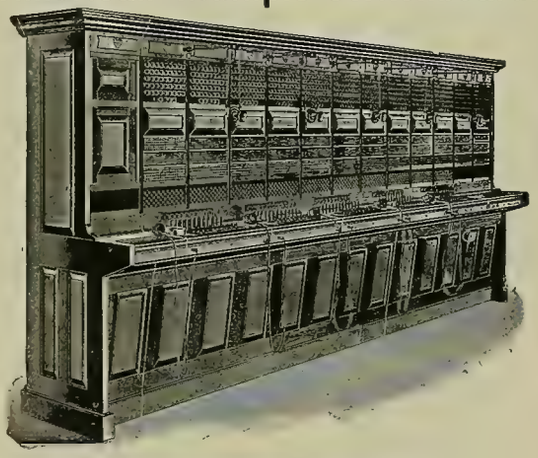
Medal Awarded at Paris Exposition.



No. 36. The Paris "Expo" Style Telephone, Series and Bridging.

Equipped with new powerful transmitter, concealed cord, long lever, gravity switch-hook, springs tipped with platinum points, insuring perfect contacts. Bell style Bipolar receiver, American Disk Carbon lightning arrester mounted on bell box.

American Multiple Switchboard.



Made for Either Magneto or Common Battery Systems.
Complete Supervisory Circuits and Signals. Perfect Busy Test.

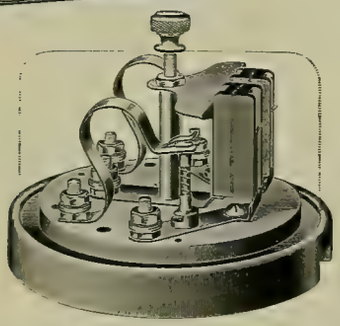
A FEW POINTS OF ADVANTAGE.

Bridging Jacks. Double Supervisory. Electric Light Signals.

NO series contacts in Jacks. NO cut-off relays.
NO coils in talking circuit. NO ground at telephone.
NO noise or click. NO repeating coils.
NO false busy test. NO limits to size.

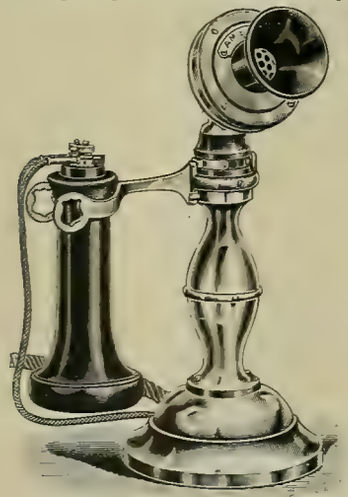
No. 35. New Common Battery Telephone.

Designed for either full common battery or centralized call switchboards. Ample room is provided for 4-cell dry battery or a condenser if needed. New powerful transmitter arranged for long distance common battery work.



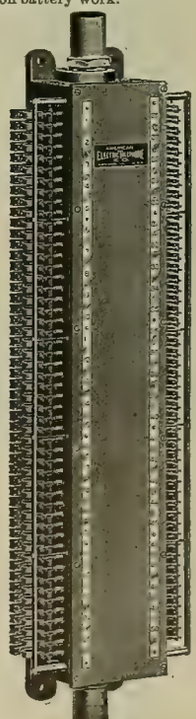
No. 91. Burns' Individual Station Metallic Circuit Protector.

Combination lightning arrester and sneak current protector.



No. 41. The Paris "Expo" Desk Set.

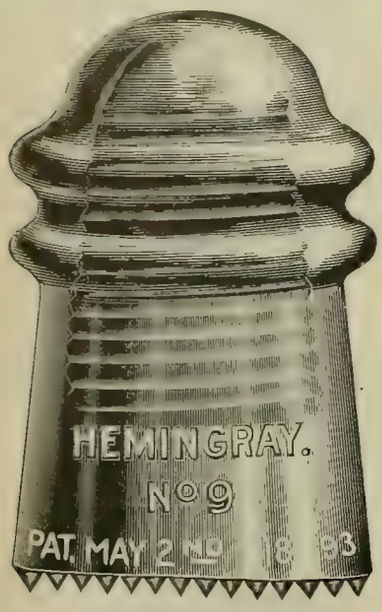
Equipped with new powerful transmitter mounted on adjustable head. Bell style receiver. New gravity switch-hook. Positive switch-spring arrangement, contacts all platinum points, silk receiver and connecting cords. All nickel-finished, making the most durable desk style telephone ever presented to the trade.



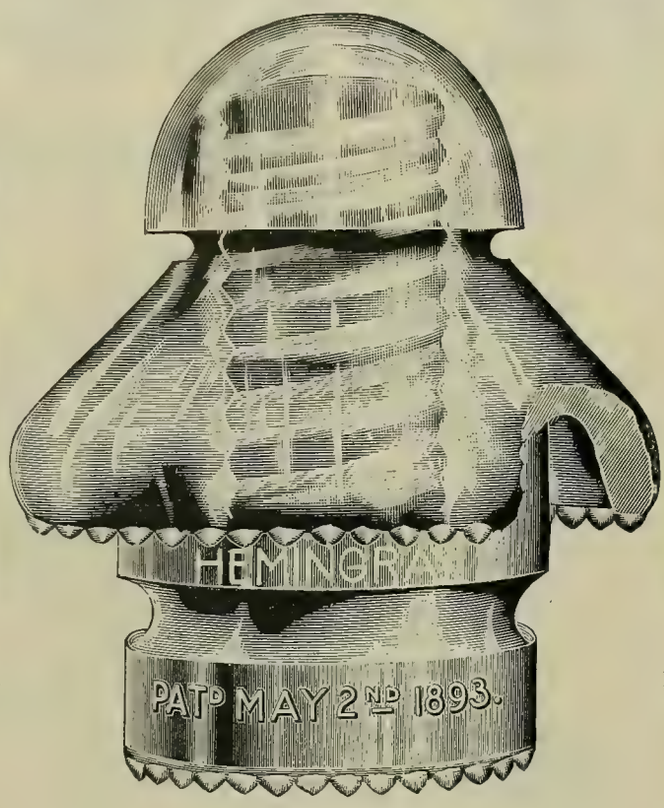
Burns' Central Office Cable Terminal.

Complete with (Heat Coil) sneak current and lightning arrester.

HEADQUARTERS FOR TELEPHONE INSULATORS.



No. 9 PONY INSULATOR.
Weight per piece..... 9½ oz.
Weight per 1,000 packed..... 675 lbs.
Packed 400 in a barrel.



TRANSPOSITION INSULATOR.
Weight per piece..... 30 oz. | Weight per 1,000 packed. .....2,115 lbs.
Packed 125 in a barrel.

No. 11 DOUBLE GROOVE PONY INSULATOR.
Weight per piece.....10 oz.
Weight per 1,000 packed.....700 lbs.
Packed 400 in a Barrel.

FACTORIES AT
MUNCIE, IND.
OFFICE AT
COVINGTON, KY.

HEMINGRAY GLASS CO.

Established 1848. MANUFACTURERS. Incorporated 1870.

R. G. HEMINGRAY, President.
BRADFORD SHINKLE, Vice-President.
D. C. HEMINGRAY, Sec'y and Treas.

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Adjustment absolute and perfect.
All parts molded in the case.
Cannot get out of adjustment.
No screws to loosen.
The Magnet cannot move.
The binding posts cannot move or turn and cannot pull out.
Cost of maintenance reduced to a minimum.

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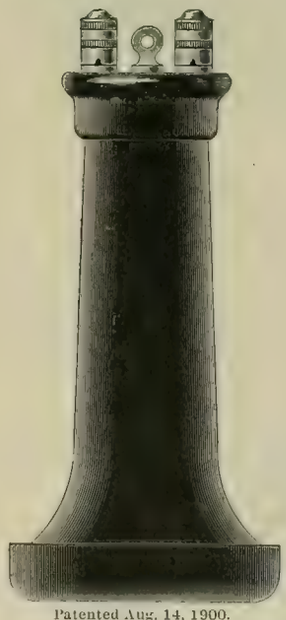

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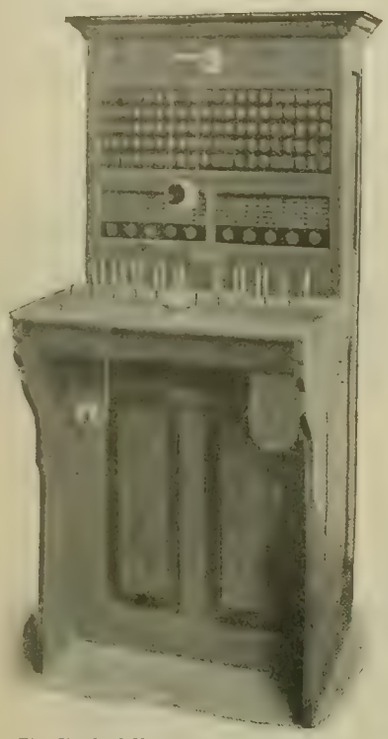

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No. 34. **Standard Magneto,** 10,000 ohms Series, nickeled Generator.

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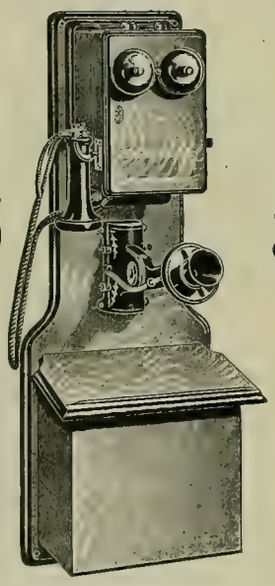

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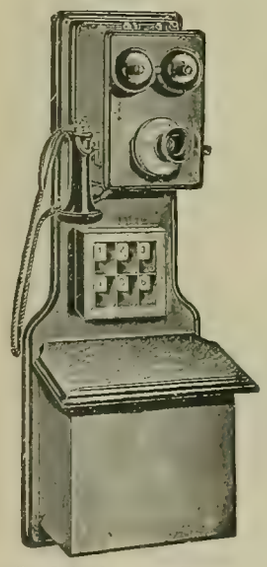
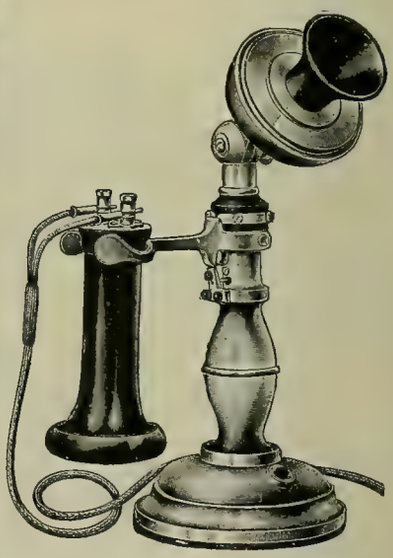
1,600 ohm **Bridging Phone,** $11.00.



Combination Switchboard and Telephone, Bridging or Series. Complete, with 6 Drops and Jacks.



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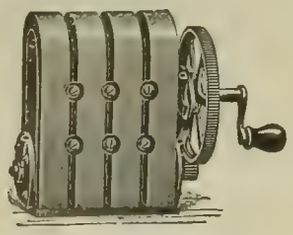
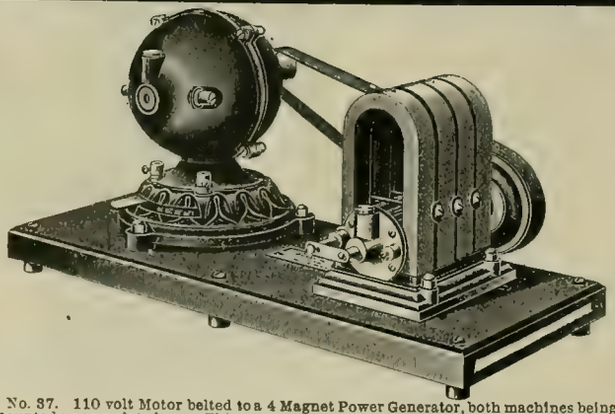


Hand Generators.



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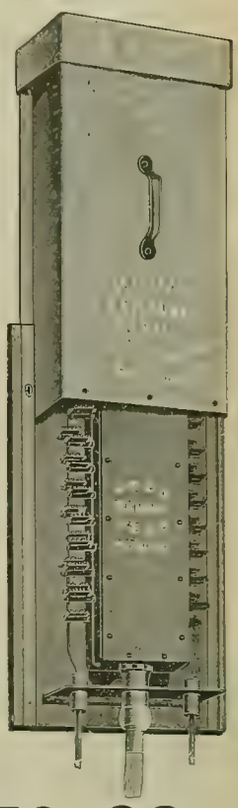
NEVER KNOWN TO FAIL OR LOSE A WIRE.

Your Exchange or Cables are not safe unless Protected by The Moon Fuse Terminal Head.



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The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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Why, the other day a rat could not keep his feet in a McRoy conduit.

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It has no coils in the telephone circuit.
It is purely automatic.
It does not require resetting.
It rings only as long as the telephone.
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It does not interfere with the talking properties of the telephone in any way.
It will not get out of order.
We warrant it for one year.

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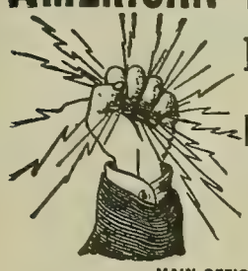

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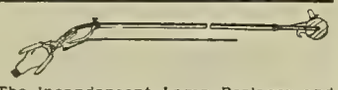

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It burns a minimum of 250 hours. No alignment necessary. Trims easier than an open arc lamp. Allows easy access to every part of lamp. Gives absolutely steady light.

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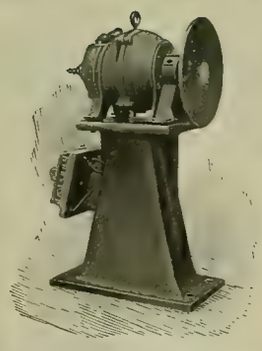

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Slow-Burning Weatherproof and Slow-Burning Wire.

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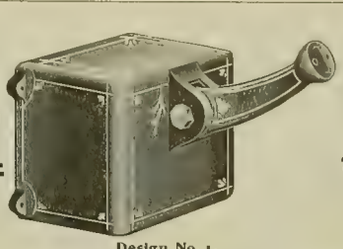

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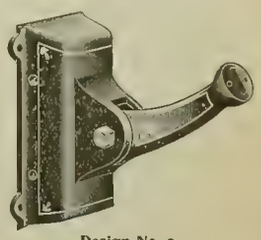
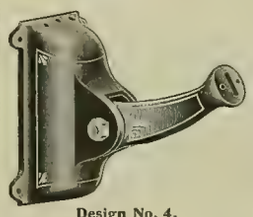
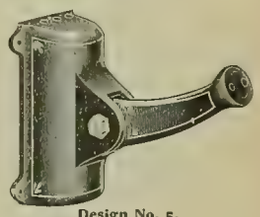


Design No. 3.



Design No. 4.

Patent Applied For.



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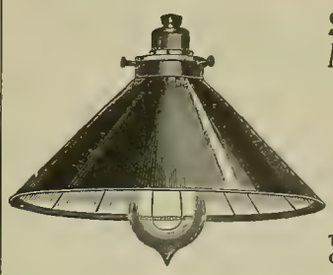

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As superintendent or engineer of lighting or power plant. 15 years' practical experience in construction of D. C. and alternating plants; good steam engineer and economical operator. Up-to-date on gas and gasoline engines, expert storage battery man and practical lead burner. Would take financial interest if desired; go anywhere. West preferred. Married; abstainer; small pay. Address "PRACTICAL HUSTLER," care Western Electrician, 510 Marquette Bldg., Chicago.

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Bids for lights to be per 1,000 lamp hours, and must be addressed to D. E. Fox, chairman committee on waterworks. A five-year contract and ten-year franchise will be given.

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Attest: ROY PENDT, Clerk.
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Dynamos,
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Two 66 in. x 15 ft. 6 in., with 76 3-in. tubes each.
One battery of six boilers, each 48 in x 16 ft., with 24 4-in. tubes and cross dome.
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One 66 in. x 15 ft. 6 in., with 90 3½-in. tubes, plug hat dome.
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One 44 in. x 9 ft. 8 in., with 46 3-in. tubes.
Two 48 in. x 12 ft., with 46 3½-in. tubes.

☞This is only a partial list. Write us your wants.

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TELEPHONE IRONS.

We manufacture an Electric Soldering Iron especially for telephone work.

Are in use by manufacturers of switchboards and by exchanges everywhere.

Send order for sample iron and you will use no other.

MANUFACTURED ONLY BY

American Electrical Heater Co,
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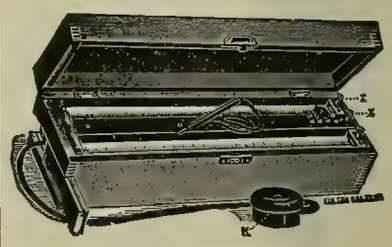
No. 11.

Weight, 15 oz. Length of iron, 13 inches. Tip, 7/8 inch in diameter. Consumes 90 watts.



A Direct Reading Ohmmeter.

Ohmmeters,
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Special Electrical Machinery.

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Successors to American Electric Specialty Co.,
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1 20-light 2000 C. P. Western Electric.
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3 40-light 2000 C. P. West. Elec., s. o.
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2 45-light 1200 C. P. Brush, No. 7.
1 50-light 1200 C. P. T.-H., L. D. 12, ball armature.
1 50-light 2000 C. P. Brush, No. 7½.
1 50-light 2000 C. P. T.-H., M. D. 2, ring armature.
2 60-light 2000 C. P. West. Elec., s. o.
1 60-light 2000 C. P. Westinghouse.
3 60-light 2000 C. P. Wood, No. 8.
1 65-light 800 C. P. Ball, 4 amp.
1 65-light 2000 C. P. Brush, No. 8, Steubenrausch fireproof commutator.
2 75-light 1200 C. P. Wood, with new armt.
2 75-light 1200 C. P. Standard, self-oilers.
2 75-light 2000 C. P. Westinghouse, s. o.
3 125-light 1200 C. P. Excelsior, latest type.

110-VOLT INCANDESCENT DYNAMOS.

1 10-light Roth, compound.
1 25-light Mayo, slow speed.
1 50-light Hawkeye.
1 50-light Lundell, self-oiler, slow speed.
1 50-light Card, multipolar, self-oiler.
1 55-light Gibbs, M. P., compound.
1 60-light T.-H., compound.
1 60-light Mather.
1 65-light Crocker-Wheeler, s. o.
1 80-light Sprague.
1 100-light Bain, compound, self-oiler.
1 100-light Siemens & Halske, type L. H.
2 110-light Gibbs, compound, self-oilers.
1 110-light Edison.
1 135-light Gibbs, M. P., self-oiler.
1 150-light Mather, compound, self-oiler.
1 150-light Gibbs, M. P., self-oiler.
1 150-light Edison.
3 150-light Fisher, direct connected to engine.
1 160-light Card, self-oiler.
1 180-light Siemens & Halske, M. P., s. o.
1 200-light Rockford.
3 210-light Edison, self-oilers, 12 K. W.
4 210-light Siemens & Halske.
1 210-light Siemens & Halske, M. P.
2 210-light Gibbs, M. P., self-oilers, s. s.
1 225-light Detroit.
1 250-light Westinghouse, horiz. type.
1 250-light Commercial, comp., self-oiler.
1 250-light Eddy, self-oiler.
1 270-light General Electric, 15 K. W., M. P., direct-connected.
1 275-light King, self-oiler, compound.
1 300-light Columbian, multipolar.
2 300-light Gibbs, M. P., self-oilers.
1 340-light Eddy, self-oiler, compound.
2 350-light Hawkeye, compound.
1 350-light National, self-oiler, comp.
1 350-light Edison, 20 K. W., shunt.
1 350-light Western Electric.
1 350-light Fisher, M. P.
1 360-light Duplex multipolar, comp.
9 500-light Siemens & Halske, self-oilers.
4 540-light Edison, 30 K. W., compound.
1 600-light Eickmeyer.
1 700-light Westinghouse, slow speed, M. P.
2 800-light Edison, 45 K. W., self-oilers, compound.
1 1000-light Edison, 60 K. W.
1 1200-light Siemens & Halske.
1 1350-light Siemens & Halske, 80 K. W., for direct connection.
1 1500-light Siemens & Halske, 100 K. W.
1 2500-light Siemens & Halske, 150 K. W., for direct connection.

DIRECT CONNECTED GENERATORS.

2 7½ K. W. Fisher, 125-volt, with Fisher engine.
1 15 K. W. General Electric, 125-volt, with Case engine.
1 80 K. W. Siemens & Halske, 125-volt, for direct connection.
1 150 K. W. Siemens & Halske, 125-volt, for direct connection.
1 60 K. W. Siemens & Halske, 250-volt, for direct connection.
1 120 K. W. Siemens & Halske, 250-volt, for direct connection.
1 75 K. W. Westinghouse, 500-volt, with Westinghouse comp. engine.

220-VOLT GENERATORS.

1 10 K. W. Lundell, s. o., M. P., s. s.
1 12 K. W. Edison, self-oiler.
1 20 K. W. Sprague, compound, s. o.
1 40 K. W. Eddy, M. P.
1 45 K. W. Edison, compound, self-oiler.
1 60 K. W. Siemens & Halske, M. P., s. o., for direct connection.
1 120 K. W. Siemens & Halske, M. P., s. o., for direct connection.

500-VOLT GENERATORS.

1 15 K. W. T.-H., self-oiler.
1 25 K. W. T.-H., self-oiler.
1 25 K. W. General Electric, M. P.
1 25 K. W. Commercial, self-oiler.
2 35 K. W. Siemens & Halske, brand new, M. P., Churchward type, s. o., very slow speed, 475 r. p. m.
1 45 K. W. Edison, compound, self-oiler.
1 60 K. W. Edison, compound, self-oiler.
1 75 K. W. Westinghouse, Kodak set, Westinghouse generator and Westinghouse comp. engine, 14x24x14, all complete, fine.

ALTERNATING GENERATORS.

1 350-light Thomson-Houston, A18.
2 600-light T.-H., A6.
1 600-light T.-H., 30 K. W., 2-phase.
1 600-light T.-H., 30 K. W., slotted armature, compound.
2 600-light G. E., A30, toothed armature, compound wound.
2 650-light T.-H., A25, self-oilers, composite wound.
1 750-light Wood, compound, self-oiler.
2 750-light Westinghouse, s. o., 37½ K. W.
1 900-light Warren, 45 K. W., inductor type.
1 1000-light Wood, 50 K. W., toothed armt.
1 1000-light Siemens & Halske, 50 K. W., 60-cycle, single-phase, inductor type.
1 1200-light Siemens & Halske, 60 K. W., 60-cycle, single-phase.
1 50 K. W. Siemens & Halske, 60-cycle, two-phase, rotary transformer, 175 volts alt. to 250 volts direct.
1 1200-light Warren, 60 K. W., self-oiler, inductor type.
1 1200-light General Electric, A60, composite wound, toothed armt.
1 1200-light Westinghouse, 60 K. W., compound, toothed armature.
1 1200-light Westinghouse, 60-cycle, 60 K. W.
1 1300-light T.-H., A70, comp. wound.
1 1500-light General Electric, monocyclic, 75 K. W., 60-cycle.
2 1500-light Warren Medberry, 75 K. W., latest type, two-phase, new.
1 2400-light Westinghouse, 120 K. W., toothed armature, compound wound.
2 2400-light General Electric, 120 K. W., toothed armt., comp. wound.
2 2400-light Westinghouse, 120 K. W., 60-cycle, toothed armt., comp.
1 4000-light Wood, 200 K. W., self-oiler, comp. wound, slotted armt.
1 4800-light Westinghouse, 240 K. W., self-oiler, comp. wound, toothed armature.

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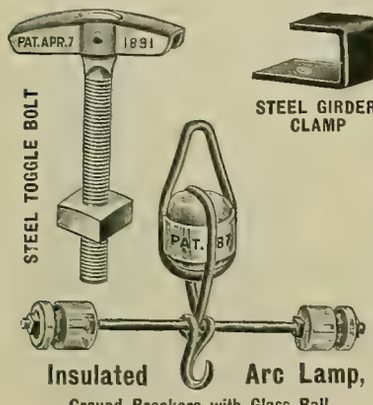

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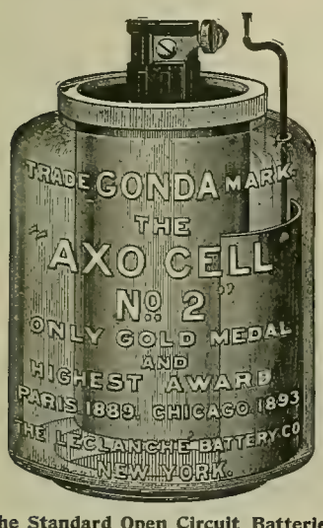

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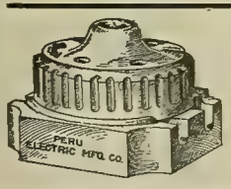

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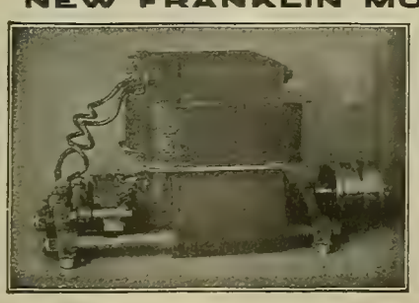

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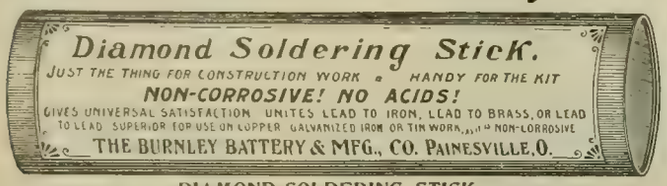

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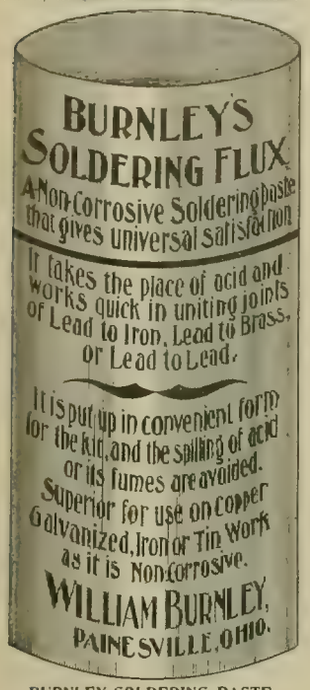

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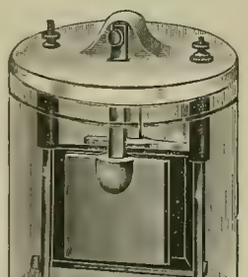

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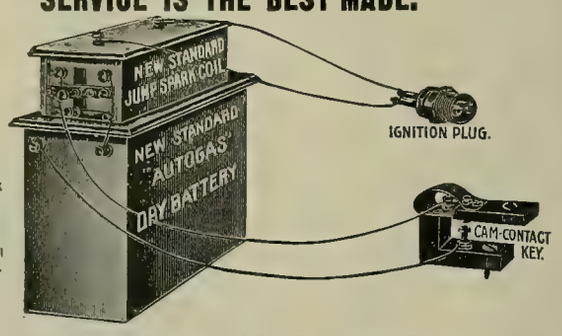

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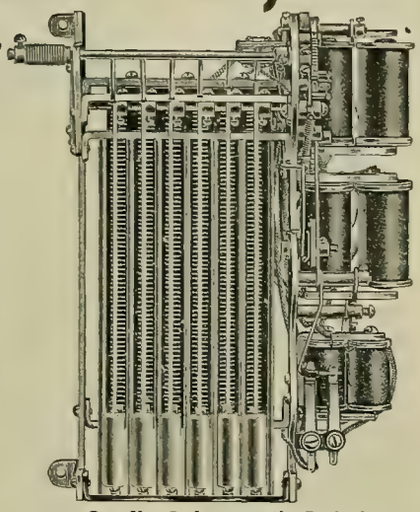

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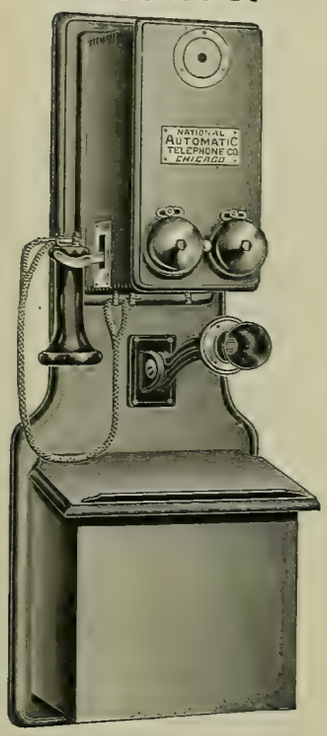

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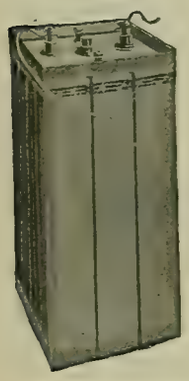

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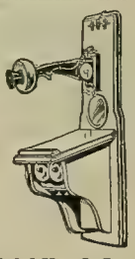

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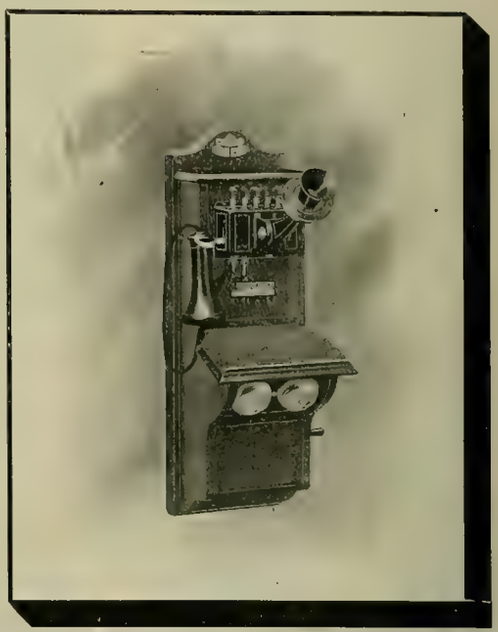

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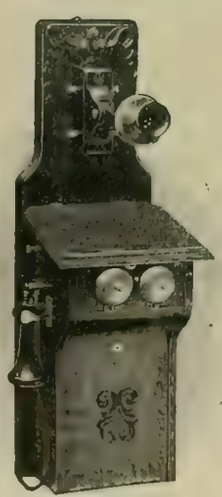
Latest Type and Most Improved Telephone on the Market. Best Quality Throughout.



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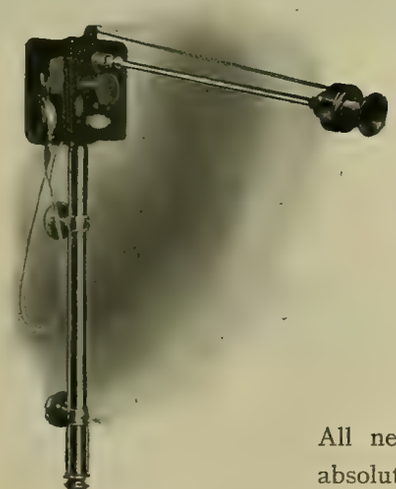

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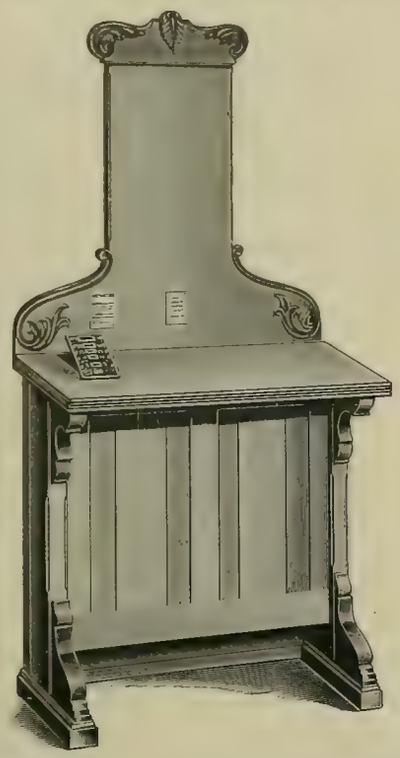

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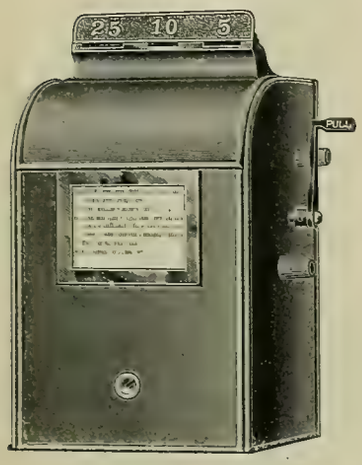

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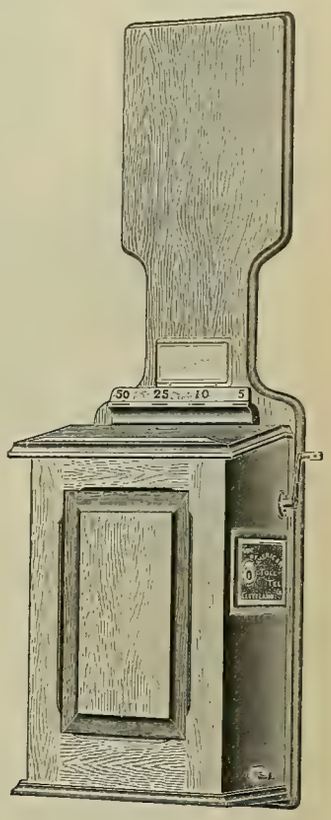

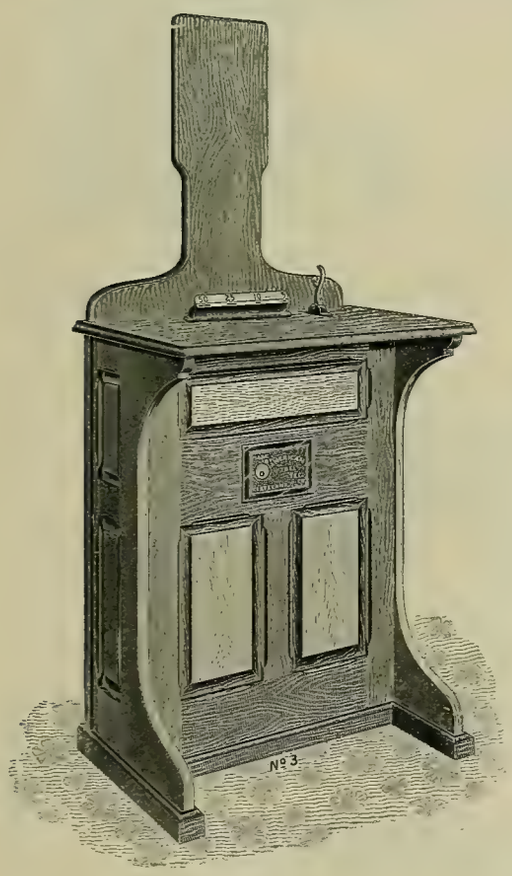

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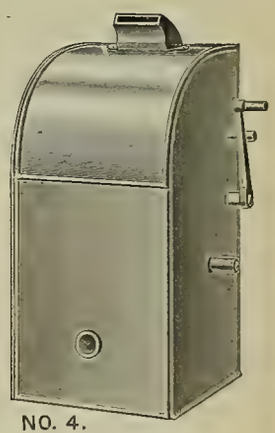
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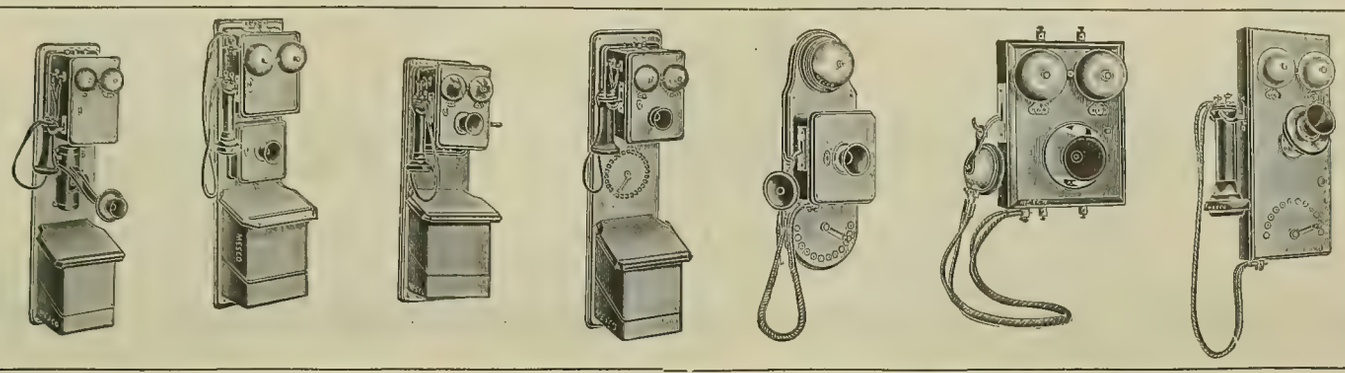

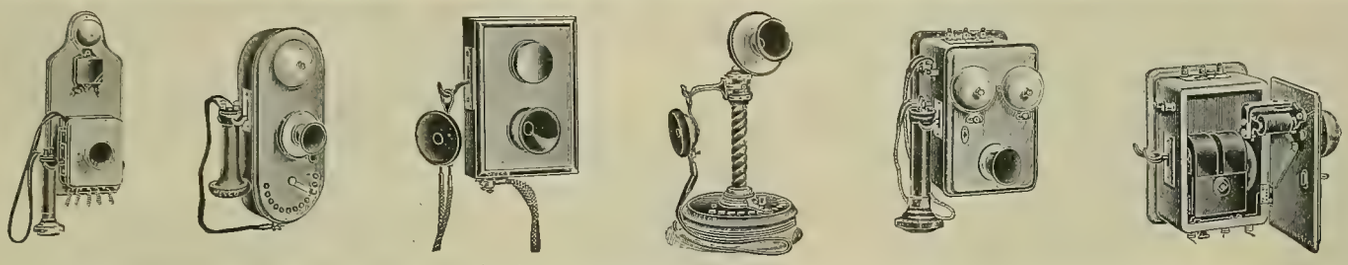

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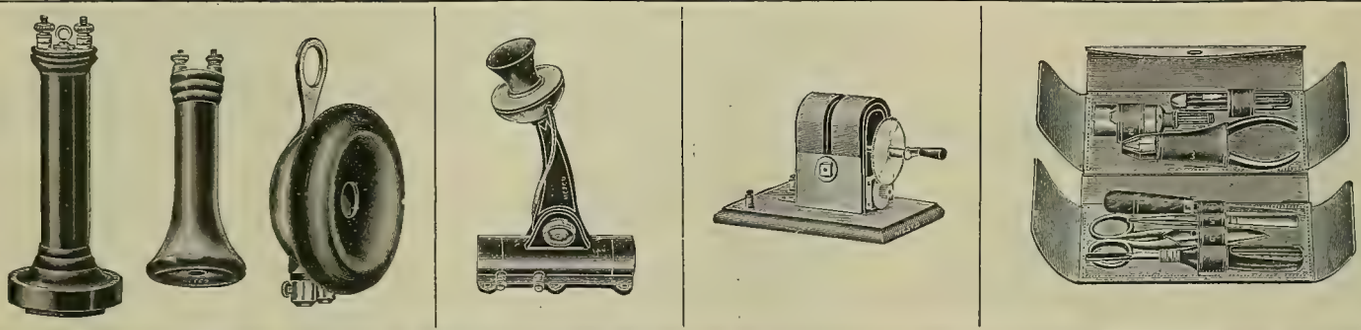

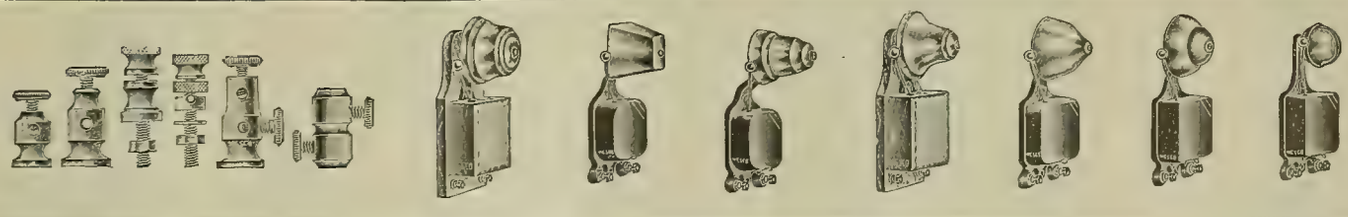

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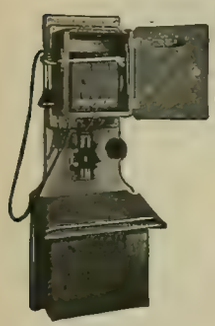

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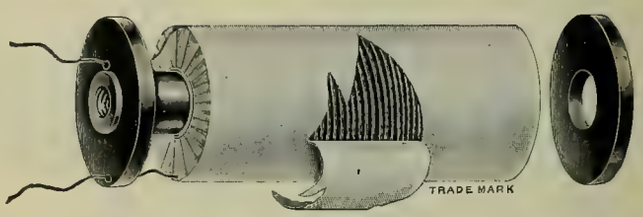

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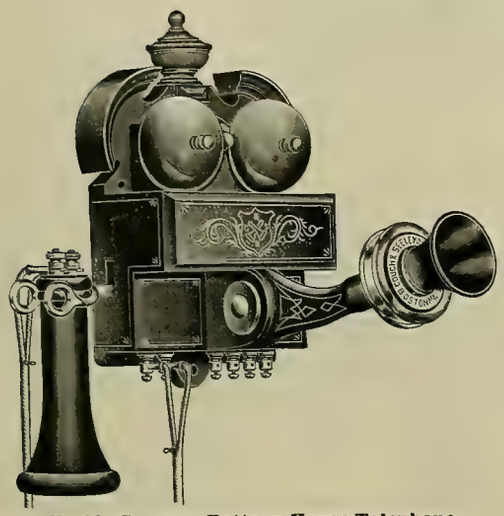

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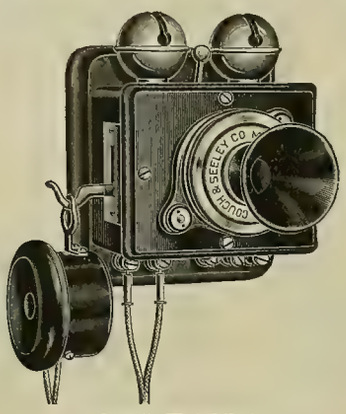

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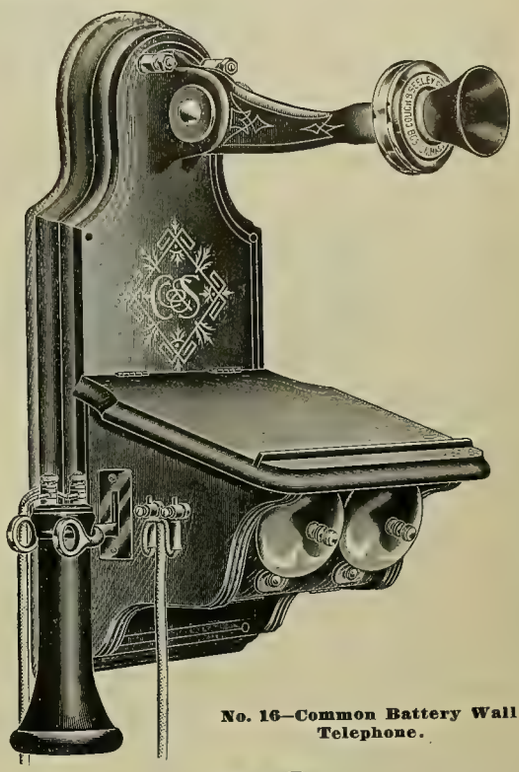

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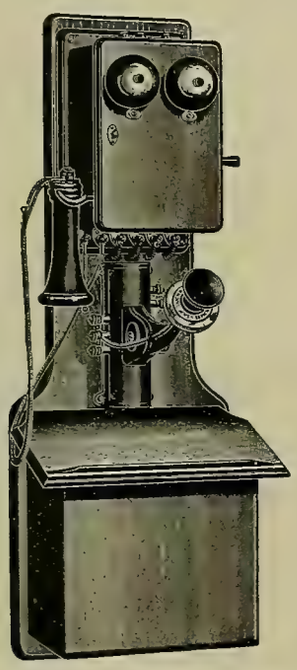

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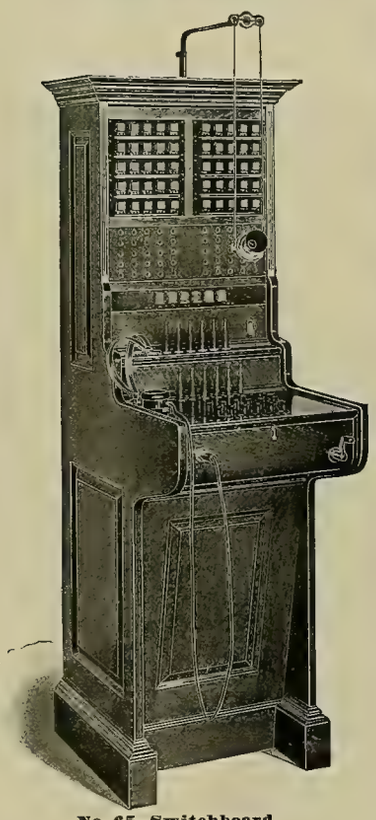

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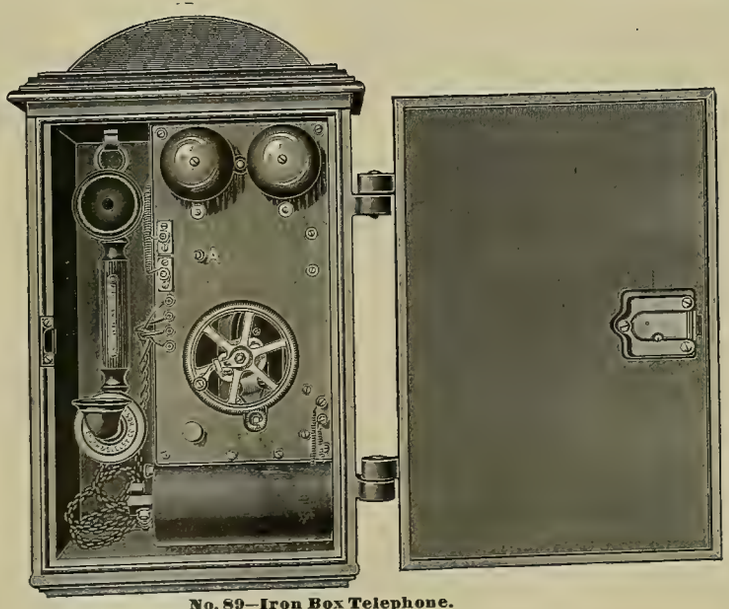

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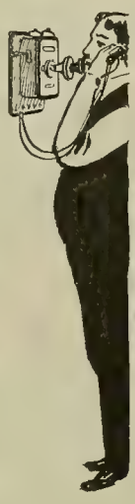

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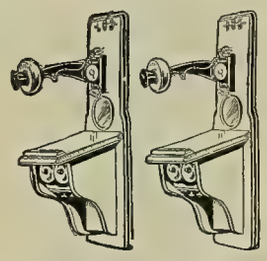

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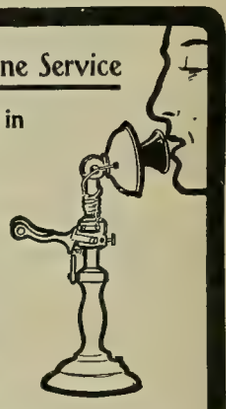

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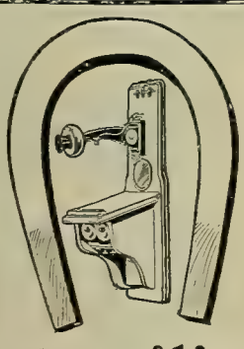

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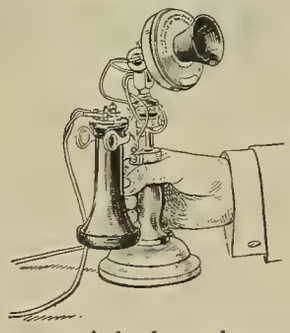

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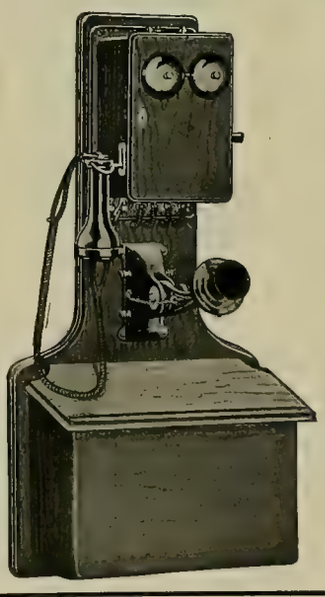

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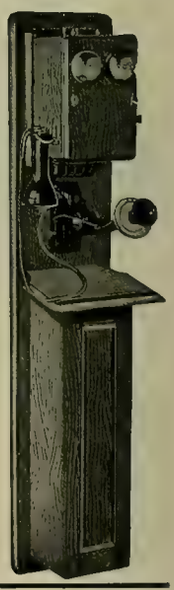

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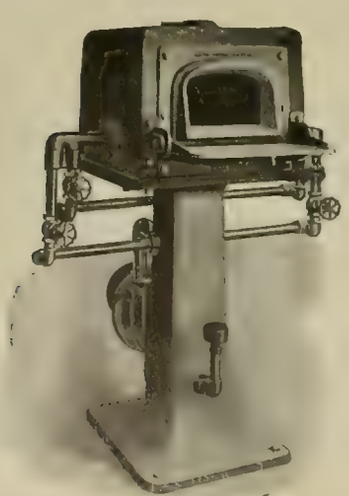

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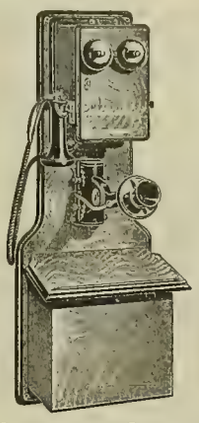

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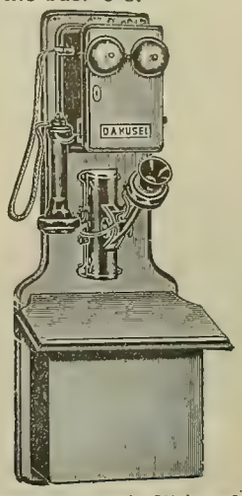

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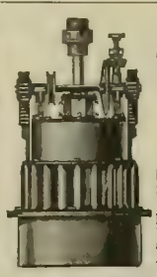

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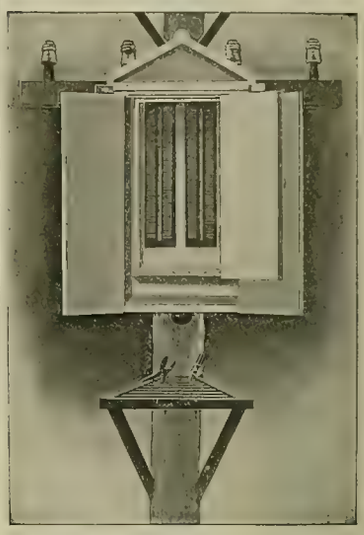

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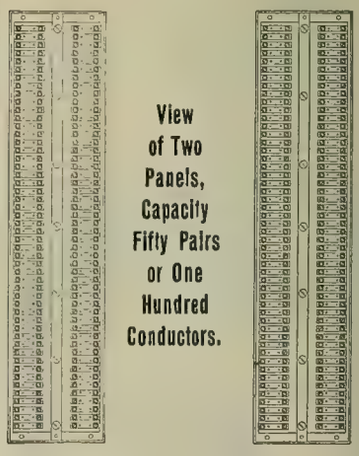

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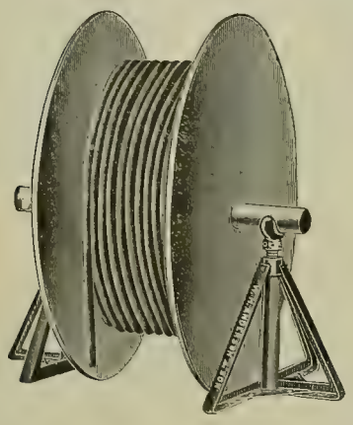

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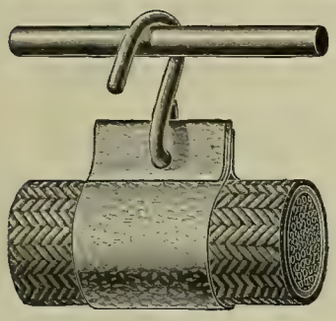

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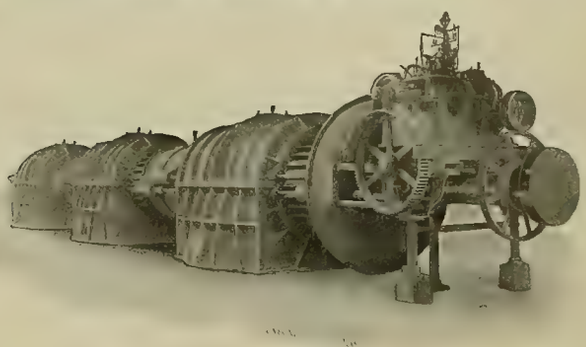

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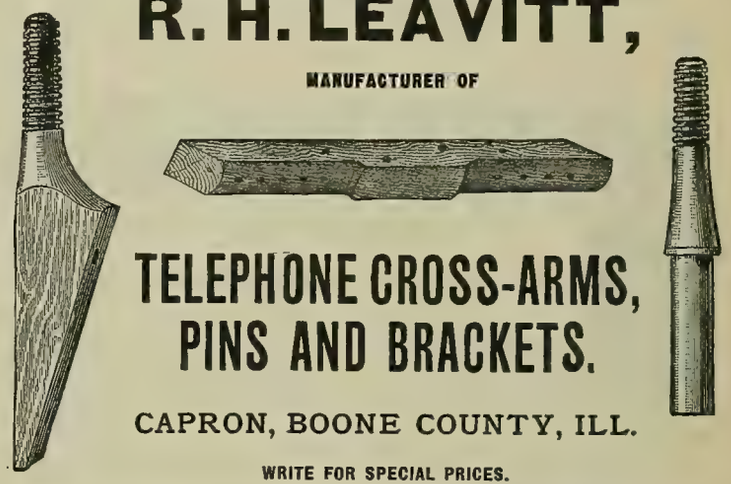

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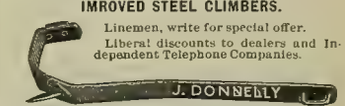

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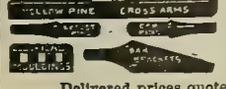

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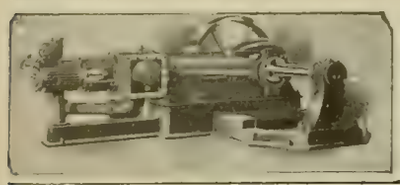

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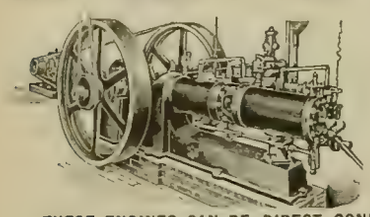

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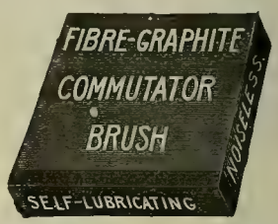

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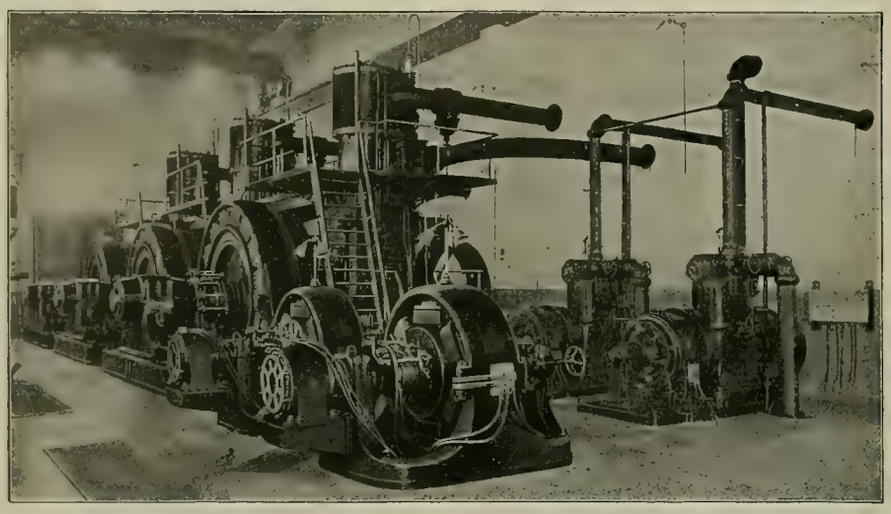

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THE STANDARD FOR RUBBER INSULATION.
Sole Manufacturers of
Okonite Wires, Okonite Tape, Manson Tape, Candee Weather-proof Wires.
THE OKONITE CO., LTD.
Willard L. Candee, H. Durant Cheever, } Managers. 253 Broadway, New York. Geo. T. Manson, Gen'l Supt. W. H. Hodgins, Secy.

"PHONO-ELECTRIC"
WIRE HAS BEEN FOUND TO BE 41 TO 47 PER CENT. STRONGER THAN HARD DRAWN COPPER WIRE.
THE EXACT COMPARATIVE STRENGTH OF THE SEVERAL SIZES WILL BE FOUND IN OUR WIRE BOOK ON THE SUBJECT.
BRIDGEPORT BRASS CO.,
19 Murray St., NEW YORK.

"IT'S TOUGH."

PARANITE
INDIANA RUBBER AND INSULATED WIRE CO.,
MANUFACTURERS OF
Paranite Rubber Covered Wires and Cables,
UNDERGROUND, AERIAL, SUBMARINE AND INSIDE USE.
TELEPHONE, TELEGRAPH AND FIRE ALARM CABLES.
All Wires are tested at Factory. JONESBORO, IND.

STERLING EXTRA INSULATING VARNISH.
Sterling Extra Black Finishing Varnish.
Sterling Black Air Drying Varnish.
Sterling Black Core Plate Varnish.
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IMITATED BY MANY
ONLY THE BEST GOODS ARE IMITATED.
LOOK AT THE LONG LIST OF OUR IMITATORS AND DECIDE FOR YOURSELF.

EQUALED BY NONE
OUR MOTTO. THE RECOLLECTION OF QUALITY REMAINS LONG AFTER THE PRICE IS FORGOTTEN.
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ELECTRIC MFG CO.
CINCINNATI, O.
U.S.A.
235

CREOSOTED WOOD CONDUITS.
Our Process Prevents Vegetable Growths from Reaching Conduits.

END ELEVATION.

LONGITUDINAL SECTION SHOWING JOINT
We Make Any Size Desired.
THE MICHIGAN PIPE CO., BAY CITY, MICHIGAN.

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Bipolar and Multipolar Motors from ⅛ to 50 horsepower. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents. The Hobart Elec. Mfg. Co., Troy, Ohio

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
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180 WASHINGTON ST., NEWARK, N. J.

ELECTRICAL OR MECHANICAL.
We have fine facilities for light manufacturing, and solicit correspondence. Estimates given on quantity or small lots. PUNCH PRESS AND SCREW MACHINE WORK.
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CIRCUIT BREAKERS
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Queen & Co.,
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480 MONON BLDG., CHICAGO.
Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils.

THE BEST ON EARTH
TIPLESS LAMPS
THE SHELBY ELECTRIC Co.
SHELBY, OHIO.

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These instruments are based upon the same general principle and are just as accurate as our regular Standard Portable Direct Current Voltmeters and Ammeters, but are much larger, and the working parts are inclosed in a neatly designed, dust-proof cast-iron case which effectively shields the instruments from disturbing influences of external magnetic fields.

Weston Standard Illuminated Dial Station Ammeter, Style B.
Weston Standard
Portable Direct Reading Voltmeters and Millivoltmeters, Ammeters and Millammeters, Wattmeters and Voltmeters, for Alternating and Direct Current Circuits.
Our portable instruments are recognized as standards throughout the civilized world.
Our Semi-Portable Laboratory Standard Voltmeters and Ammeters are still better.
They are the most reliable, absolute standards for Laboratory use.
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15 East 32nd St., NEW YORK.

Compound Prism Globes and Shades
FOR ALL KINDS OF LIGHTING.
TWO GOLD ONE SILVER Medals
Awarded at Paris Exposition.
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CARBONS
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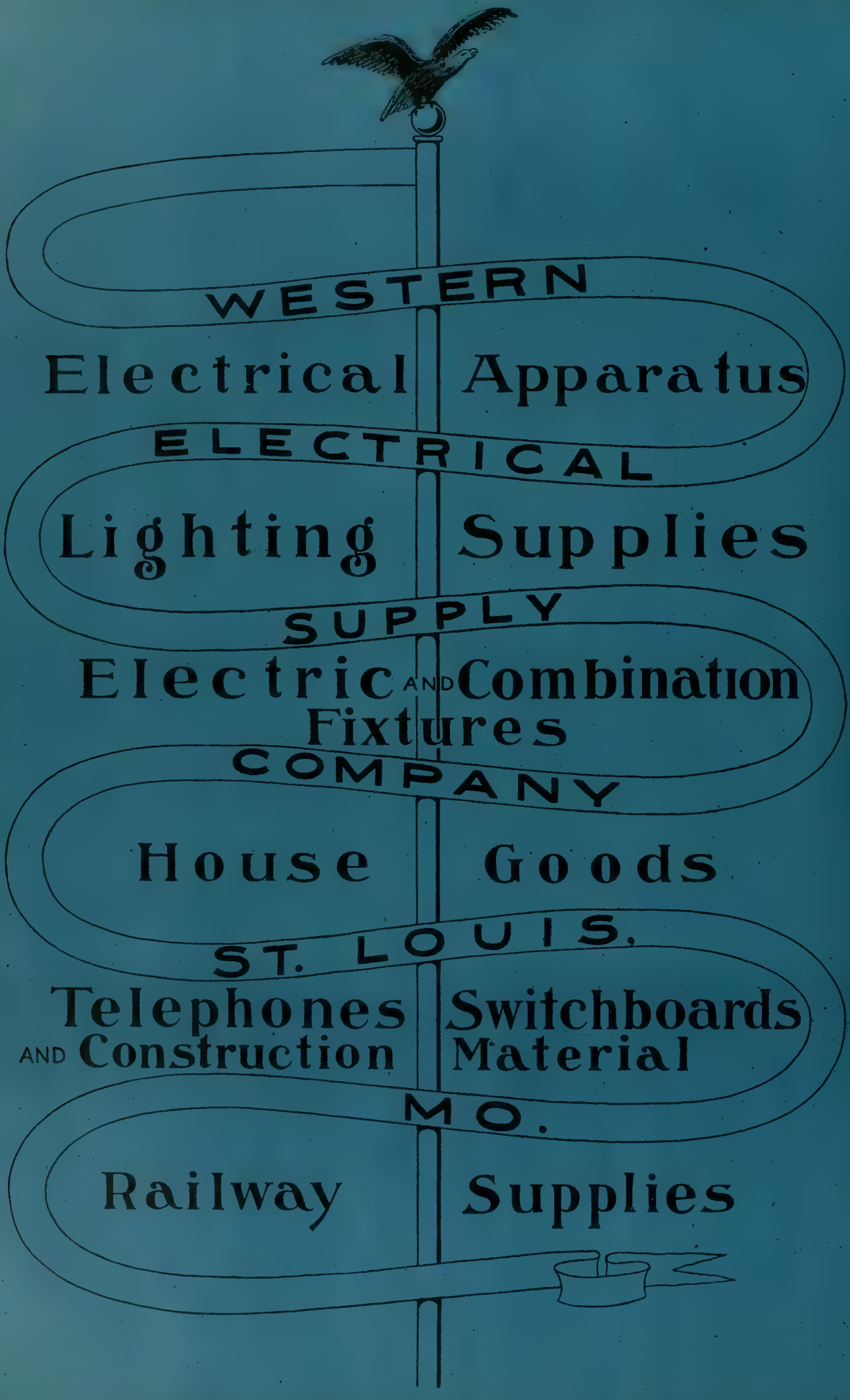
CLEVELAND, OHIO, U. S. A.
NOT IN CARBON TRUST

Mention the Western Electrician, when writing for catalogues.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is seldom loaded to its fullest carrying capacity except for a small portion of the daily service.

The installation of a **"Chloride Accumulator"** Sub-Station

for roads having lines extending a considerable distance from the Power House permits the use of **FEWER FEEDERS** and these **LOADED TO THEIR NORMAL CAPACITY** all the time.

In this way **MAXIMUM EFFICIENCY** is secured and a material saving in copper effected.

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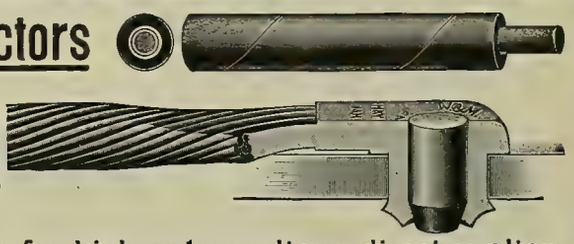
IN SHEET OR WIRE, ANY SIZE, SHAPE OR DEGREE OF HARDNESS FOR ALL PURPOSES.

BAKER & CO.

408-410-412-414 N. J. Railroad Ave., Newark, N. J.

Scrap and Native Platinum Purchased. New York Office, 120 Liberty Street.

"CROWN" Insulated Conductors AND Rail Bonds



"Crown" wires are the perfection of Rubber Insulation for high or low voltage, direct or alternating currents, solid or stranded conductors up to 2,500,000 circular mils' capacity.

"Crown" bonds are the perfection of simplicity and economy in rail bonding, together with perfection of contact.

In "CROWN" WIRES or "CROWN" BONDS you secure the best attainable results, electrically and mechanically.

Solid or stranded bare copper conductors; also lead-encased and armored for aerial, underground and submarine work.

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WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

WHY DO YOU ALLOW

THE CARBON QUESTION

TO BE A SOURCE OF WORRY TO YOU WHEN WE GUARANTEE

COLUMBIA CARBONS

(FOR ENCLOSED ARCS)

TO BE SUPERIOR TO ANY IMPORTED CARBON IN UNIFORMITY OF SIZE AND STRAIGHTNESS, OR SUBJECT TO RETURN AT OUR EXPENSE? THE LARGEST CARBON CONSUMERS IN THE U. S. ARE SATISFIED WITH "COLUMBIAS." A TRIAL ORDER WILL MAKE YOU A STEADY CUSTOMER. LET US SEND YOU CONVINCING PROOF OF THEIR SUPERIORITY.

NATIONAL CARBON COMPANY,

1198 W. MADISON AVE., CLEVELAND, OHIO.

THE GORDON PRIMARY CELL.

The most improved, efficient, long lived and economic primary cell of the new century.

Extensively used for telephone, telegraph, fire and police alarm service, railroad signal work, gas engine ignition and automobiles.

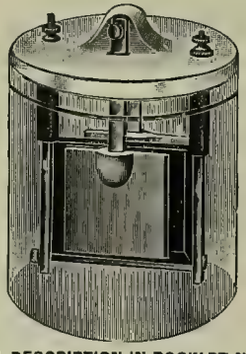
Manufactured in ten different styles.

Catalogue, price-list, etc., upon application.

THE GORDON BATTERY CO.,
13 and 15 Laight Street, New York.

EDISON LALANDE BATTERIES.

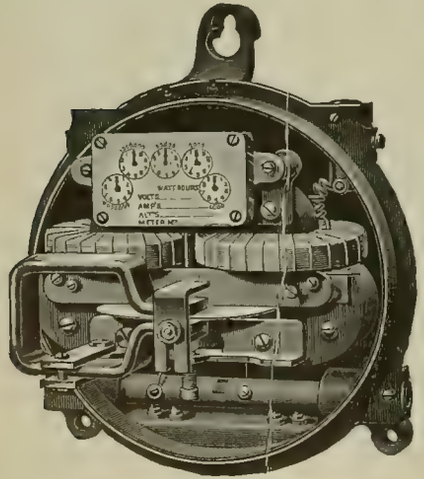
FOR GAS ENGINES,
SLOT MACHINES,
AUTOMOBILES,
RAILROAD SIGNALS,
CROSSING BELLS,
SMALL MOTORS,
ETC.



CONSTANT CURRENT.
NO LOCAL ACTION,
WILL NOT FREEZE.
LIQUID TIGHT
CELLS FOR
PORTABLE
WORK.

FULL DESCRIPTION IN BOOKLET NO. 4.

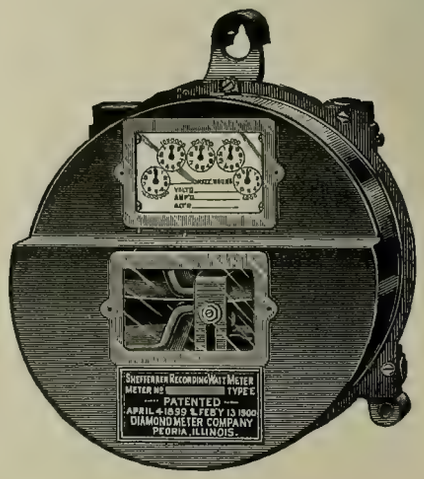
EDISON MANUFACTURING COMPANY,
186 FIFTH AVENUE, NEW YORK.



Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



DIAMOND METER CO.
PEORIA, ILL., U. S. A.

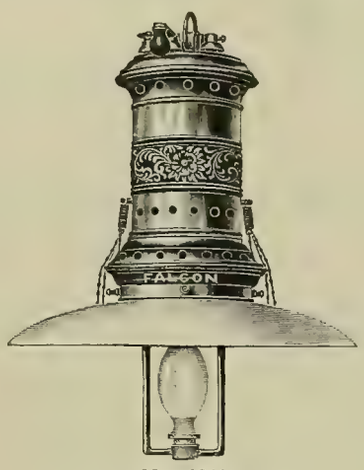
"FALCON"
Direct Current Arc Lamps.

FOR—
100 to 125 Volt Circuits.
200 to 240 Volt Circuits.
450 to 550 Volt Circuits.

CURRENT—
Four or Five Amperes.

LIFE—
180 Hours One Trimming.

LENGTH—
24 Inches Over All.



No. 1011.
FOR INSIDE USE.

WEIGHT—
15 Pounds (no glass).

FINISH—
Japanned, Japanned-Copper,
Polished Brass, Brush Brass.

USE—
Ornamental for Indoors,
Plain for Outdoors.

PRICES—
Write for them.

Central Electric Company,

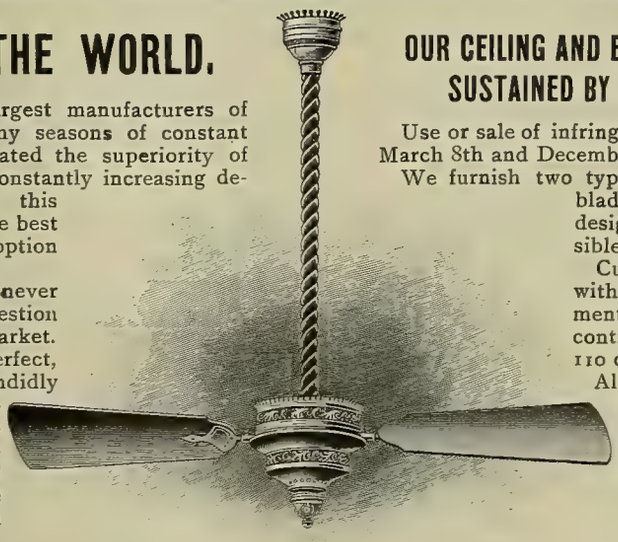
264-266-268-270 Fifth Avenue, CHICAGO.

CEILING DIEHL FANS

STANDARD OF THE WORLD.

We are the original and largest manufacturers of ceiling fans in the world. Many seasons of constant use have absolutely demonstrated the superiority of Diehl fans, and the large and constantly increasing demand for them throughout this and other countries is one of the best recommendations for their adoption that we can offer.

Diehl fans are copied, but never equaled. They are without question the most perfect fans on the market. Electrically and mechanically perfect, attractive in appearance, splendidly finished, highly efficient, noiseless in operation, free from repairs—are some of their important features. Fourteen years' experience in the manufacture of ceiling fans assures perfection in all respects.



OUR CEILING AND ELECTROLIER FAN PATENTS SUSTAINED BY U. S. COURT DECISION.

Use or sale of infringements stopped by injunctions March 8th and December 5th, 1900.

We furnish two types of ceiling fans, two or four blades. We carry the largest line of designs and finishes to meet all possible requirements.

Cut illustrates ceiling fan No. 13 with switch. It has a very ornamental corona and basket, also switch controlling fan when operated on 110 or 220 volt circuits.

All standard fans wound for direct arc circuits of any amperage at same price as 110 volt. All ceiling fans have blades with 60-inch sweep.

Investigate the merits of Diehl fans before placing your orders.

DIEHL MANUFACTURING CO.,

SHOW ROOMS { NEW YORK, 561-563 Broadway.
CHICAGO, 192-194 Van Buren St.
BOSTON, 128-132 Essex St.
PHILADELPHIA, W. Irwin Cheyney & Co.

MAIN OFFICE AND WORKS:
ELIZABETHPORT, N. J.

HELIOS-UPTON STORAGE BATTERIES

FOR STREET RAILWAYS, POWER AND LIGHTING PLANTS, FOR ELECTRICAL VEHICLES, TELEGRAPH, TELEPHONE AND ELECTRIC ELEVATORS.

BATTERY SUPPLIES AND REPAIRS.

We make very low prices for repairs of batteries manufactured by the Electric Storage Battery Company. Send us dimensions of plates required and the number and **we will make you a quotation that will save you money.** We will guarantee that our plates can be used with better results in installations of the Electric Storage Battery Co. than the plates of their own manufacture. To sustain our claims we refer you to the Kansas City Electric Light Company, who have a large installation, manufactured and installed by this Company.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA. CHICAGO, ILL. PEABODY, MASS.

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Western Electric Co.
Western Elec. Supply Co.

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General Electrical Repair Co.
Hobart Elec. Mfg. Co.
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Sage & Bro., F. B.

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McLennan & Co., K.
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Western Elect. Supply Co.

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Bullock Elec. Mfg. Co.
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Swarts Metal Refining Co.

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Johnston, Thomas J.
Page, Chas. G.

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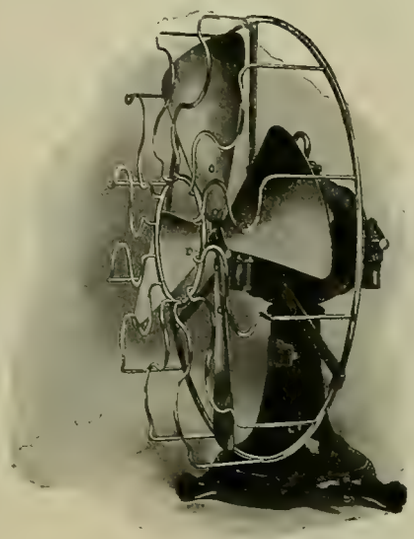

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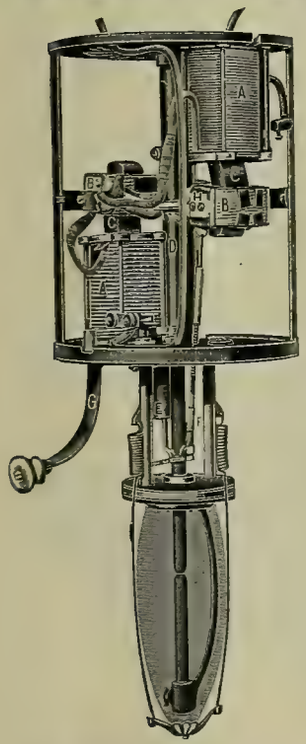

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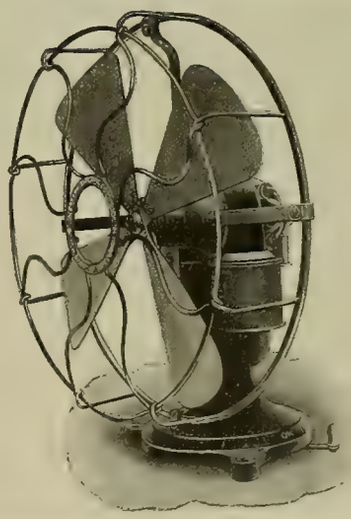

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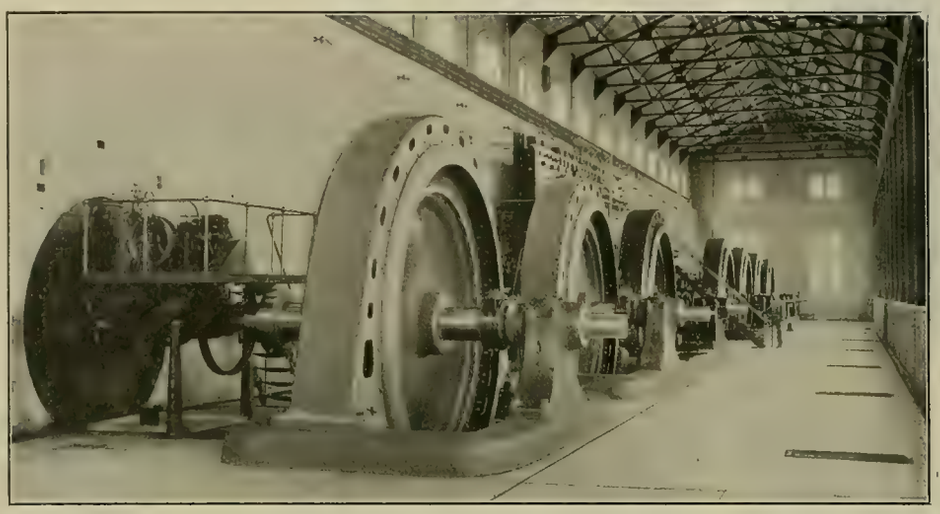

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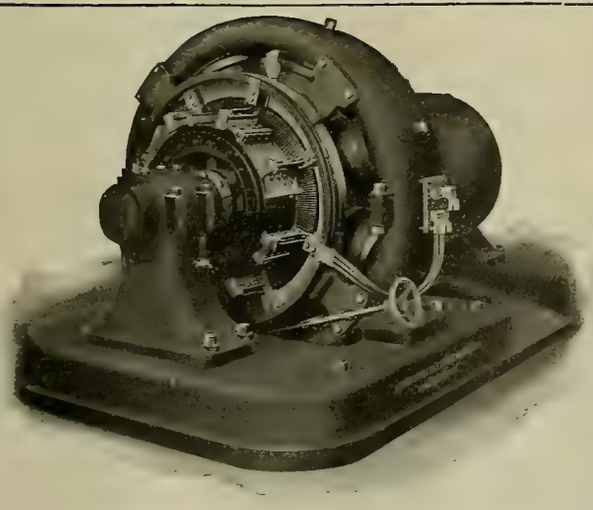

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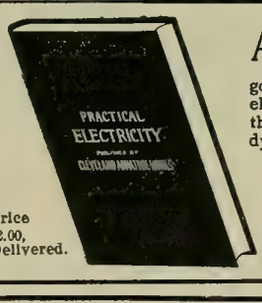

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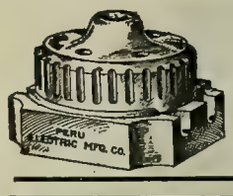

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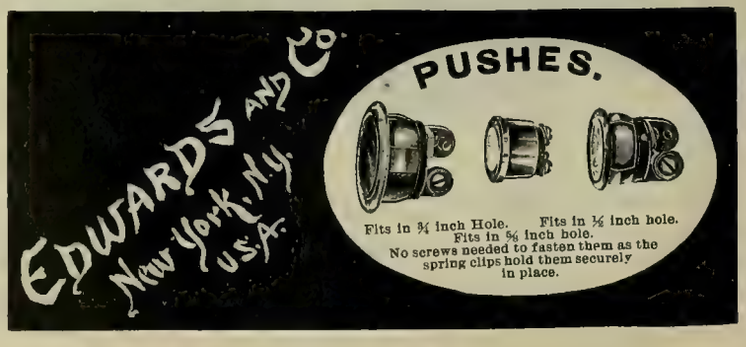

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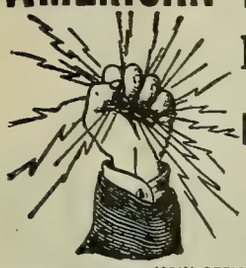

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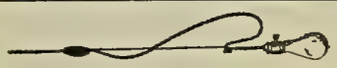

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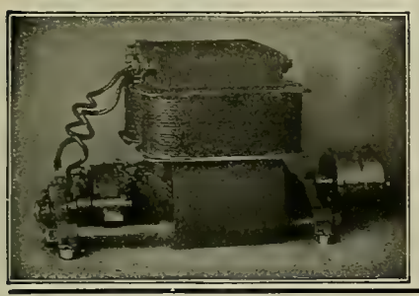

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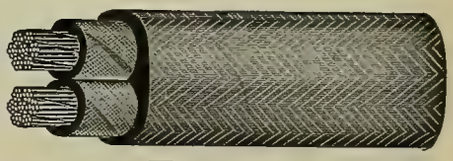

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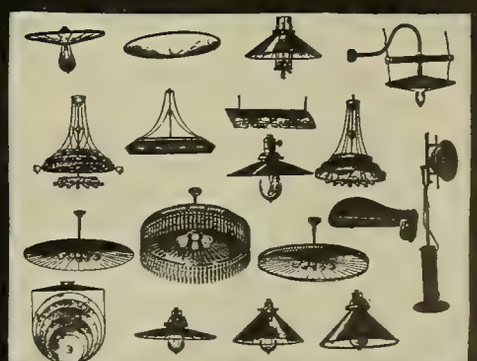

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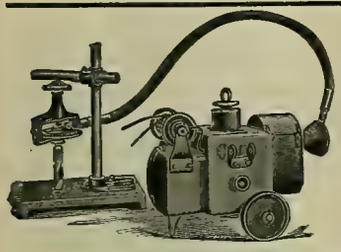

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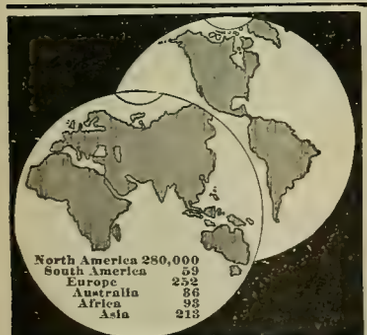

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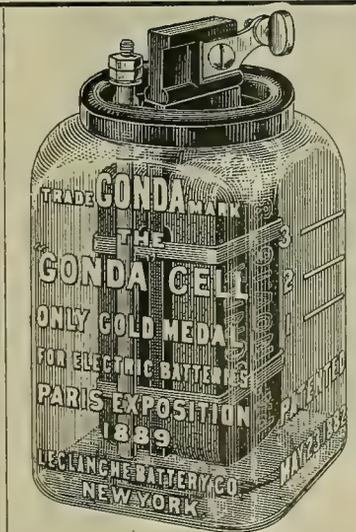

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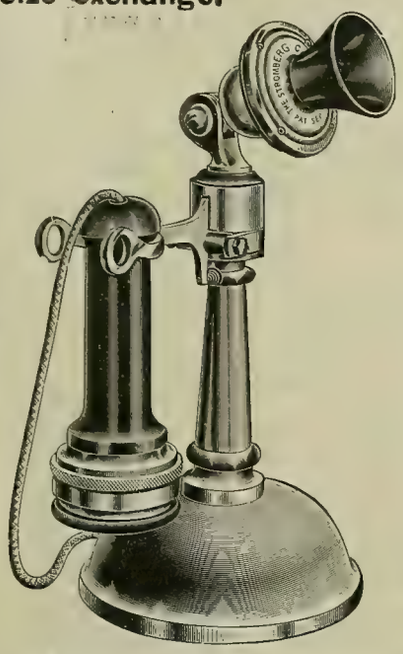

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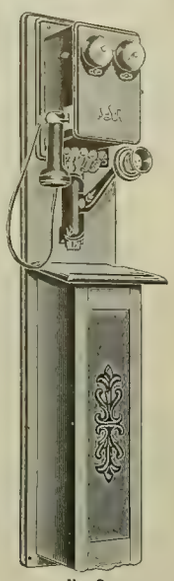

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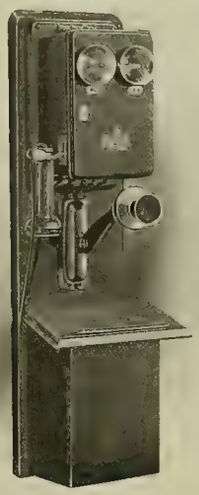

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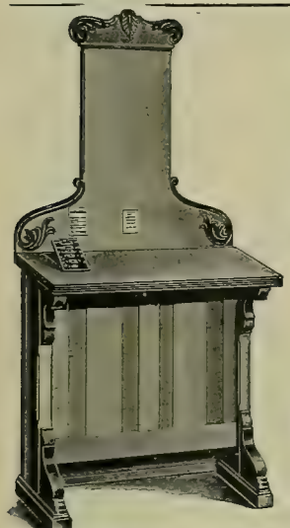

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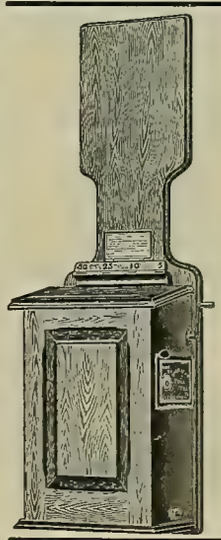

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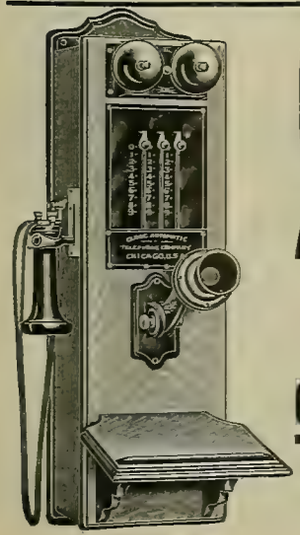

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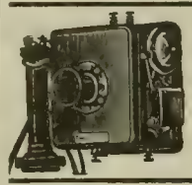

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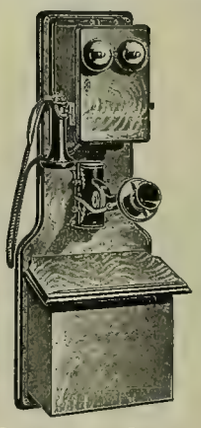

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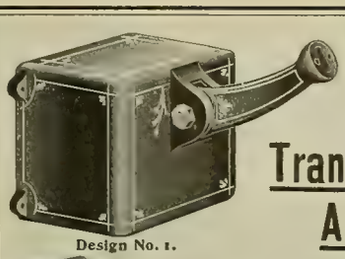

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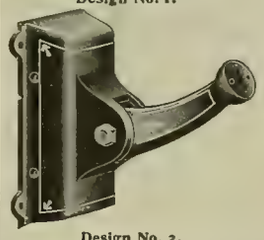

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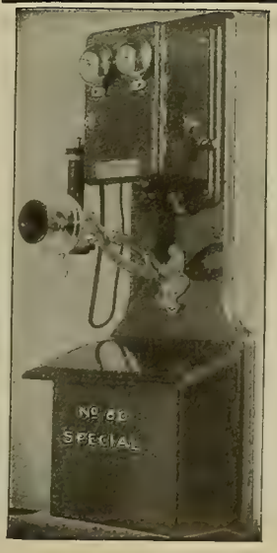

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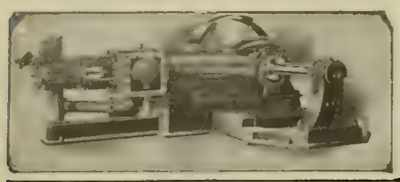

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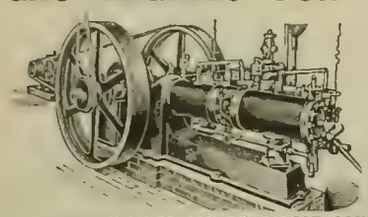

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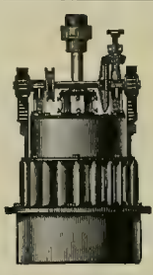

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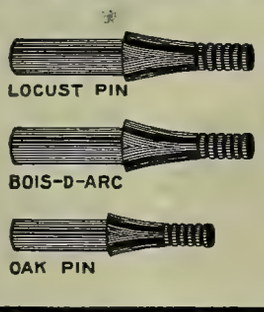

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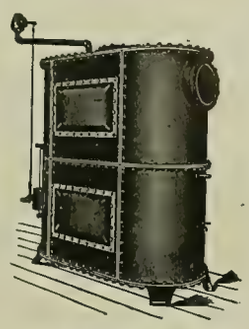

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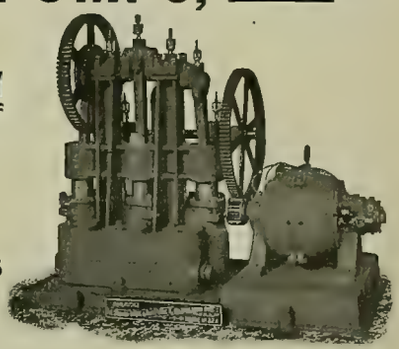

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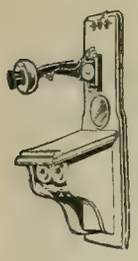

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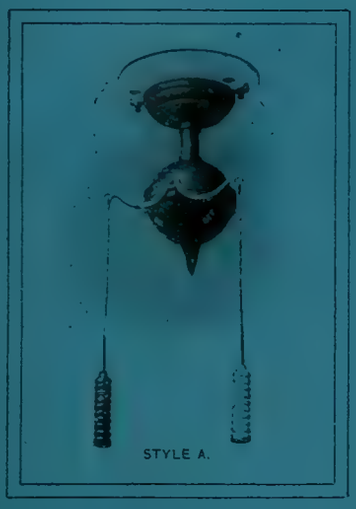

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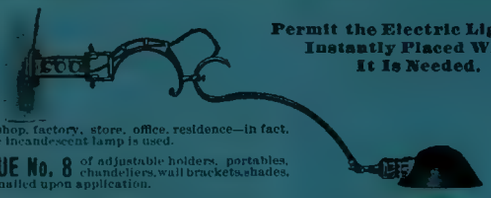

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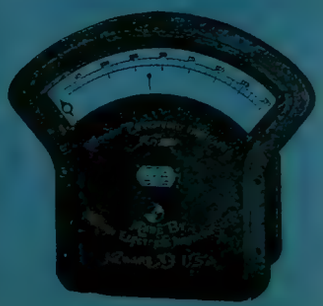

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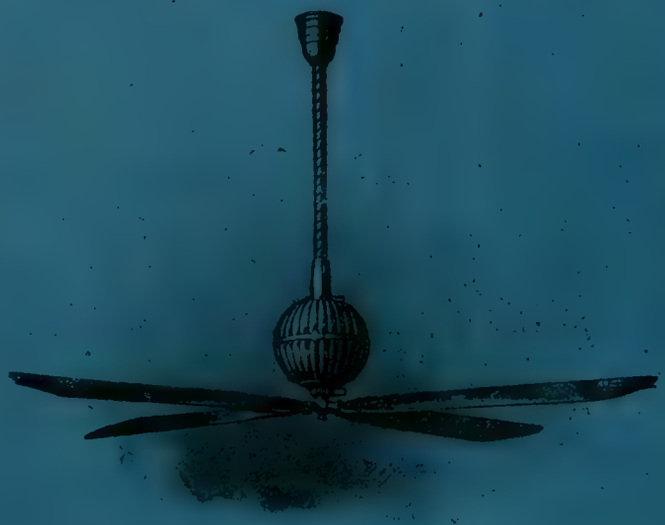

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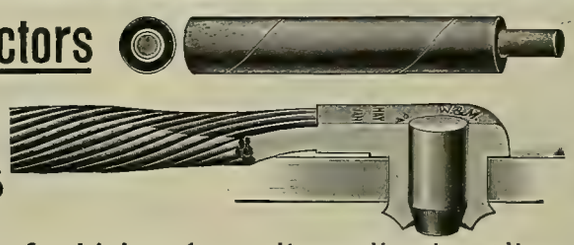

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CHICAGO EDISON COMPANY, 139 Adams Street, CHICAGO.

WE EXCEL AND UNDERSELL ALL

and are manufacturing and selling all kinds of

ELECTRICAL NOVELTIES AND SUPPLIES.

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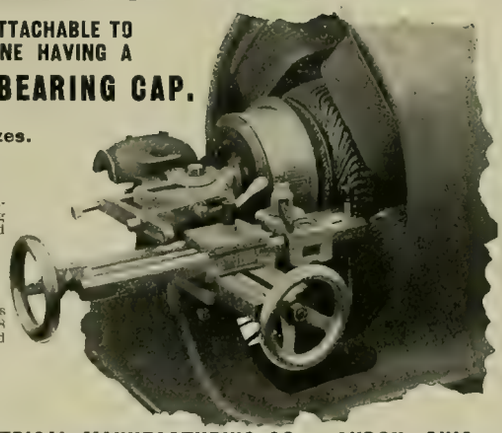

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SHOW HIGHEST TESTS YET MADE ON TUBES.

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THEY COMPLY WITH THE UNDERWRITERS' REQUIREMENTS.

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(10923)

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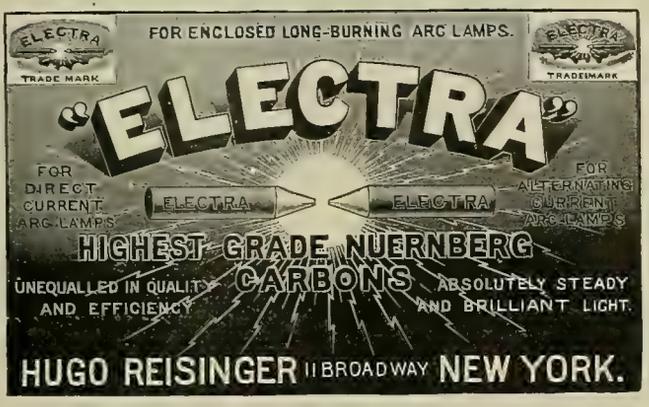
All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."



Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

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100 to 125 and 200 to 250 volts. 12 and 16 inch.
Made with universal joint, to be used as either desk or bracket fan.

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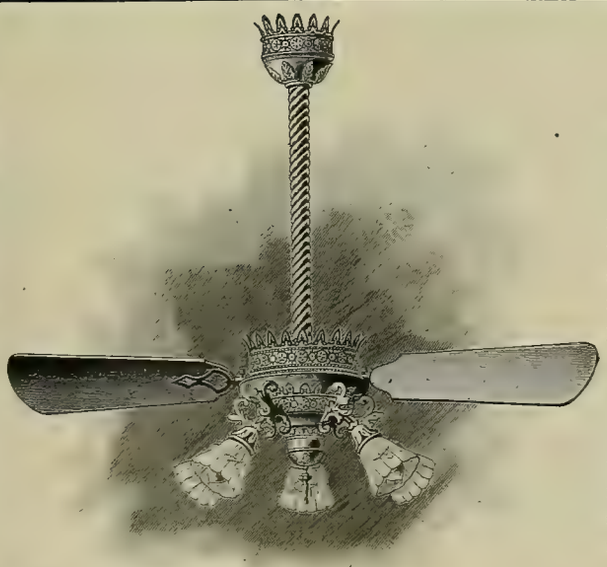
The handsomest fan ever offered to the public. During the winter blades can be removed, making an ornamental and serviceable lighting fixture. Can be run successfully with motors on arc circuits and lights on alternating system, as the two currents are kept entirely separate throughout and are thoroughly insulated.

We carry the largest line of fans ever offered—all finishes, special designs, two or four blades. Our fans meet *all* requirements.



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Our Ceiling and Electrolier fan patents have been sustained by U. S. court decision. The use or sale of infringements stopped by injunctions.

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Stilwell-Bierce Smith-Vaile.
Meters.
Diamond Meter Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Mica.
Chicago Mica Co.
Munsell & Co., Eugene.
Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.
Motors—See Dynamos and Motors.
Mouldings, Electrical.
Wright & Craycroft.
Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.
Patent Attorneys.
Barnacle, F. W.
Johnston, Thomas J.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.
Platinum Bought and Sold.
Baker & Company.
Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Poles and Ties.
Berthold & Jennings.
Davis & Stitt Co.
Huebel & Co., C. J.
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Maltby Lumber Co.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
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Sterling & Son, W. C.
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Valentine-Clark Co., The.
Worcester Co., C. H.
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Akron Smoking Pipe Co.
Bowers Manufacturing Co.
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Mogadore Insulator Co.
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Rockwood Mfg. Co.
Smith Co., S. Morgan.
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American Steel & Wire Co.
Rail Joints.
Continuous Rail Joint Company of America.
Refiners.
Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
Smith, Theo.
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Becker Bros.
Chicago Edison Co.
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General Electrical Repair Co.
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Schureman & Hayden.
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Second-Hand Mach'y.
Alexander, Thomas.
Bartlett & Co., A. F.
Chicago House Wrecking Co.
Gregory Electric Co.
Hodge-Walsh Elec. Eng. Co.
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Walsh's Sons & Co.
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Cream Flux Co.
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Queen & Co.
Robertson & Sons, Jas. L.
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Manross, F. N.
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Central Electric Co.
Central Tele. & Elec. Co,
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Chicago Telephone Sup. Co.
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Ericsson Telephone Co.
Farr Tel. & Cons. Supply Co.
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Horix Mfg. Co., The
Independent Tel. Supply Co.
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Westinghouse El. & Mfg. Co
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Westinghouse El. & Mfg. Co
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Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
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Sterling Varnish Co.
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Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

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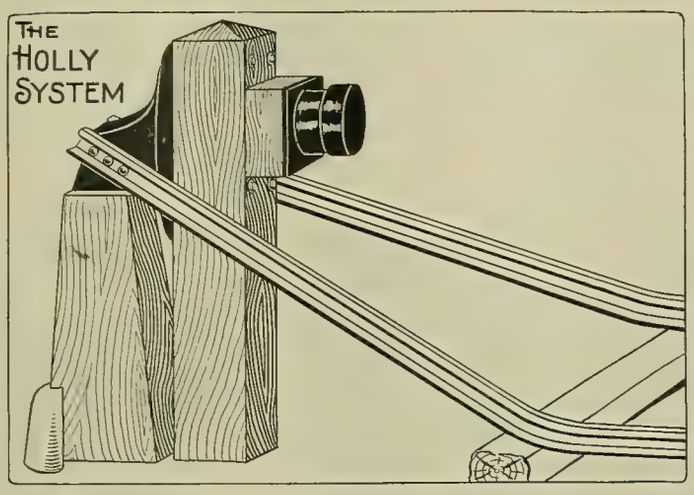

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If you are contemplating the installation of an underground heating plant, stop and investigate the HOLLY SYSTEM, the original and only successful system of underground steam distribution which has proved a mechanical and financial success.

We were the first to install the underground heating plants, and as we have had over fifteen years of experience, we can guarantee results.

Electric Companies who are operating our system report that they are paying all their fuel and station expenses and interest on the investment for steam mains from the sale of their exhaust steam. Write for our new pamphlet.

AMERICAN DISTRICT STEAM CO.,
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Mention Western Electrician.

WE CANNOT GIVE YOU A

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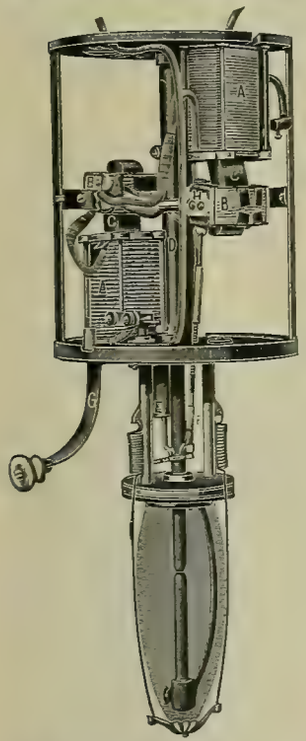

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Alternating Arc Lamp Using 5 Amperes.

We don't use an OSCILLATOR, but our new

"DIVIDED COIL" MECHANISM.

This does away with choke coils, springs and moving iron.

NATIONAL ARC LAMP CO.,

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DIRECT CURRENT SINGLY ON 110-220-500 VOLT CIRCUITS.

In Groups in Series.
Two 110 Fans on 220 V.
Five 110 Fans on 550 V.
Three 170 Fans on 500 V.
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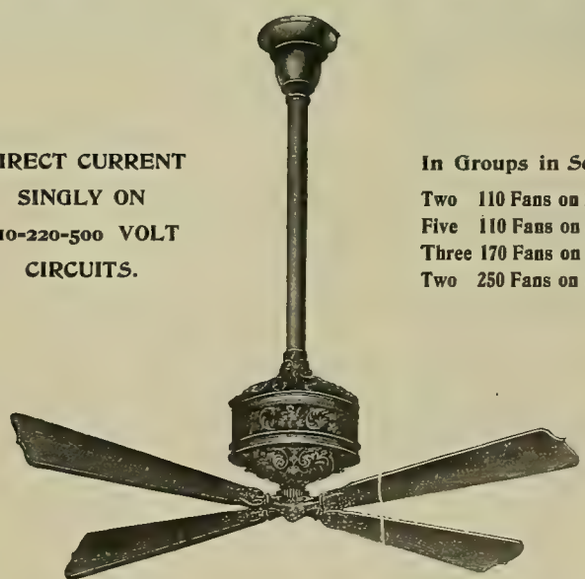

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CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.
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LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.
PARIS, 46 Avenue de Breteuil.

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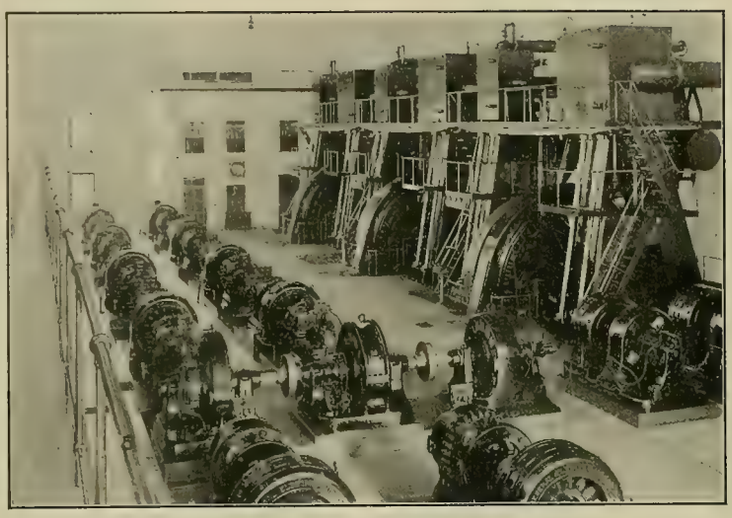
INSTALLATIONS



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DESIGNERS
MANUFACTURERS
AND ERECTORS OF

Steel Bridges
Steel Buildings
and All Classes of
Metallic Structures

WE have decided to carry at all our plants a large stock of Raw Material, from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc.

The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

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East Berlin, Conn.
Elmira, N. Y.
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Horseheads, N. Y.
Lafayette, Ind.
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Pittsburg, Pa.
Rochester, N. Y.
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Sydney, N. S. W.
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Youngstown, Ohio.

European Office: LONDON

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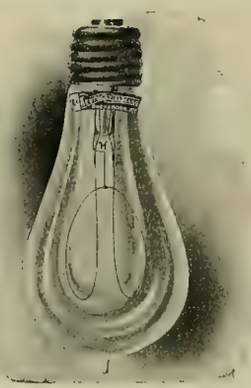

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Once tried will make a steady Customer. Price Right. Quality Right.

SEND A TRIAL ORDER.

KENTUCKY ELECTRICAL CO.,

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ALWAYS RELIABLE.

Adopted by the Government, Railroad and Telephone Companies.

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USED FOR BELL WORK,

Grade Crossings, Telephones, Gas Engine and Automobile Work, Lighting Miniature Lamps, Etc.

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Drug and Chemical Works,
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Vegetable Boiler Compounds.

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10,000 Boiler Feed Waters are Being Treated by DEARBORN METHODS.

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TYPE C.
JUNCTION CUT-OUT.
1 TO 30 AMPERES, 2,500 VOLTS.

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USE OUR TRANSFORMER AND JUNCTION CUT-OUTS.

The Most Approved Fuses and Fittings upon the Market.

Made by the D. & W. FUSE CO., Providence, R. I.

MANUFACTURERS OF THE LATEST TYPE OF

High and Low Tension Non-Arcing Fuses, Junction and Transformer Cut-Outs, Service Switches, Telephone Protectors, Plug Fuses and Subway Boxes.

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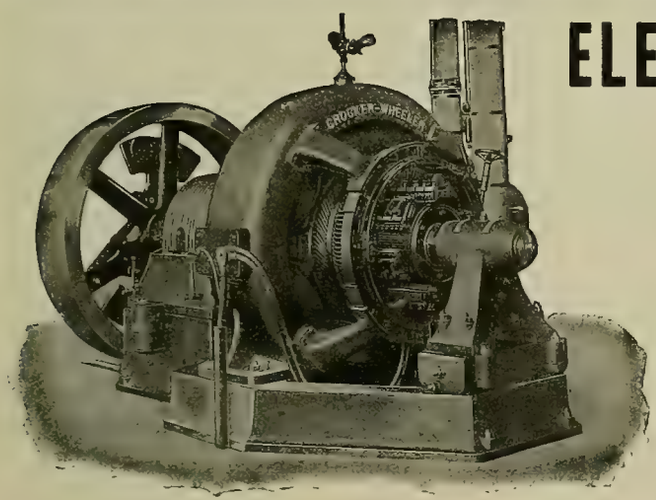

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Alternating or Direct Current
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Power Plants for Long Distance Transmission.

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LIGHTNING CANNOT ENTER YOUR STATION AND YOUR PROTECTION IS ABSOLUTE

If you have installed Swinging Ball Lightning Arresters. Write for prices and circulars. We can ship promptly from Chicago Stock.

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ELECTRICAL SUPPLIES,
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McIntire and American Joints, Fuse Wire, Lightning Arresters, Fuse Blocks.
Cheap, Good. MAGNET WIRE. Guaranteed.
TWO BIG STORES.
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Quality the Best. Prices Low. Correspondence Solicited.
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POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
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For Constructing Automobile Motors, 4 H. P. and 7½ H. P.
OPPOSITE CYLINDER BALANCED TYPE WITH BLUE PRINTS.
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Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., 909, 100 Sole Manufacturers, Washington Street, - CHICAGO.

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Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

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(General Electric Co.) Harrison, N. J.

What is
Economy
in conduits?
Greatest capacity
Smoothest finish
Least labor
Least material

Least cost
McRoy conduits

McROY CLAY WORKS
BRAZIL, INDIANA
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HAVE YOU USED
LeValley-Vitae Carbon Brushes?
Now in use by the Leading Electric Railway, Light and Power Plants. Trial Orders Filled Promptly.
J. Holt Gates & Co., Agts.
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AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.
Contains no acid or any element injurious to electrical connections.
ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.
YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

THIS IS WHAT ONE USER HAS TO SAY OF IT:
"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
"Per J. H. Goehst, Constr. Supt. CHICAGO EDISON CO."

FOR SALE BY ALL SUPPLY HOUSES OR
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OUR PLATES DON'T BUCKLE

Short Circuits do not Injure but IMPROVE Them.
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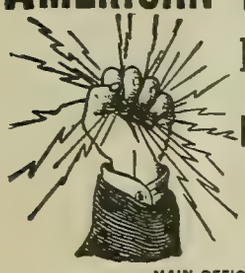
PROVIDENCE, R. I.



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Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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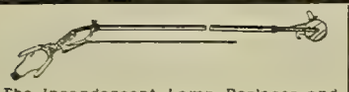

The Incandescent Lamp Replacer and Cleaner replaces and cleans any c. p. lamp at any height or angle.
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Six Years with General Electric Company.
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Patent Causes. Patent Soliciting.

IDEAL AUTOMATIC ANNUNCIATORS.
The Best on the Market.
Write for Prices.
Manufactured by
THE HEATH ELECTRIC CO.,
DETROIT, MICH.

Eldredge Battery Voltmeter,
For Testing Primary and Storage Batteries, 0 to 3 Volts.
DEAD BEAT.
The only low-price pocket instrument indicating in volts. Connecting posts have non-removable nuts. Light weight and neat in appearance.
Eldredge Electric Mfg. Co.,
Springfield, Mass., U. S. A.

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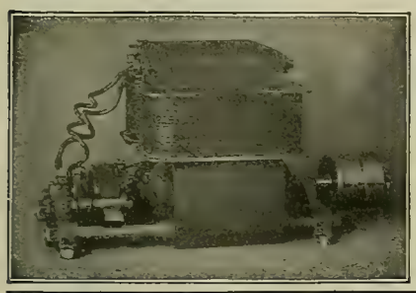

Sets of castings and material furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron contains eight slots. Pulley for round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Run as motor will drive sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 6-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with these machines. Full size detail blue prints furnished with each set of material, showing how to connect for both SERIES and SHUNT windings.
The change can be made from one winding to the other whenever desired.
Write for Dynamo Circular No. 16.
FRANKLIN MODEL SHOP,
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THE GORDON PRIMARY CELL.

The most improved, efficient, long lived and economic primary cell of the new century.
Extensively used for telephone, telegraph, fire and police alarm service, railroad signal work, gas engine ignition and automobiles.
Manufactured in ten different styles.
Catalogue, price-list, etc., upon application.

THE GORDON BATTERY CO.,
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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

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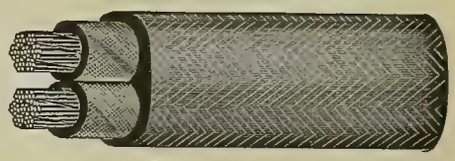

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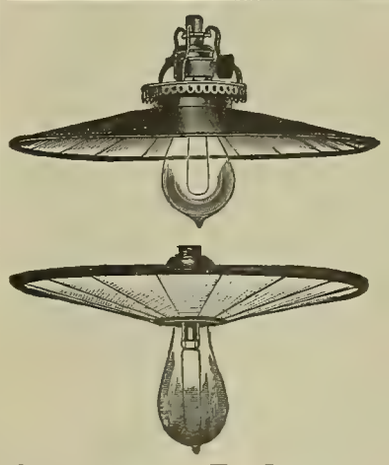
WORKS AT
TRENTON, N. J.



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A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

GET OUR PRICES.

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Position as salesman, house or traveling. Ten years' experience in various electrical branches. Extensive acquaintance in Illinois and Indiana. Now employed en route. Address "TRAVELER," care Western Electrician, 510 Marquette Bldg., Chicago.

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Position as superintendent or manager of electric light or power plant by a thoroughly competent engineer who has had 13 years' practical experience in construction and management of same. At present holds responsible position as secretary and superintendent of an electric light company. Other reasons than a better position for wanting to make a change. Can give best of references from present and past employers. Address "D. H.," care Western Electrician, 510 Marquette Building, Chicago.

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A second-hand, 150-kw., 110-volt, direct-current, slow speed, belted, multipolar dynamo. Give lowest cash price. Address "F.," care Western Electrician, 148 Times Building, New York.

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Situation wanted as traveling salesman for a first-class electrical house by a practical electrician. Has been in telephone business for eight years. Also in electric plant for three years. Address "S. E. R.," care Western Electrician, 510 Marquette Building, Chicago.

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
250 WASHINGTON ST., NEWARK, N. J.

FOR SALE—A BARGAIN.

150 hard rubber cells, 7x7x10¼ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

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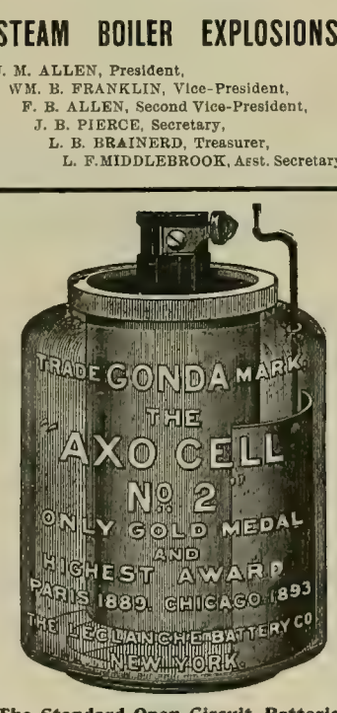

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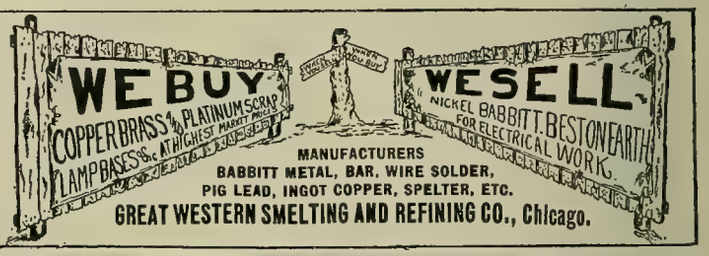

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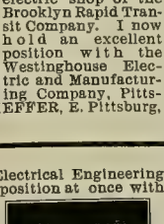

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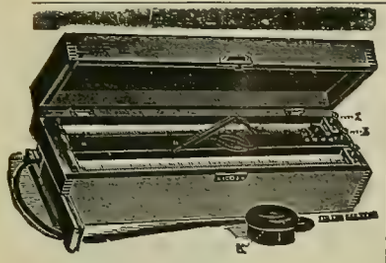

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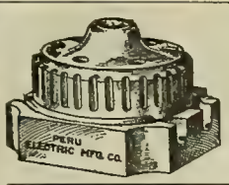

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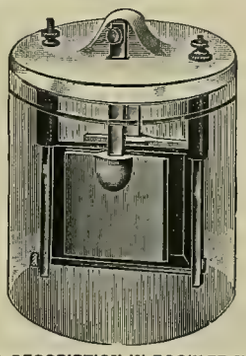

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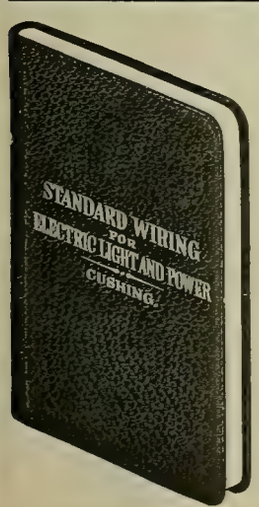

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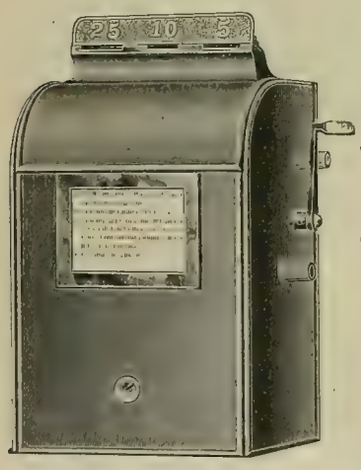

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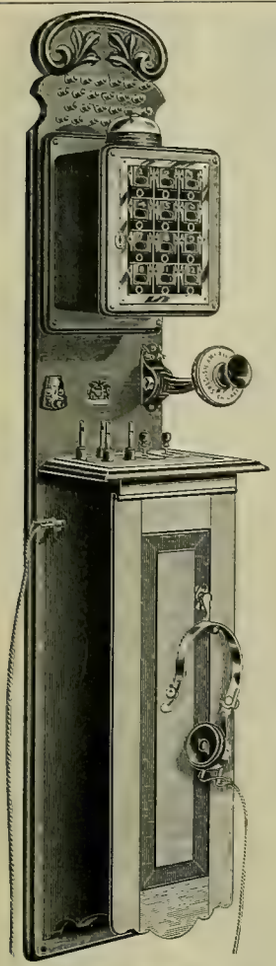

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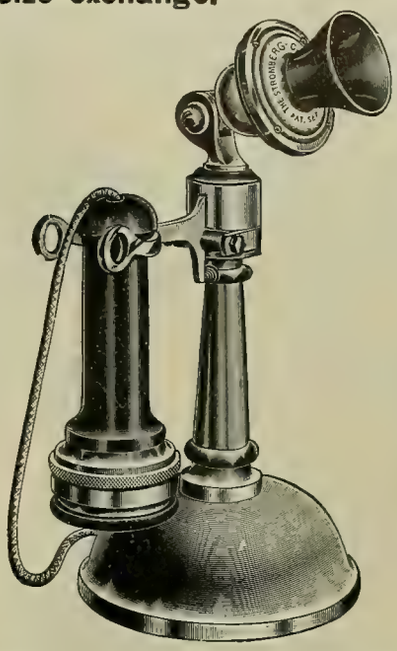

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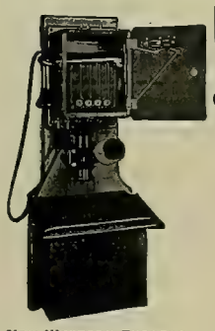

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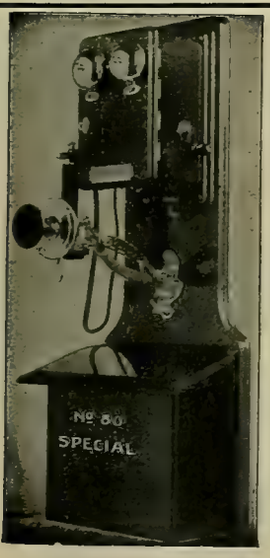

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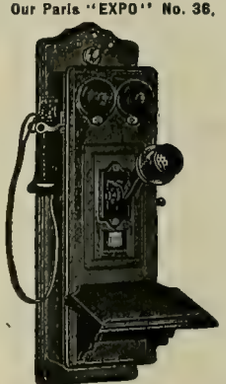

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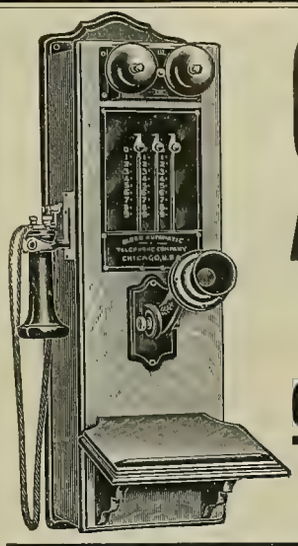

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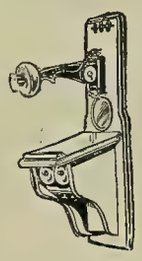

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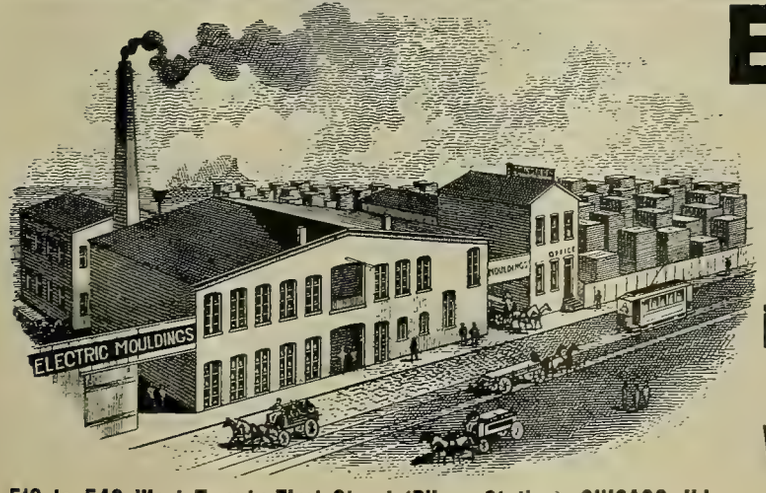

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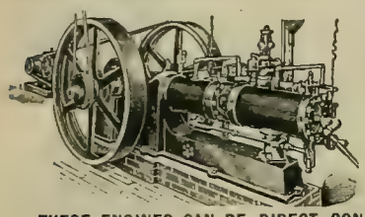

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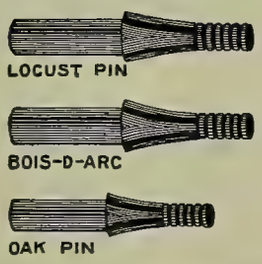

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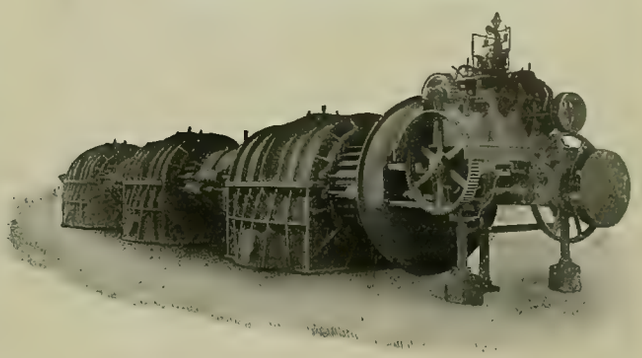

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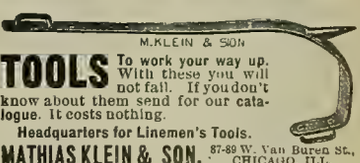

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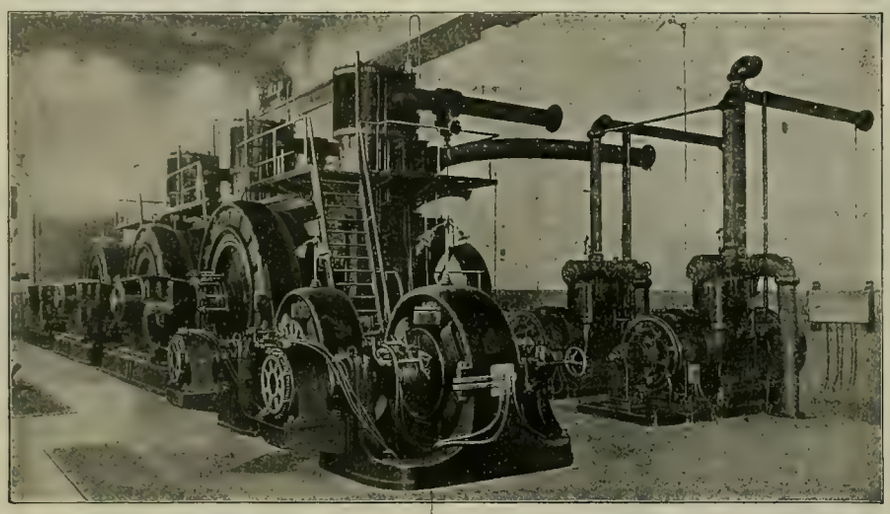

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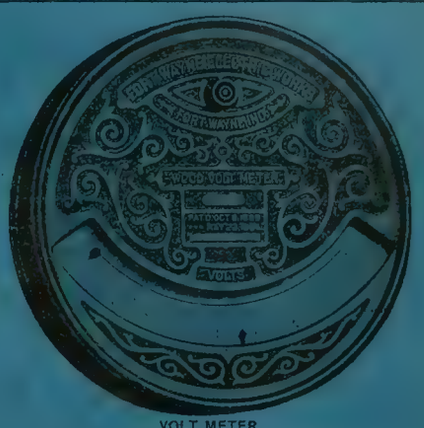

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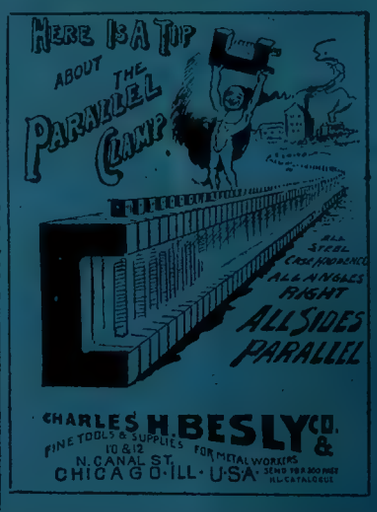

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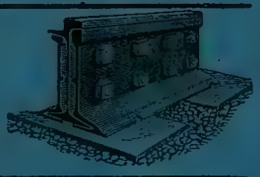

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1893—World's Fair, Medal for Rubber Insulation.
THE STANDARD FOR RUBBER INSULATION.
Sole Manufacturers of
Okonite Wires, Okonite Tape, Manson Tape, Candee Weather-proof Wires.
THE OKONITE CO., LTD.
Willard L. Candee, Durant Cheever, } Managers. 253 Broadway, New York. Geo. T. Manson, Gen'l Supt. W. H. Hodgins, Secy.

PARANITE
INDIANA RUBBER AND INSULATED WIRE CO.,
MANUFACTURERS OF
Paranite Rubber Covered Wires and Cables,
UNDERGROUND, AERIAL, SUBMARINE AND INSIDE USE.
TELEPHONE, TELEGRAPH AND FIRE ALARM CABLES.
All Wires are tested at Factory. JONESBORO, IND.

"PHONO-ELECTRIC" WIRE "IT'S TOUGH."

Combines High Tensile Strength, High Elastic Limit and Great Toughness with Remarkable Wearing Qualities.
Trolley — Telephone — Telegraph.
BRIDGEPORT BRASS CO.,
19 Murray St., New York.

PAPER PULLEYS
Rockwood Manufacturing Company, Indianapolis, Indiana, U. S. A.

STERLING EXTRA INSULATING VARNISH.
Sterling Extra Black Finishing Varnish,
Sterling Black Air Drying Varnish,
Sterling Black Core Plate Varnish.
THE STERLING VARNISH CO., Pittsburg, Pa., U. S. A.
THE STERLING VARNISH CO., 95 Colmore Row, Birmingham, England.

ERICSSON BI-POLAR
ALL METAL RECEIVER EXCEPTIONALLY STRONG. NEEDS NO ADJUSTING.
IT IS THE BEST. WHY NOT HAVE IT?
SWEDISH RECEIVER
ERICSSON TELEPHONE CO. 296 B'WAY. N.Y.

ERICSSON SWITCHBOARDS
Of all sizes. Telephones for all uses. Write for particulars and tell your needs.
ERICSSON TELEPHONE CO., 296 Broadway, NEW YORK.

One Reason
why Bullock Generators and Motors are best is because they are designed with the greatest of care. The mechanical and electrical details are a near approach to perfection. Send for our descriptive bulletins.
Bullock Electric Mfg. Co., Cincinnati, U. S. A.
253

CREOSOTED WOOD CONDUITS.
Our Process Prevents Vegetable Growths from Reaching Conduits.

END ELEVATION.

LONGITUDINAL SECTION SHOWING JOINT
We Make Any Size Desired.
THE MICHIGAN PIPE CO., BAY CITY, MICHIGAN.

2,000 IN USE.
Bipolar and Multipolar Motors from ¼ to 50 horsepower. Dynamos from 10 lights to 700. We sell or rent. Good profits for agents.
The Hobart Elec. Mfg. Co., Troy, Ohio

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO., 160 WASHINGTON ST., NEWARK, N. J.

I-T-E
CIRCUIT BREAKERS
CUTTER ELECTRICAL CO., PHILADELPHIA

STANLEY A. C. WATTMETERS.
Permanent Accuracy Guaranteed.
STANLEY INSTRUMENT CO.,
New York: 146 Broadway.
San Francisco: 31-33 New Montgomery St.
Canada: The Royal Electric Co., Montreal and Toronto.

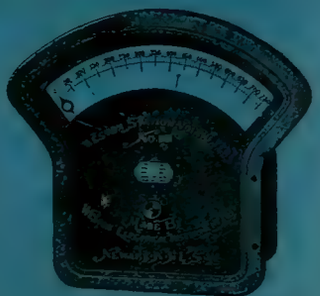
Queen & Co.,
1010 Chestnut St., Phila.
480 MONON BLDG., CHICAGO.
Acme Testing Sets, Queen-Wirt Switchboard Instruments, X-Ray Focus Tubes, Induction Coils.

THE BEST ON EARTH
TIPLESS LAMPS THE SHELBY ELECTRIC CO. SHELBY, OHIO.

WESTON Electrical Instrument Co.,
114-120 William St., NEWARK, N. J., U. S. A.

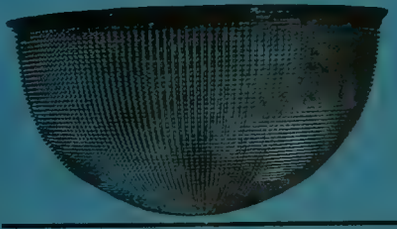
Illuminated Dial Station Instruments.
These instruments are based upon the same general principle and are just as accurate as our regular Standard Portable Direct Current Voltmeters and Ammeters, but are much larger, and the working parts are inclosed in a neatly designed dust-proof cast-iron case which effectively shields the instruments from disturbing influences of external mag-

BERLIN.—European Weston Electrical Instrument Co., Ritterstrasse No. 88.


Weston Standard Illuminated Dial Station Voltmeter. Style E. "Flush Type."

Weston Standard
Portable Direct Reading Voltmeters and Millivoltmeters, Ammeters and Milammeters, Wattmeters and Voltmeters, for Alternating and Direct Current
Our portable instruments are recognized as standards throughout the civilized world.
Our Semi-Portable Laboratory Standard Voltmeters and Ammeters are still better.
They are the most reliable, absolute standards for Laboratory use.

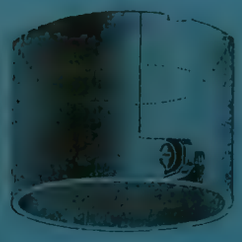
LONDON.—Elliott Bros., No. 101 St. Martins Lane.

HOLOPHANE GLASS CO.,
15 East 32nd St., NEW YORK.

Compound Prism Globes and Shades
FOR ALL KINDS OF LIGHTING.
TWO GOLD ONE SILVER Medals
Awarded at Paris Exposition.
WRITE FOR CATALOGUE.

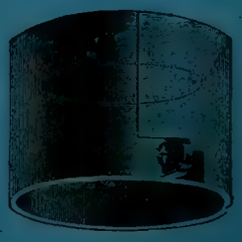
THE UNITED STATES CARBON COMPANY
CARBONS
SPECIALTIES A SPECIALTY ELECTROLYTIC.
ALTERNATING. DIRECT. ENCLOSED. OPEN.
CLEVELAND, OHIO, U. S. A.
NOT IN CARBON TRUST.

BREWSTER

UNIVERSAL SIGN RECEPTACLES.



A SYSTEM OF UNITS



From which may quickly be formed, wired and installed anything in the shape of

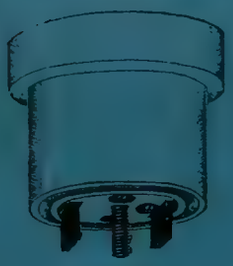
THOROUGHLY WEATHERPROOF

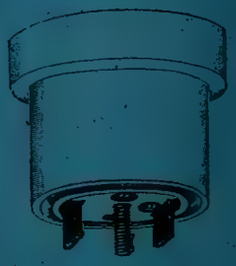
Electric Signs

—OR—

Electrical Decorations

OF ANY STYLE OR VARIETY.



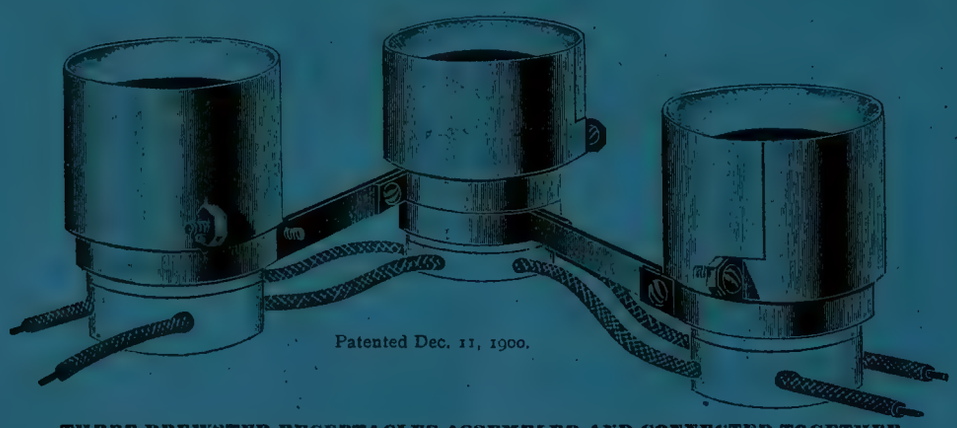


PARTS OF THE UNIT.

"THE CONNECTING LINK."

When through using the receptacles in the shape of one sign or decoration, a very little labor only is necessary to make them up into something else—something entirely different.

READY TO ASSEMBLE.



Patented Dec. 11, 1900.

THREE BREWSTER RECEPTACLES ASSEMBLED AND CONNECTED TOGETHER.

Illustrating method of use and simplicity of means by which a perfectly rigid, yet readily adjustable, construction in any form or design desired is provided.

Just the Thing for Theaters or for Merchants Who Want to Keep Abreast of the Times by Electrical Advertising and yet Require Variety.

THE ELECTRIC MOTOR & EQUIPMENT CO.,

12-14 BEAVER ST., - - - NEWARK, N. J.

SOLE MANUFACTURERS AND SALES AGENTS.

A RAILWAY FEEDER is seldom loaded to its fullest carrying capacity except for a small portion of the daily service.

The installation of a "Chloride Accumulator" Sub-Station

for roads having lines extending a considerable distance from the Power House permits the use of FEWER FEEDERS and these LOADED TO THEIR NORMAL CAPACITY all the time.

In this way MAXIMUM EFFICIENCY is secured and a material saving in copper effected.

Bulletins illustrating the above mailed upon application.

THE ELECTRIC STORAGE BATTERY CO.

Allegheny Avenue and 19th Street, Philadelphia, Pa.

Sales Offices: New York, 100 Broadway. Boston, 60 State St. Chicago, Marquette Bldg. Baltimore, Equitable Bldg. St. Louis, Wainwright Bldg. San Francisco, Nevada Block. Detroit, Michigan Electric Co. Cleveland, New England Building. R 19

PLATINUM

IN SHEET OR WIRE, ANY SIZE, SHAPE OR DEGREE OF HARDNESS FOR ALL PURPOSES.

BAKER & CO.

408-410-412-414 N. J. Railroad Ave., Newark, N. J.

Scrap and Native Platinum Purchased. New York Office, 120 Liberty Street.

Genuine Telephone Wire

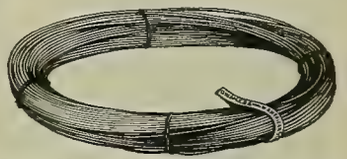
Of highest conductivity and heaviest galvanizing, made in accordance with the specifications of the largest Telegraph and Telephone Companies, has an embossed tin seal securely riveted around every bundle as follows:

NOTE THE SEALS FOR THE THREE GRADES.

W.&M. EXTRA B.B. Made By AMERICAN STEEL & WIRE CO.

W.&M. B.B. Made By AMERICAN STEEL & WIRE CO.

W.&M. STEEL Made By AMERICAN STEEL & WIRE CO.



Bundle of Telephone Wire with Seal Attached.

AVOID SUBSTITUTION of inferior wires by seeing that every bundle is tagged (according to grade) with one of these seals.

ALSO Copper Wire, bare and insulated, single and stranded, for telephone, light and power.

GALVANIZED STRAND.

AMERICAN STEEL & WIRE CO.,

THE ROOKERY, CHICAGO, ILL.

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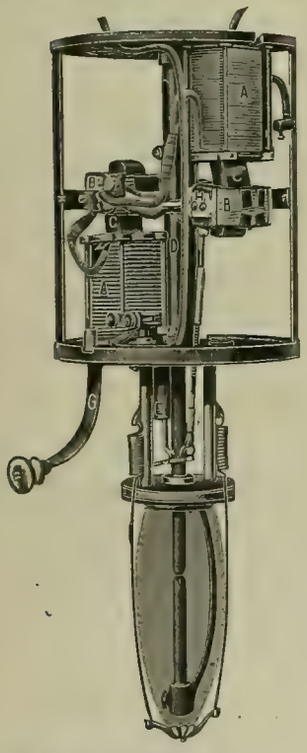
PARAGON FAN MOTORS.

WRITE FOR PRICES.

CHICAGO EDISON COMPANY, 139 Adams Street, CHICAGO.

WE CANNOT GIVE YOU A

MESSAGE FROM MARS



BUT WE CAN GIVE YOU AN

=Alternating= Arc Lamp: Using =5 Amperes.=

We don't use an OSCILLATOR, but our new

"DIVIDED COIL" MECHANISM.

This does away with choke coils, springs and moving iron.

NATIONAL ARC LAMP CO.,

LORAIN, OHIO.

MANHATTAN SERIES

A. C. Enclosed Arc Lamp System.

ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

MANHATTAN GENERAL CONSTRUCTION COMPANY,

NEWARK, N. J.

SALES OFFICE: 11 BROADWAY, NEW YORK.

GOULD STORAGE BATTERIES.

ESPECIALLY ADAPTED FOR

STREET RAILWAY POWER PLANTS.

ALSO CENTRAL STATIONS AND ELECTRIC VEHICLES.

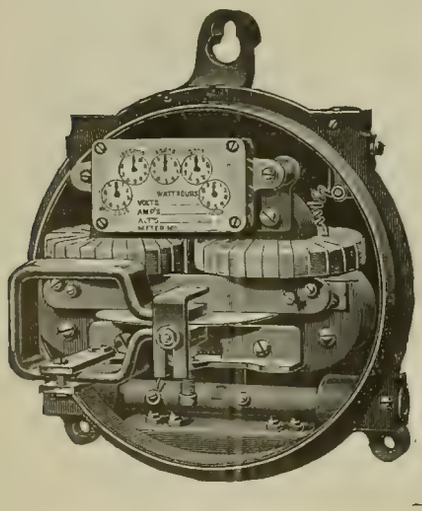
Electric Elevators, Railroad Signal Apparatus, Telegraphs, Telephones, Electric Fire Alarms.

Send for Description and Catalogue.

GOULD STORAGE BATTERY CO.,

NEW YORK OFFICE, 25 West 33d St.

Works, DEPEW, N. Y. NEW YORK, N. Y., U. S. A.



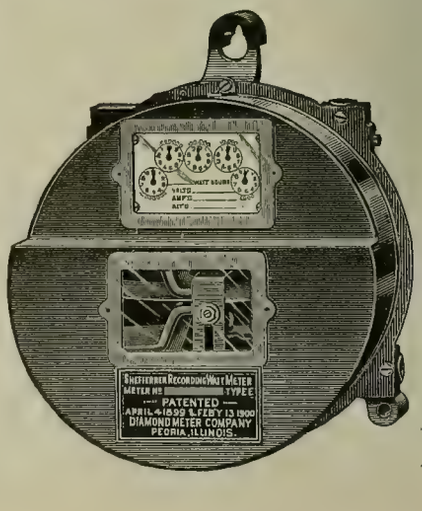
Scheeffer Recording Wattmeter.

ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.

DIAMOND METER CO.

PEORIA, ILL., U. S. A.



AS GOOD AS THE NAME.

COLUMBIA CARBONS

FOR ENCLOSED AND OPEN ARCS.

A FEW YEARS AGO PRACTICALLY ALL THE HIGH GRADE CARBONS CONSUMED IN THE U. S. WERE SUPPLIED BY IMPORTERS. TO-DAY WE ARE SUPPLYING THE BULK OF THE TRADE IN THIS COUNTRY REQUIRING HIGH GRADE CARBONS BECAUSE COLUMBIA CARBONS ARE

GUARANTEED SUPERIOR

TO ANY IMPORTED CARBON. SEND US A TRIAL ORDER. IF THEY ARE NOT ALL WE CLAIM FOR THEM, YOU CAN RETURN THEM AT OUR EXPENSE. THE PRINCIPAL CENTRAL STATIONS HAVE DISCARDED IMPORTED CARBONS FOR THE COLUMBIA BECAUSE THEY ARE ACKNOWLEDGED FAR SUPERIOR

TO IMPORTED CARBONS.

SAMPLES FURNISHED FREE OF EXPENSE.

NATIONAL CARBON COMPANY,

1198 W. Madison Ave., CLEVELAND, OHIO.

Columbia Lamps.

Unequaled in Quality.

Efficiency Guaranteed.

Highest Maintenance of Candle Power.

Any Voltage.

Any Candle Power.

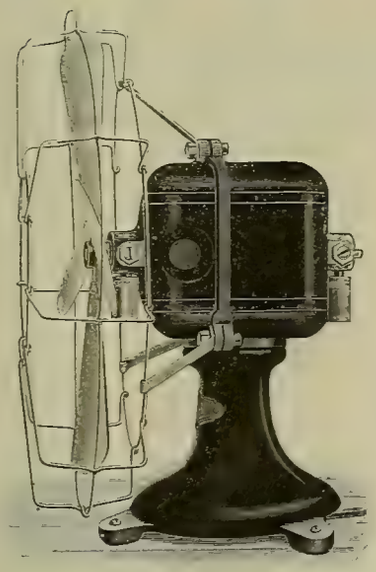
Have You Tried the "Columbia?"

Shipped from Chicago Stock. Don't wait.

Central Electric Company,

SALES AGENTS,

OKONITE TRADE MARK 264-266-268-270 Fifth Ave., CHICAGO. OKONITE TRADE MARK



USE OR SALE OF

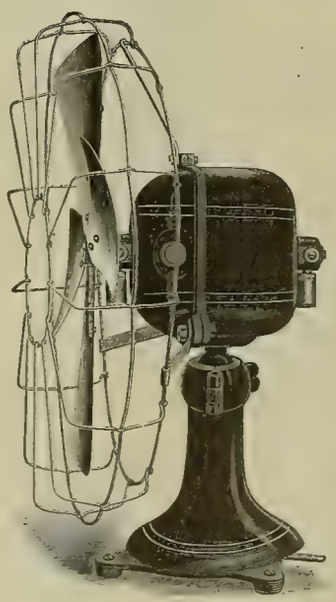
Infringements stopped by Injunctions.

Our ceiling and electrolier fan patents sustained by U. S. court decision. Use or sale of Infringements stopped by injunction March 8th and December 5th, 1900.

DIEHL DESK FAN MOTORS.

The enviable reputation we have established in the manufacture of high grade ceiling fans has been fully maintained in our production of ***DESK FANS.*** They are acknowledged by users to be the best ever produced. Following are some of the important features they possess:

Silk insulation on armature wires,
Hard-drawn copper commutator bars,
Self-aligning bronze bearings,
Improved self-oiling oil cup,
Unbreakable three-speed switch base,
Very strong guards—no solder used,
Body of fan richly enameled and embellished with fine gold stripes.
Absolutely the highest efficient fans on the market.



Endorsed and approved by thousands of users throughout the world. 14 years in the manufacture of fans assures perfection in all respects.

DIEHL MFG. CO.,

Main Office and Works: ELIZABETHPORT, N. J.

SHOWROOMS:

NEW YORK, 561-563 Broadway. CHICAGO, 192-194 Van Buren St.
BOSTON, 128-132 Essex St. PHILADELPHIA, W. Irwin Cheyney & Co.
NEW ORLEANS, Newman-Spranley Co., Ltd.

HELIOS-UPTON STORAGE BATTERIES

FOR STREET RAILWAYS, POWER AND LIGHTING PLANTS, FOR ELECTRICAL VEHICLES, TELEGRAPH, TELEPHONE AND ELECTRIC ELEVATORS.

BATTERY SUPPLIES AND REPAIRS. We make very low prices for repairs of batteries manufactured by the **Electric Storage Battery Company.** Send us dimensions of plates required and the number and **we will make you a quotation that will save you money.** We will guarantee that our plates can be used with better results in installations of the Electric Storage Battery Co. than the plates of their own manufacture. To sustain our claims we refer you to the Kansas City Electric Light Company, who have a large installation, manufactured and installed by this Company.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA. CHICAGO, ILL. PEABODY, MASS.

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Spies Electric Company.
Western Electric Co.
Western Elec. Supply Co.
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Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
Sage & Bro., F. B.
Western Electric Company.
Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires) **Copper, Sheet and Bar.**
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General Electric Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co
Western Elect. Supply Co.
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Chicago Edison Co.
Electric Appliance Co.
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Reisinger, Hugo.
United States Carbon Co.
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Smith Co., S. Morgan.
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Western Elect. Supply Co.
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Chicago Edison Co.
General Electrical Repair Co.
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Mogadore Insulator Co.
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Peru Elec. Mfg. Co.
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American Electrical Works.
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General Electric Co.
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National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
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Central Electric Co.
Chicago Edison Co.
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General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
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Ohio Electric Works.
Sawyer-Man Elec. Co.
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Western Elec. Supply Co.
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Klein & Son, Mathias.
Smith & Hemenway Co.
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Diamond Meter Co.
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Chicago Mica Co.
Munsell & Co., Eugene.
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Crocker-Wheeler Company.
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General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.
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Wright & Craycroft.
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Besly & Co., Chas. H.
Robertson & Sons, Jas. L.
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Barnacle, F. W.
Johnston, Thomas J.
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Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.
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Amer. Reflector & Ltg. Co.
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Bartlett & Co., A. F.
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Gregory Electric Co.
Illinois Maintenance Co.
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Rose Electric Company.
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Queen & Co.
Robertson & Sons, Jas. L.
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Manross, F. N.
Steel Boxes.
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Gould Storage Battery Co.
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Western Elec. Supply Co.
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American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
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Central Tele. & Elec. Co.
Century Telephone Cons. Co.
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Roebling's Sons Co., J. A.
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Western Electrical Sup. Co.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

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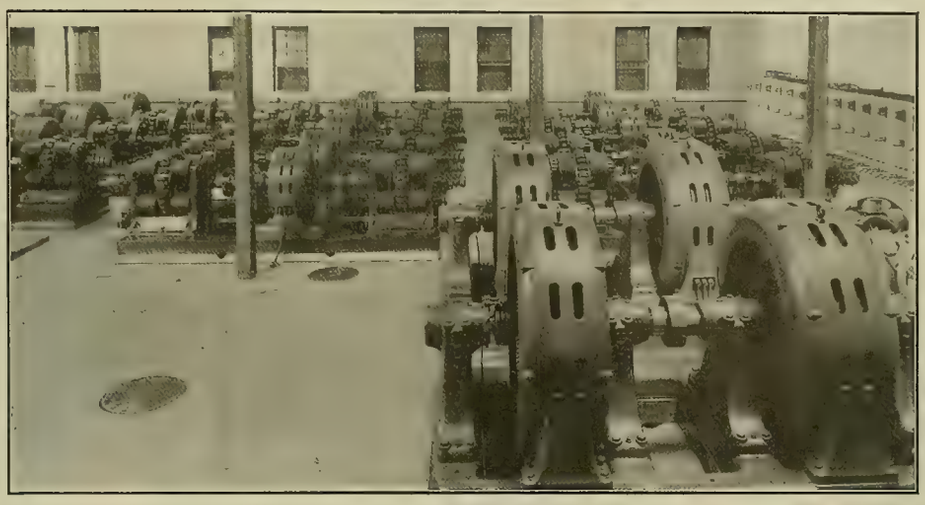
THE GENERAL ELECTRIC COMPANY'S

INSTALLATIONS



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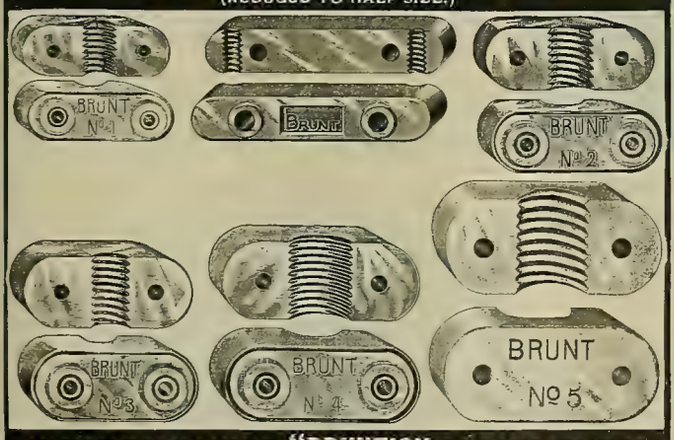

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THEY COMPLY WITH ALL UNDERWRITERS' REQUIREMENTS.

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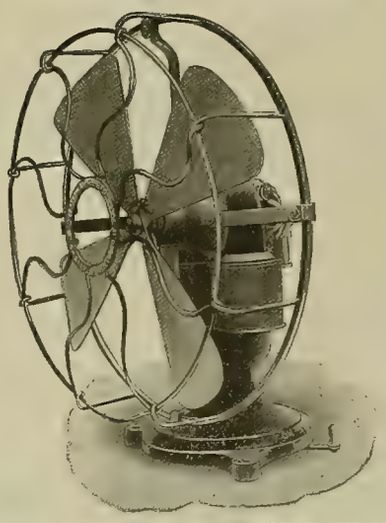
DIRECT CURRENT CIRCUITS.

Ceiling Fan Motors

PROVIDED WITH SWITCH GIVING THREE SPEEDS.

Wired for Chandelier Attachment.



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MADE FOR 110, 220 AND 500 VOLT CIRCUITS.

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High Frequency.

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Special Model,
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The Best Fan Made.
Adopted as
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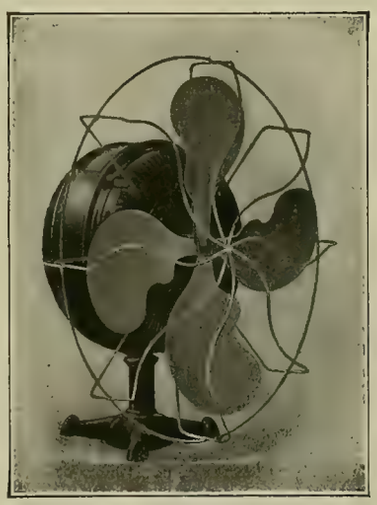

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All Voltages, All Frequencies.

Made in
All Styles and Finish.
Swivel, Trunnion, Bracket,
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All with Variable Speed
Regulation.

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OUR OILS ARE THE BEST AND HIGHEST GRADE THAT CAN BE PRODUCED FROM TIONA PENNSYLVANIA CRUDES ONLY.

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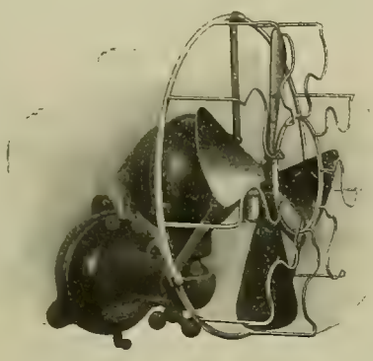

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ARE COPIED BUT NEVER EQUALED.

LUNDELL FANS have always had a higher efficiency and greater durability than any other fan.

LUNDELL FANS are the most popular and their reputation is based on their superiority.

LUNDELL FANS give a greater breeze than any other fan consuming the same amount of power.

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LUNDELL FANS run easily and noiselessly and require the least attention.

LUNDELL FANS are made in a variety of styles and sizes to meet all requirements.

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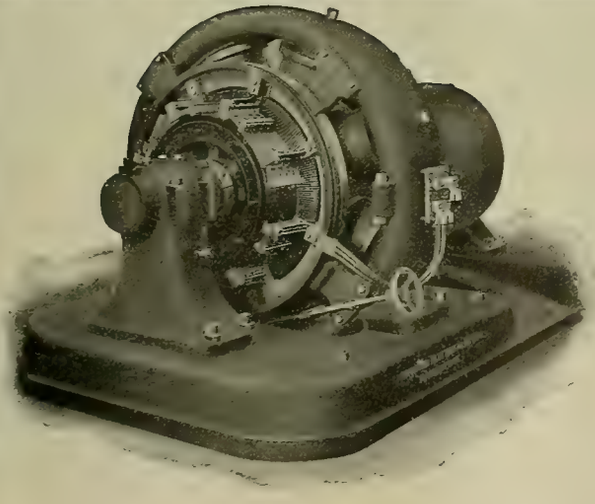

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Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

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Our latest production in high grade Insulation, Highest Insulating Qualities. Flexible as rubber.

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The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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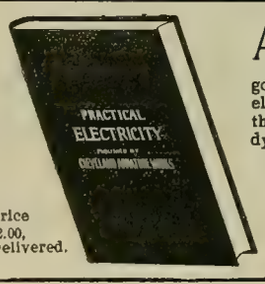

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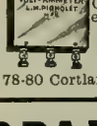

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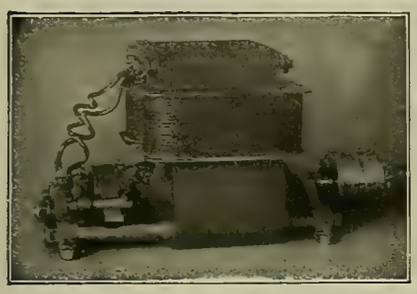

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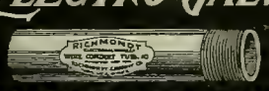

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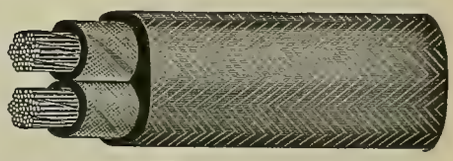

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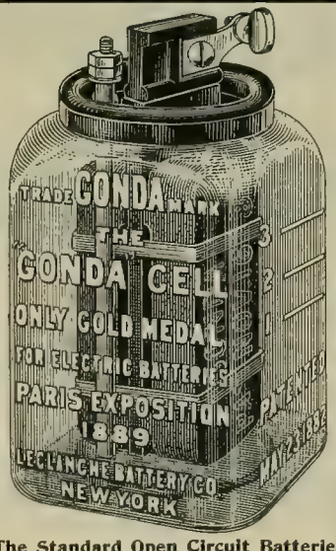

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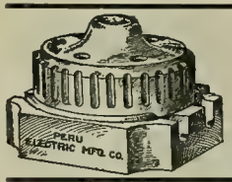

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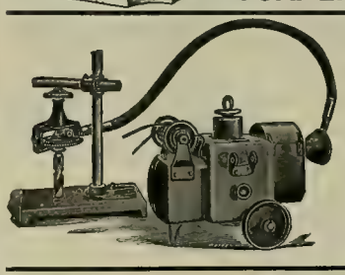

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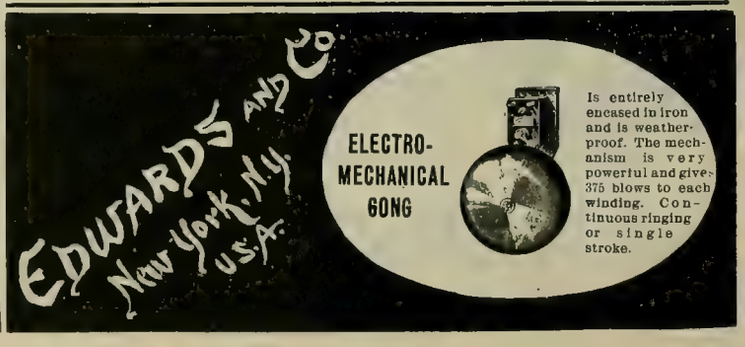

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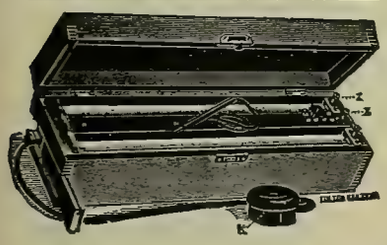

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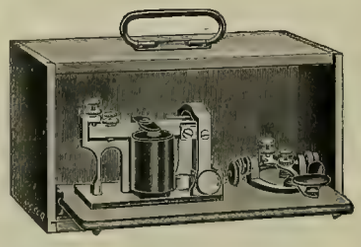

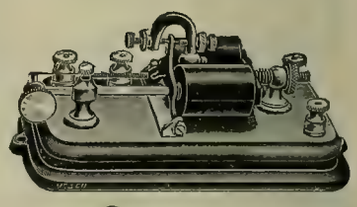

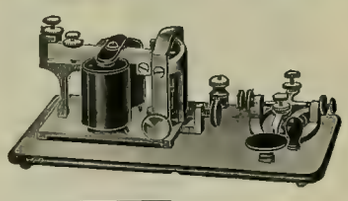

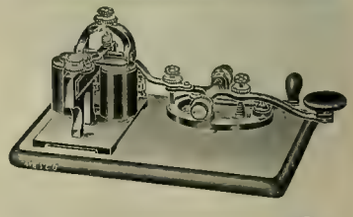

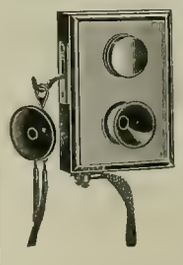

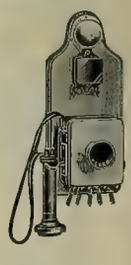

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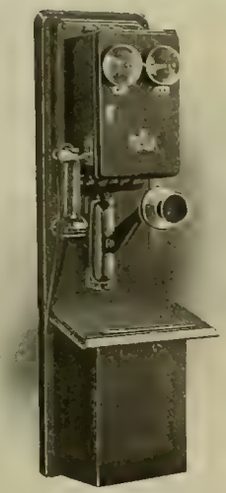

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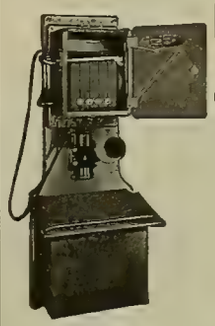

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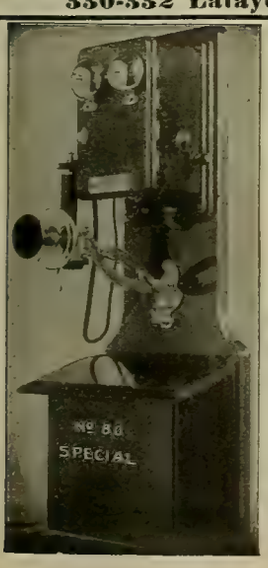

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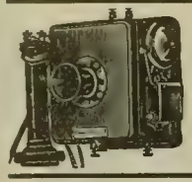

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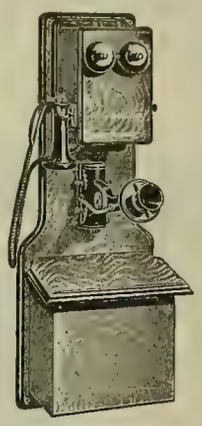

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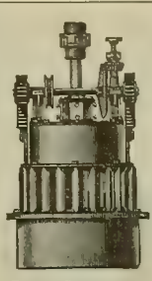

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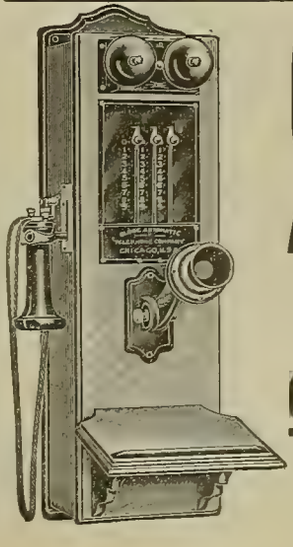

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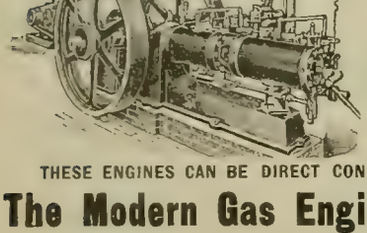

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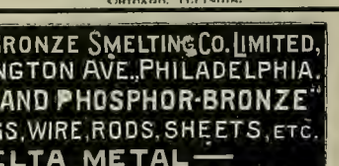

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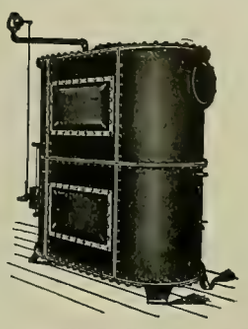

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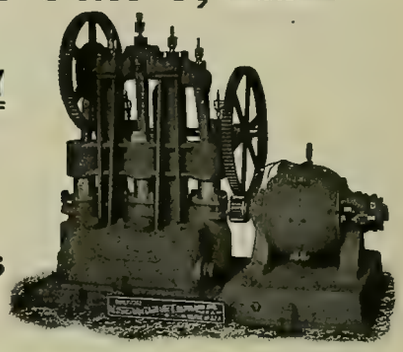

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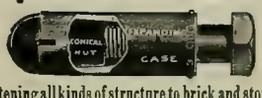

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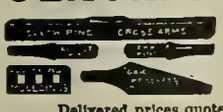

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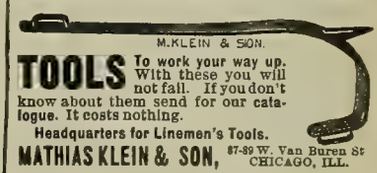

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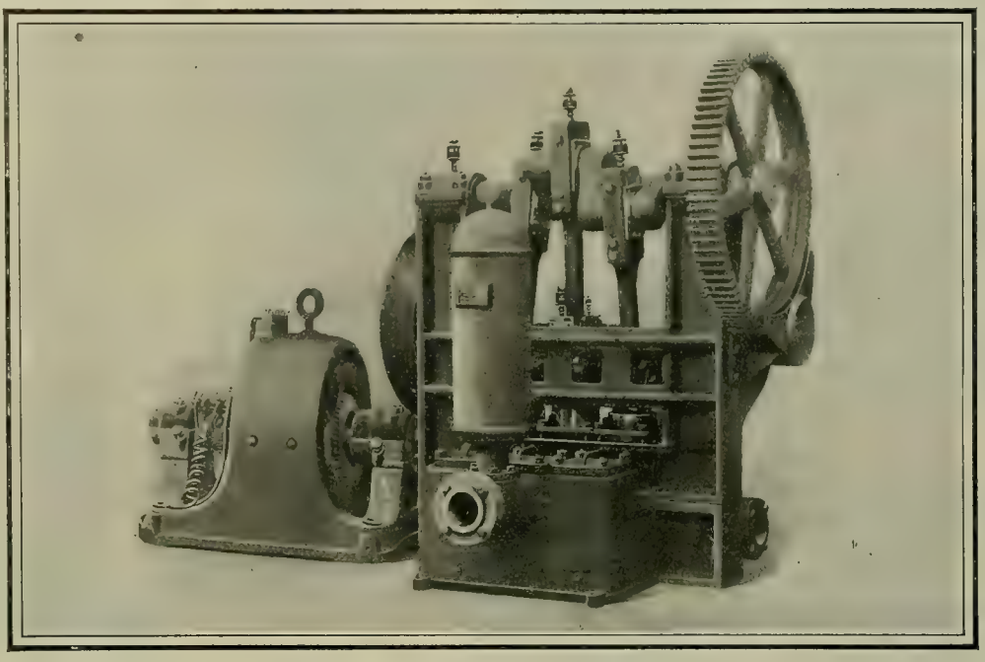

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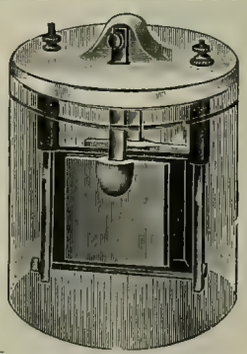

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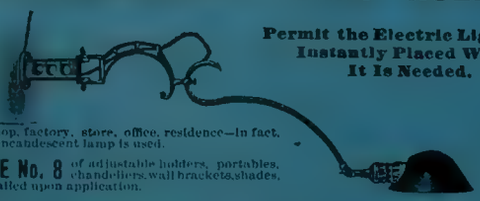

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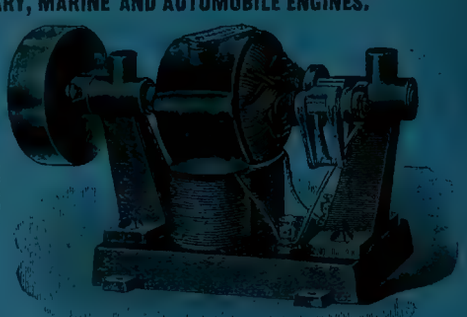

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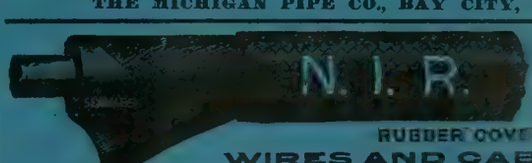

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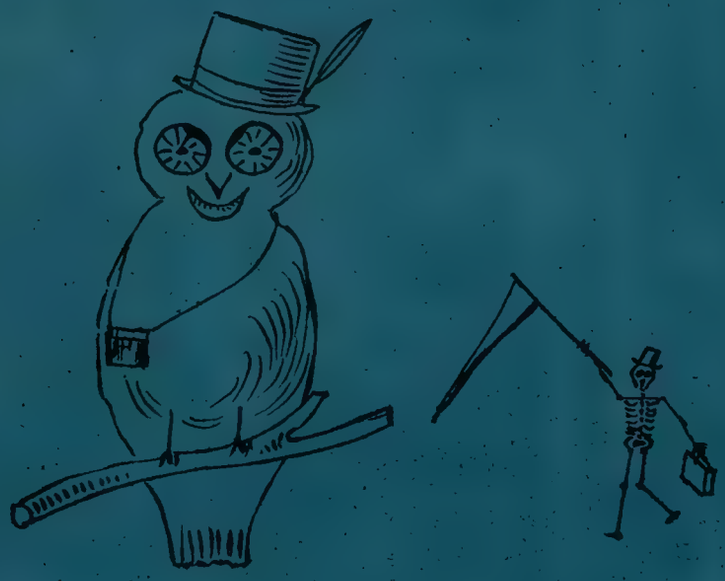

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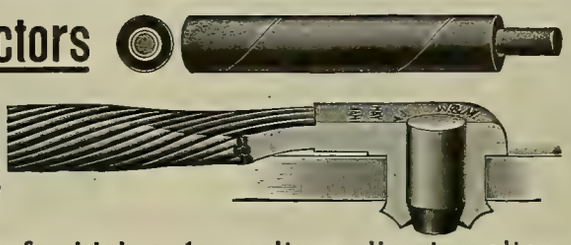

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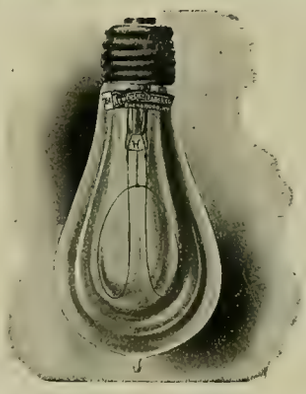

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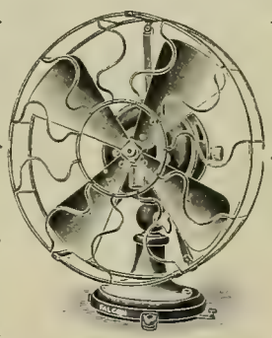

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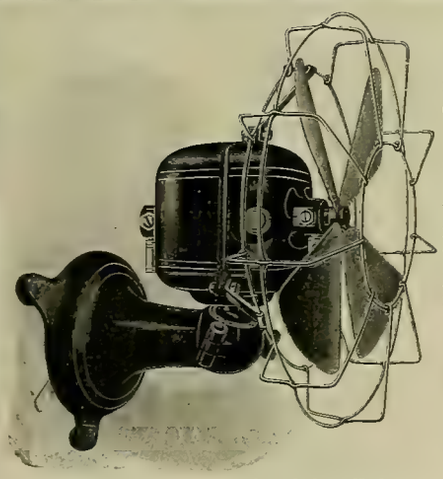

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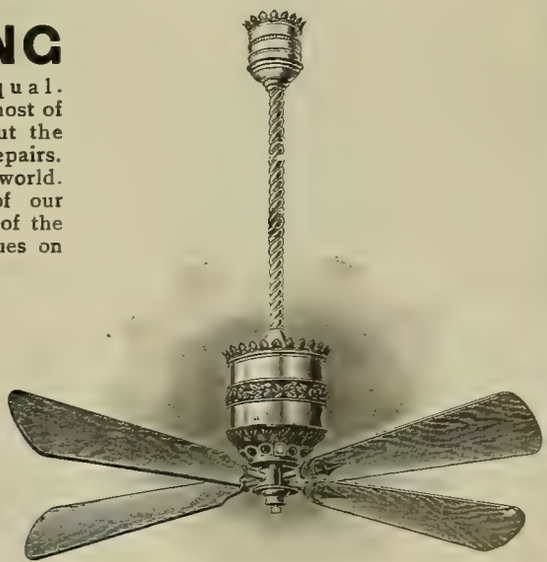

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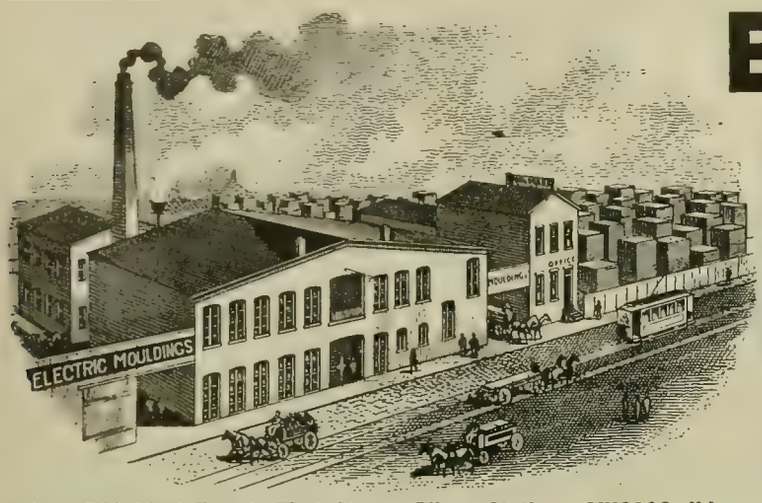

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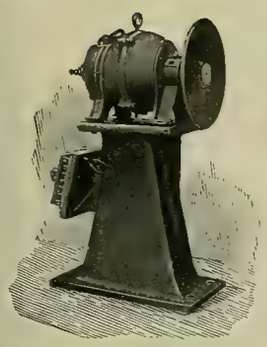
White-Washing M'ch's.
Star Brass Works.
Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 3.

CARBONS CARBONS CARBONS

The "Electra" Carbons are the recognized standard all the world over.

There are no Carbons better than the "Electra" and none "just as good."



ELECTRIC POWER

LUNDELL MOTORS

The most serviceable power apparatus to-day is the Lundell Motor. It is adapted to all kinds of machine-driving. It has a strong starting torque and an accurate adjustment of speed. It is compact, economical and durable. Send for our Illustrated Bulletin No. 03205.

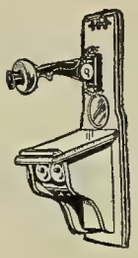
CORRESPONDENCE INVITED.

SPRAGUE ELECTRIC COMPANY,

GENERAL OFFICES: 527-531 WEST 34th ST., NEW YORK.

BRANCH OFFICES: CHICAGO, BOSTON, ST. LOUIS, BALTIMORE.

CHICAGO TELEPHONE COMPANY.



37,000 TELEPHONES IN SERVICE.

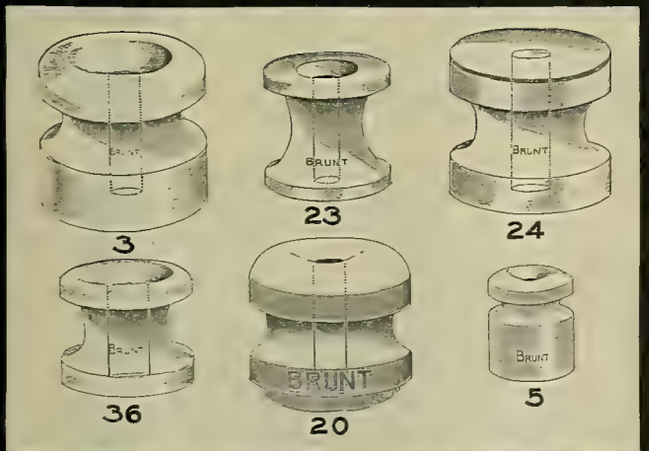
Business or Residence, 16 cents per day and up, connecting with the entire country by Toll and Long Distance lines. Metallic Circuits, Single or Party Lines, Unlimited or Measured Service.

Low rates for all. Small rates for small users.

CONTRACT DEPARTMENT, 203 Washington Street, CHICAGO, ILL.

HIGH GRADE Porcelain Insulators.

ALL STYLES AND SIZES.



CUTS REDUCED ONE-HALF SIZE

INSIST ON HAVING BRUNT'S TUBES, INSULATORS AND CLEATS.

THEY COMPLY WITH ALL UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

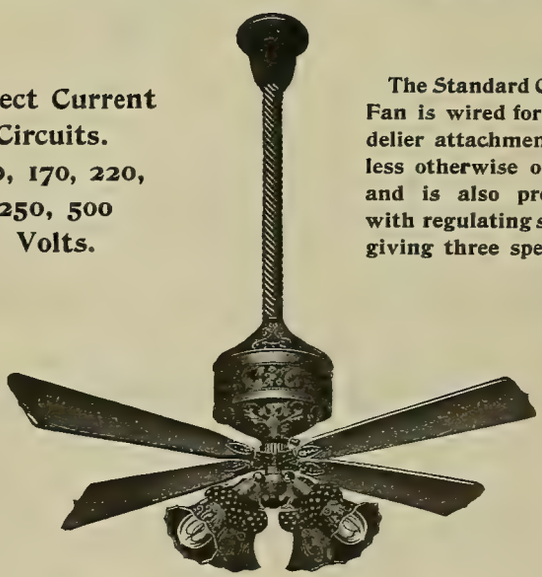
THE G. F. BRUNT PORCELAIN WORKS,

NO. 1. EAST LIVERPOOL, OHIO.

FAN MOTORS

Direct Current Circuits. 110, 170, 220, 250, 500 Volts.

The Standard Ceiling Fan is wired for chandelier attachment unless otherwise ordered and is also provided with regulating switch giving three speeds.



STANDARD CEILING FAN WITH CHANDELIER ATTACHMENT.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.

MERCANTILE ELECTRIC CO., 810 Spruce St., St. Louis, Mo.

STANDARD ELECTRIC CO., Cincinnati, Ohio.

CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

ANTWERP, 32 Rue Boudewyns.

LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.

PARIS, 46 Avenue de Breteuil.

New Continental Lamp

FOR

110 VOLT DIRECT CURRENT CIRCUITS

AN IMPORTANT ADVANCE IN ARC LIGHTING

A Gain in Light Economy of 35% over all other Arc Lamps

97	Volts	at	Arc	with	110	Volts	at	Mains
102	"	"	"	"	115	"	"	"
107	"	"	"	"	120	"	"	"

Will guarantee $3\frac{3}{4}$ Ampere Lamp to give the same light as an ordinary 5 Ampere Lamp

NO DEAD RESISTANCE

The Patents are fundamental and are owned by this Company

HELIOS-UPTON COMPANY, PHILADELPHIA, PA.

WE ANALYZE Fuel Oils, Coals, Metals, Waters, Iron Ores, Cements, Lime-Rock, Clays, etc.

ASSAY LABORATORIES now finished; all kinds of Gold, Silver and other metal determinations and assay work can be done.

WE DO NOT INSPECT, NOR FURNISH ENGINEERING ADVICE. STRICTLY LABORATORY WORK ONLY.

Laboratory Department DEARBORN DRUG AND CHEMICAL WORKS,

WM. H. EDGAR, President. **27, 28, 29, 30, 31, 32, 33 and 34 RIALTO BUILDING, CHICAGO, ILL.** **Telephone, Harrison 1358 and 1373.**

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Railway Parks Properly Lighted

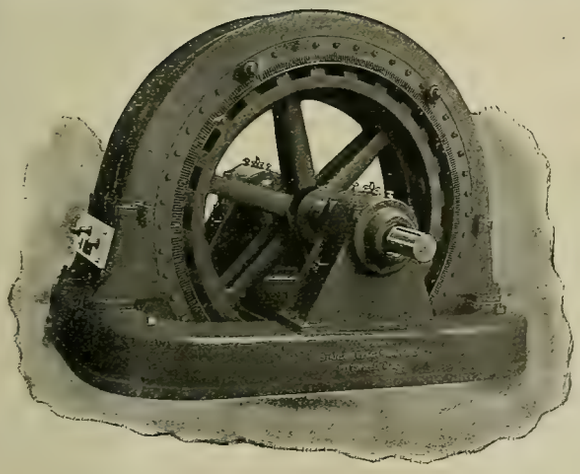
For Pavilions and Terminal Stations the Power Circuit Single Globe Enclosed Arc Lamp.

Use General Electric Enclosed Arc Lamps.

For Water Fronts, Parks and Promenades the Power Circuit Double Globe Enclosed Arc Lamp.

GENERAL OFFICE: SCHENECTADY, N. Y.

Chicago Office, Monadnock Building. **Sales Offices in all Large Cities.**



Alternating or Direct Current Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co.,
Pittsfield, Mass.

Northern Electrical Mfg. Co.,
Madison, Wis.

FREE
INFORMATION
DESCRIPTIVE MATTER
CORRESPONDENCE
ADVICE

ABOUT

Eaco Hotel Telephone Service.

The greatest opening in the country for work for contractors. Nine-tenths of the hotels in the United States have unsatisfactory annunciator systems. The Eaco Hotel Telephone system makes the service of even a poor hotel superior. No hotel man will refuse to listen to a proposition to make his house more efficient and serviceable to the general public.

ELECTRIC APPLIANCE COMPANY,
92 AND 94 WEST VAN BUREN STREET, CHICAGO.

FUSE

McIntire and American Joints, Fuse Wire, Lightning Arresters, Fuse Blocks.
Cheap, Good. **MAGNET WIRE.** Guaranteed.
TWO BIG STORES.
AMERICAN ELECTRIC FUSE CO.
NEW YORK: 116 Nassau St. CHICAGO: 345-347 S. Canal St.

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PRICES RIGHT
EUGENE MUNSELL & CO.,
218 Water St., New York. 117 Lake St., Chicago.

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Consulting Engineer
Railway Lighting and Power Plants,
415 LOCUST ST., ST. LOUIS, MO.

HENRY H. HUMPHREY,
Consulting
Electrical Engineer.
CENTRAL LIGHTING STATIONS,
ELECTRIC POWER TRANSMISSION.
Suite 1305, Chemical Bldg., St. Louis.

D. L. BENSON,
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ELECTRICAL AND
MECHANICAL ENGINEER,
520 MONADNOCK BLOCK,
Telephone Main 3244. CHICAGO.

SPRINGS
All Small Springs Used by Electrical Trade.
The Wallace Barnes Co.,
Bristol, Conn.
ESTABLISHED 1857.
Submit samples for prices.
Complete assortment, high-grade cold rolled steel always in stock. Catalog upon application.

YOU NEED IT!

Cale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, - CHICAGO.

DEWAR BULBS FOR LIQUID AIR
Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

EDISON DECORATIVE AND MINIATURE
LAMP DEPARTMENT,
(General Electric Co.) Harrison, N. J.

Remember!
McRoy
conduits
make the
cheapest
subway.

McROY CLAY WORKS
BRAZIL, INDIANA
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

VOLT-AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET.
78-80 Cortlandt St., NEW YORK, N. Y.

CREAM FLUX
AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.
Contains no acid or any element injurious to electrical connections.
ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.
YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux. Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

THIS IS WHAT ONE USER HAS TO SAY OF IT:
"AFTER having tried the various soldering salts on the market, and after giving your Cream Flux severe tests on heavy cable connections, and on the finest stranded flexible drop cord work, we can safely say it meets all claims you make for it. I consider it one of the best ever offered for sale. Very truly,
"Per J. H. Goehst, Constr. Supt. CHICAGO EDISON CO."

FOR SALE BY ALL SUPPLY HOUSES OR
CREAM FLUX CO., Sole Manufacturers, 100 Washington St., **CHICAGO.**

OUR PLATES DON'T BUCKLE

Short Circuits do not Injure but IMPROVE Them.

C. S. B.
Storage Batteries.

Columbus Battery and Specialty Co.,
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COLUMBUS, OHIO.

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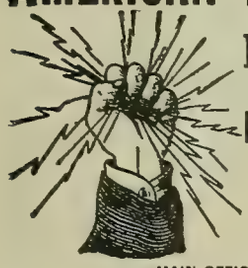
PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
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INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

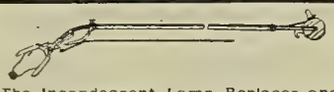
NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohoe, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

IDEAL AUTOMATIC ANNUNCIATORS.
The Best on the Market.
Write for Prices.
Manufactured by
THE HEATH ELECTRIC CO.,
DETROIT, MICH.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

GASOLINE MOTORS
—FOR—
BICYCLES, VEHICLES, LAUNCHES.
LOWELL MODEL CO.,
NORTH CHELMSFORD, MASS.

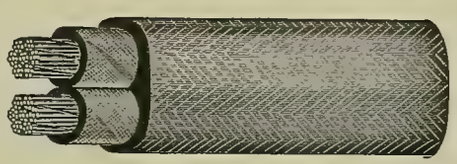


The Incandescent Lamp Replacer and Cleaner replaces and cleans any c. p. lamp at any height or angle.
Incandescent Electric Light Manipulator Co.,
116 Bedford St., Boston, Mass.

NEW FRANKLIN MODEL DYNAMO.

Sets of castings and material furnished in various stages of completion. Wrought iron fields; armature formed of punchings of sheet iron contains eight slots. Pulley for round or flat belt. Terminal wires to binding screws set in fibre connection board at top of pole pieces. Run as motor will drive sewing machine, dental engine or watchmaker's lathe. Ten-volt current. Run as a generator will light four 6-candle lamps. This machine is not a toy but is designed for use. Many interesting experiments can be performed with these machines. Full size detail blue prints furnished with each set of material, showing how to connect for both SERIES and SHUNT windings.
The change can be made from one winding to the other whenever desired.
Write for Dynamo Circular No. 16.
FRANKLIN MODEL SHOP,
129-131 West 31st Street, NEW YORK CITY.

INSULATED RUBBER WIRES AND CABLES.



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WORKS AT
TRENTON, N. J.

NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.

The next international numbers of the WESTERN ELECTRICIAN will be ELECTRIC LIGHT AND POWER NUMBERS, covering the National Electric Light Association's meeting at Niagara Falls, May 21, 22 and 23. There will be two special convention numbers, to be dated May 18 and 25, and their large domestic and foreign circulation will be of great value to your business. It is not too early to reserve space for these splendid special convention numbers. Send in your order NOW and get a good position.

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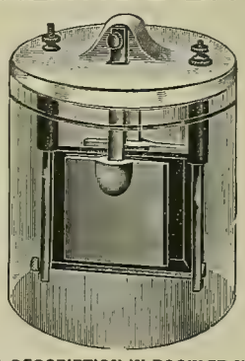
FOR GAS ENGINES,
SLOT MACHINES,
AUTOMOBILES,
RAILROAD SIGNALS,
CROSSING BELLS,
SMALL MOTORS,
ETC.



CONSTANT CURRENT.
NO LOCAL ACTION.
WILL NOT FREEZE.
LIQUID TIGHT
CELLS FOR PORTABLE WORK.

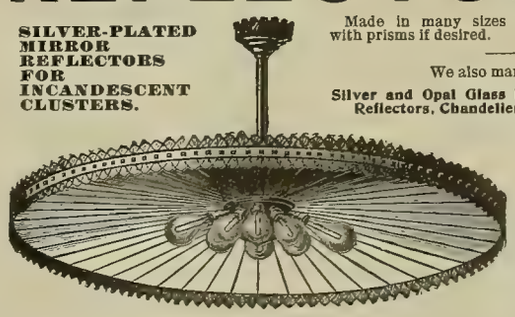
FULL DESCRIPTION IN BOOKLET NO. 4.
EDISON MANUFACTURING COMPANY,
185 FIFTH AVENUE, NEW YORK.

REFLECTORS!

SILVER-PLATED MIRROR REFLECTORS FOR INCANDESCENT CLUSTERS.

Made in many sizes and styles. Trimmed with prisms if desired.

We also manufacture
Silver and Opal Glass Inverted Double Cone Reflectors, Chandeliers and Sun Burners
For lighting and ventilating
Churches, Theatres, Halls and Public Buildings.



Street and Ornamental Sign Lamps of Every Kind for Oil, Gas or Gasoline. Border Lights, Bunch Lights, Foot Lights and Gas Stands for Theatres.

SEND FOR CATALOG.
AMERICAN REFLECTOR & LIGHTING COMPANY,
271-273 FRANKLIN STREET, CHICAGO, ILL., U. S. A.

WANTED.

Commutator assembler. State experience and wages wanted. Address "J. C.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

A good temperate industrious man for a small electric light plant. Must understand boilers, engines and dynamos, and be able to do line work. Address "W. T.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

By a well established firm having a Chicago house, some first-class specialty that can be sold to the electrical trade through the West and South. "X A CO.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Assistant, to work on test floor of concern manufacturing direct-current dynamos and motors from 1 K. W. to 250 K. W. Must have had previous experience in testing. Answer in confidence. State past experience and salary expected. Address "MIDDLE WEST," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Experienced and thoroughly competent mechanical draftsman and designer. Permanent position to the right person. Address MILWAUKEE ELECTRIC CO., 286 Reed Street, Milwaukee, Wis.

WANTED.

First-class experienced mechanical draftsmen wanted at once; some of them acquainted with electrical work. Those with shop experience preferred. Apply by letter to Chief Draftsman, P. O. Box 911, Pittsburg, Pa., stating experience in full and giving references.

WANTED.

By an electric construction company in Michigan, a competent man to act as general foreman in charge of construction work. Must be experienced and active. State age, qualifications, references, etc. Address "Box 210," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

A position is offered with a firm of electrical contractors to an educated man capable of making estimates and getting business. Apply, giving experience and full particulars, to "Box 110," care Western Electrician, 510 Marquette Building, Chicago.

U. S ENGINEER OFFICE, 735 N. Capitol St., Washington, D. C., April 10, 1901. Sealed proposals will be received here until noon, May 9, 1901, and then publicly opened, for furnishing cast iron and steel cable racks, porcelain insulator clamps, insulators and accessories, for electrical installation for New Building for Government Printing Office. Information furnished on application. JOHN STEPHEN SEWELL, Capt. Engrs.

WANTED.

Position by electrical workman and stationary engineer. Understands installing and maintenance of electric lighting and motors, and machinery throughout. Will accept steady position at reasonable salary. Fifteen years' experience; licensed, and references. Address, with particulars, "ELECTRIC POWER," care Western Electrician, 510 Marquette Building, Chicago.

Plant For Sale.

Controlling interest in Electric Light Plant in County Seat town of 3,500 to 4,000 people in Iowa. Plant is making money, is in good condition, and earning 15%. A good investment for anyone. Address INVESTMENT, care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

One 100-line "Express" type telephone switchboard in handsome oak cabinet; 50 to 60 series and bridging telephones, platinum contacts; one 50-wire aerial cable, 140 feet long; one 50 wire "Moon" fusible terminal head with outer casing; one 50-wire combination lightning arrester and distributing board in cabinet; 200 6-pin cross-arms, braces, lag screws, etc. The above goods have been in use but a short time. Will sell all or any part very cheap. Made by the largest telephone manufacturer in the U. S. Shipped on approval. We have outgrown the system and desire to put in the central energy system. Address "EXPRESS," care Western Electrician, 510 Marquette Building, Chicago.

ELECTRIC LIGHT PLANT.

BOLIVAR, MO., April 9, 1901.

Bids will be received by the City of Bolivar, Mo., until 7:30 p. m. of April 30, 1901, for machinery, appliances and materials, delivered f. o. b. cars Bolivar, Mo., for a Municipal Electric Light Plant, in accordance with the official plans and specifications of said city. Bids will also be received on the work erected, as per said specifications and plans.

Bids must be sealed and addressed to E. L. Schofield, City Clerk.

Certified check required for 3 per cent. of amount of bid, but no check for less than $50 00.

Plans and specifications are on file and may be seen at the office of said City Clerk at Bolivar, Mo., and at the office of Owen Ford, Consulting and Supervising Engineer, 710 Security Building, St. Louis, Mo.

The right to reject any and all bids is reserved.

J. K. LEAVITT, Mayor.
E. L. SCHOFIELD, City Clerk.

Franchise and Grounds

For a term of years will be given by the village of Cabery, Ill., for electric-light purposes and pumping water for the village. Cabery is a prosperous town of about 600 people. A good patronage can easily be obtained. For full particulars address P. M. RAVENSKILDE, Trustee of the village of Cabery, Ill.

WE BUY AND SELL
SECOND-HAND ELECTRICAL MACHINERY.
WALSH'S SONS & CO.,
150 WASHINGTON ST., NEWARK, N. J.

FOR SALE—A BARGAIN.

150 hard rubber cells, 7x7x10¼ inches. THOMAS ALEXANDER, 188 E. Randolph St., Chicago.

FOR SALE.

HIGH-SPEED AUTOMATIC ENGINES.

We make a specialty of this class of machinery. Our stock changes so rapidly that we deem it useless to give list here. We handle everything in the line of Steam Power Equipment. All of it is thoroughly repaired and refinished. Write for particulars. **CAMP ENGINEERING CO., 18 S. Canal St., Chicago, Ill.**

INVENTIONS FOR EUROPE.

Engineers of standing and acquaintance in Europe wish to arrange for handling several good inventions abroad. We want such as are adapted for the organization of companies, etc. Liberal propositions made.
ZERBE CO., Engineers, 11 Broadway, New York.

We Can Ship at Once:

2—100 K. W. 140 volt Edison Bipolars.
1—200 K. W. Fort Wayne, 1,100 volt Alternator.
1—240 K. W. Stanley, 2 phase, 1,100 or 2,200 volts.
2—120 K. W. Atype General Electric Alternators.
4—100 K. W. Westinghouse, 1,100 volt Alternators.
1—120 K. W. Slattery, 1,100 volt Alternator.
2—45 K. W. 125 volt Edison Bipolars.
1—90 K. W. Standard, 2,200 volt Alternator.
1—50 K. W. National, 2,200 volt Alternator.
1—26 x 48 Allis Corliss.
1—15 x 23 x 15 Armington & Sims Cross-compound.
1—13 x 19 x 15 McIntosh & Seymour Tandem-compound.
1—18½ x 18 Ideal, and many other items in

ELECTRICAL AND STEAM APPARATUS.

Write for our latest price-list No. 40.

ILLINOIS MAINTENANCE CO.,
E. H. CHENEY, Manager.
204 Dearborn Street, CHICAGO.

FOR SALE.

MOTORS

in 110 volt, 220 v. and 500 v. d. c. All sizes from ¼ h. p. to 200 h. p. Alternating motors from 1 to 15 h. p.

GENERATORS

125 v., 250 v. and 550 v. d. c. from 1 k. w. to 300 k. w. 550 v., 1,100 v. and 2,200 v. alternating from 18 k. w. to 240 k. w. Single phase, two phase and three phase.

Every machine listed in our Bargain Sheet is actually in stock in our works. Every machine is guaranteed. We have the largest stock of electrical apparatus in the world. Send for our monthly Bargain Sheet with lowest *net cash* prices.

GREGORY ELECTRIC CO.,
64-56-58-60-62 South Clinton Street, CHICAGO.

ALL ARC LAMPS, $3.00.

DIRECT CURRENT:
T.-H., M 2, K 2 and Type D; Wood, single clutch; Brush, double; W. E., 14 hour; American, single; Ball, double.
ALTERNATING CURRENT: Helios, No. 3; Helios, No. 4; Helios, No. 5; A. B., No. 6.
ROSE ELECTRIC CO., ST. LOUIS, MO.

FOR SALE.

One M. P. 80 T. H. 500 V. Railway Generator.
One D. 62 T. H. 500 V. Railway Generator.
Three 13 in. x 52 ft. Heavy Double Leather Belts.
Two Tubular Boilers, 16 ft. x 60 in., with 44 4-in. Flues.
Two Tubular Boilers, 14 ft. x 60 in., with 64 3½-in. Flues.

These boilers have full fronts and complete with necessary fixtures, including U. S. Rocking Grate Bars.

With the generators are included circuit breaker, current indicator, rheostat and three-pole switch.

All of the above equipment is in good operative condition, having been in service up to the day we started our new power station.

If interested, correspond with the

DECATUR TRACTION & ELECTRIC COMPANY,
DECATUR, ILLINOIS.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.

ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our free illustrated book.

"Can I Become an Electrical Engineer?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Mechanical Drawing, etc., at your home, by mail. Institute indorsed by Thos. A. Edison.

Electrical Engineer Institute,
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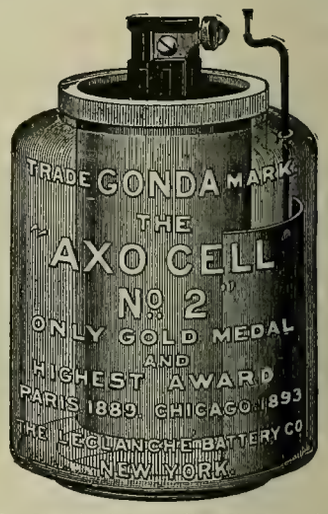
Eldredge Battery Voltmeter,

For Testing Primary and Storage Batteries, 0 to 3 Volts.

DEAD BEAT.

The only low-price pocket instrument indicating in volts. Connecting posts have non-removable nuts. Light weight and neat in appearance.

Eldredge Electric Mfg. Co.,
Springfield, Mass., U. S. A.



The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

BECKER BROTHERS 39-43 W. WASHINGTON ST., CHICAGO.

Manfrs. of the well known

Brushes for Dynamos and Motors.

SEND FOR DESCRIPTIVE CIRCULAR AND PRICE LIST.

REPAIRS for everything electrical, including..... National Electric Company's Machines.

Send your **BURNT-OUT TRANSFORMERS** to the

General Electrical Repair Co.,

141 SO. CLINTON ST., CHICAGO.

We can **REPAIR** them or will **BUY** them.

"PALMER & OLSON"
1, 2, 3, 5, 7½, 10 H. P.

ARTS!

AND TREASURES

Of the Ancients have been lost, until revived in the design of the

PALMER & OLSON Electric Motors.

Catalogue and price lists on application.

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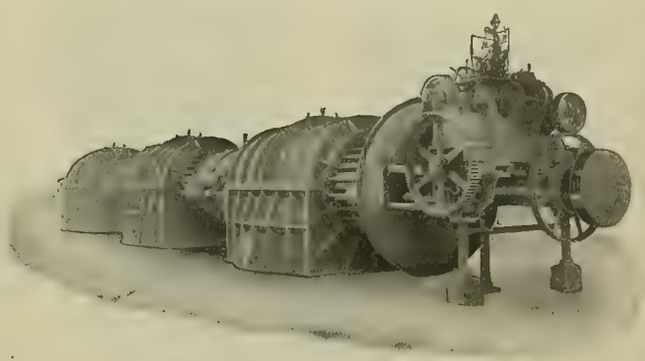

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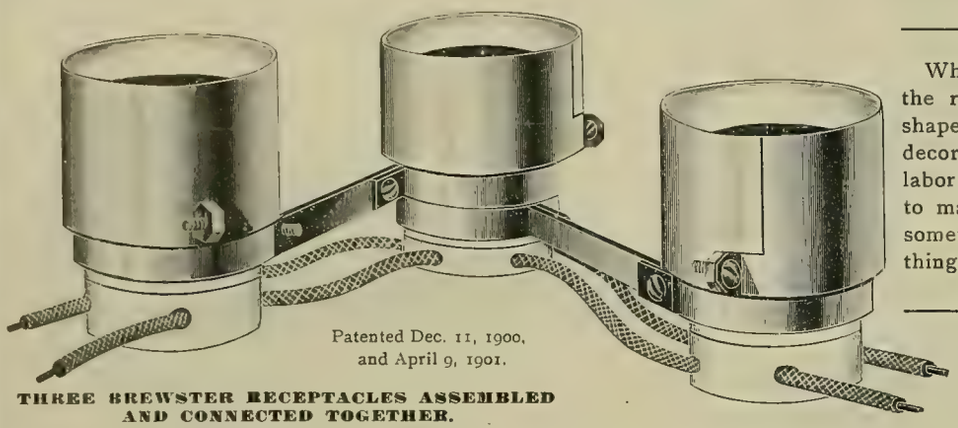

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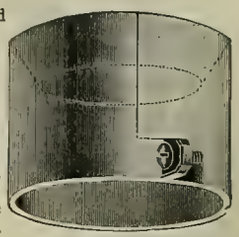

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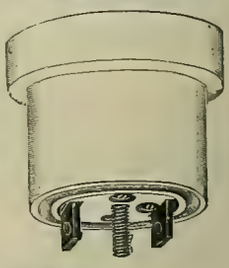

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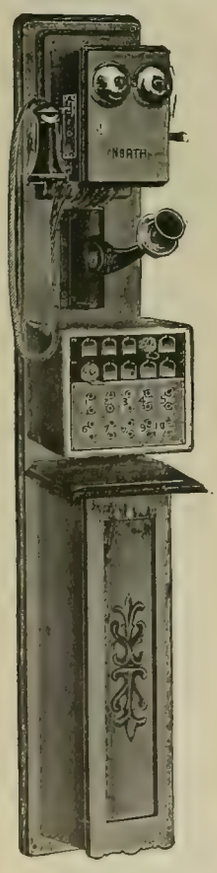

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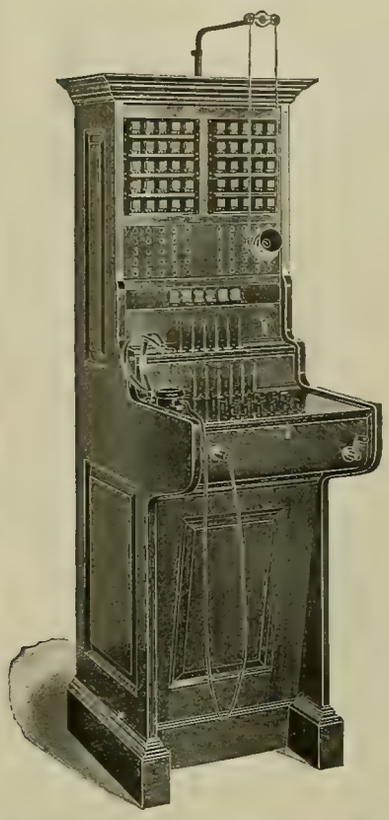

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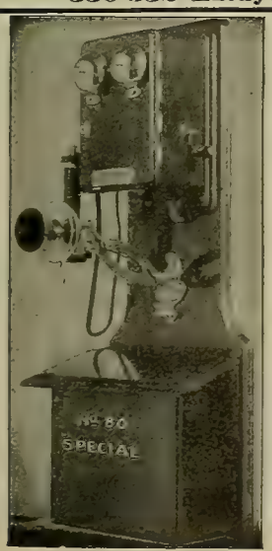

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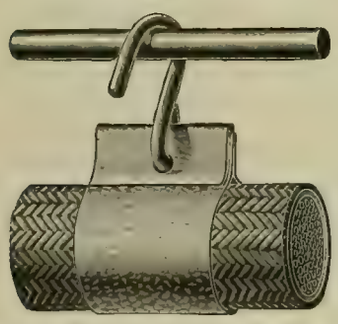

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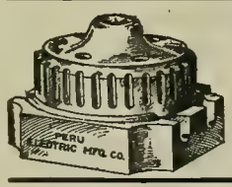

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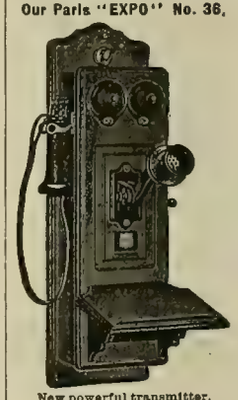

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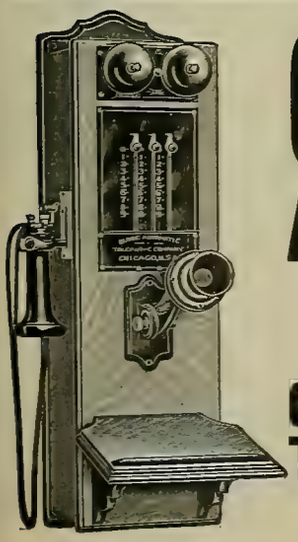

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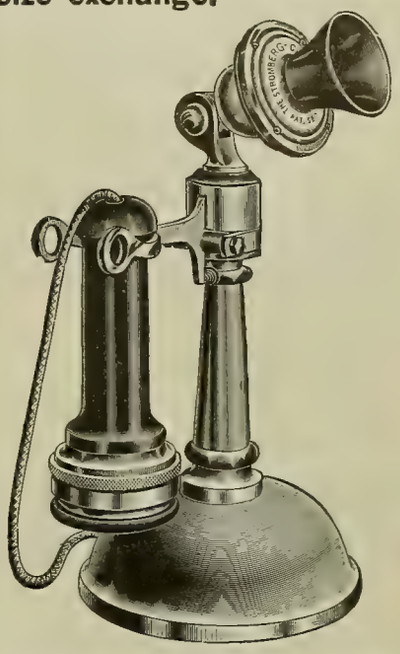

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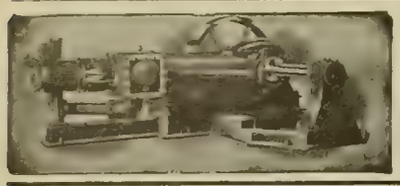

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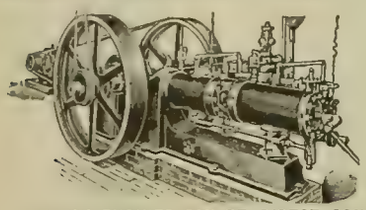

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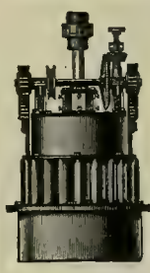

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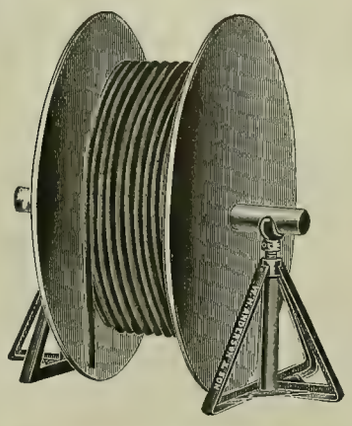

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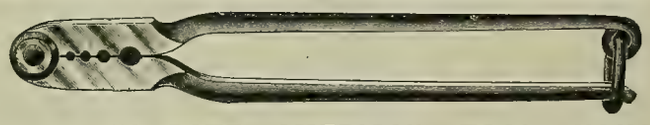

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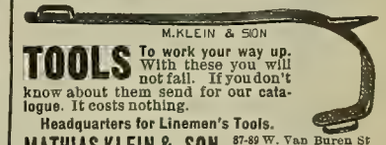

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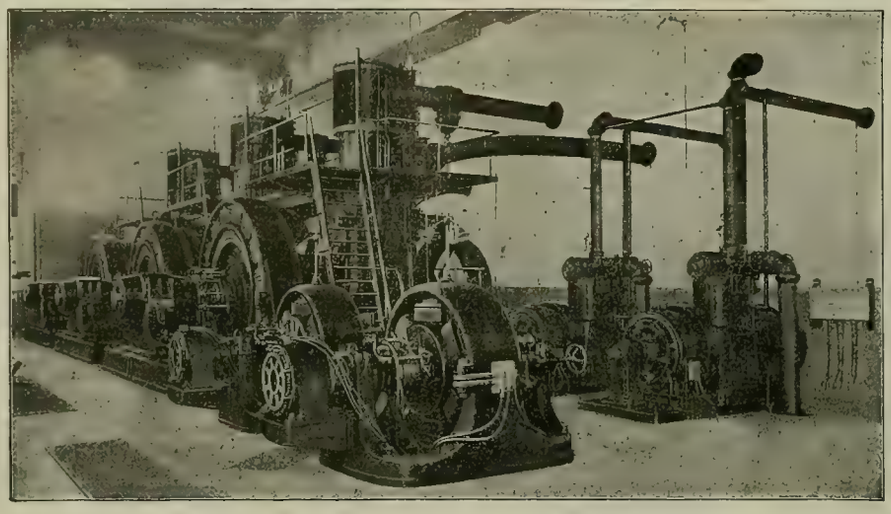

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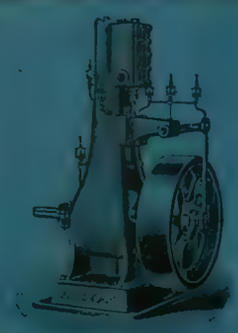

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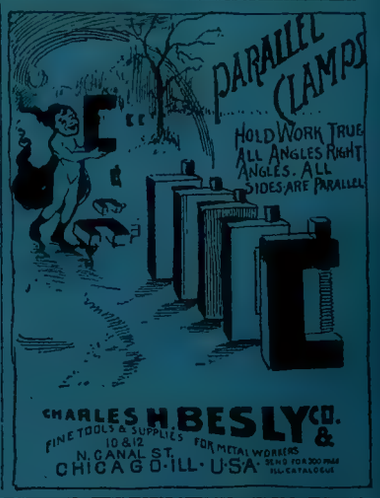

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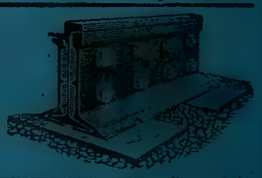

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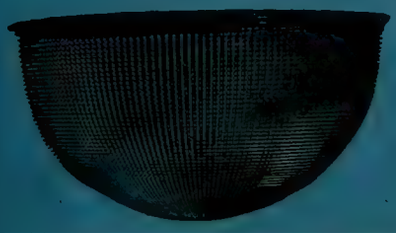
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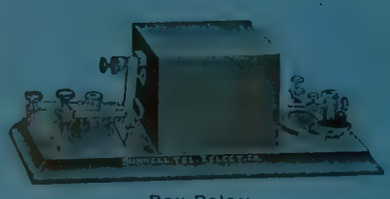

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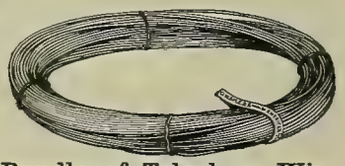

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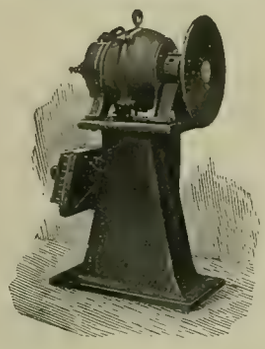

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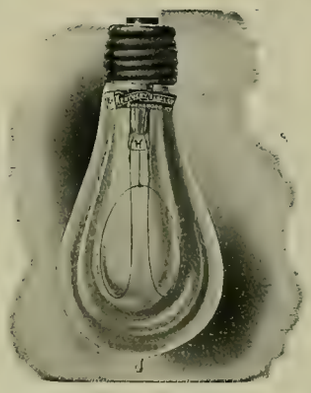

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The most improved, efficient, long lived and economic primary cell of the new century.

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Manufactured in ten different styles.

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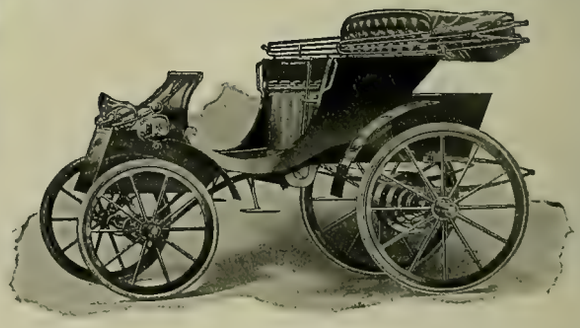

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Lowest Priced Electric Vehicle in the World.

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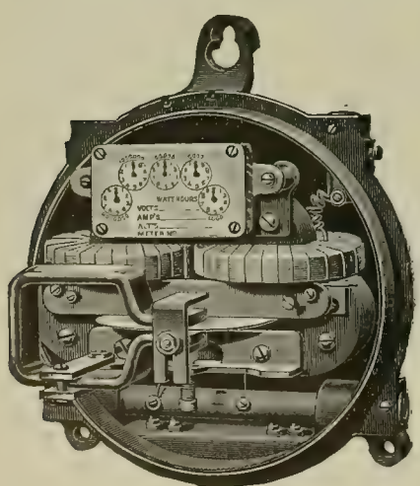

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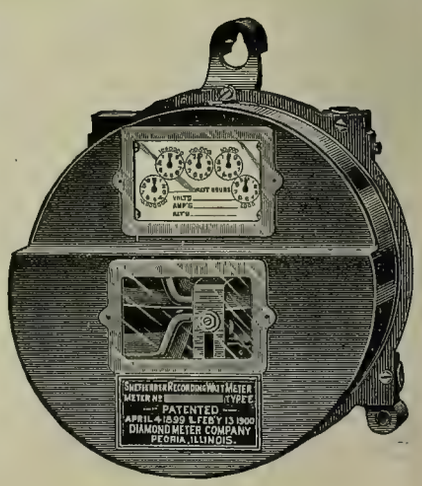
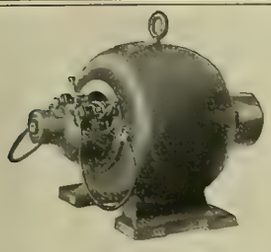
ROUND PATTERN TYPE "E." FOR ALTERNATING CURRENTS.

An Accurate and Sensitive Meter.
Improved Ball Bearing.



DIAMOND METER CO.

PEORIA, ILL., U. S. A.



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Planets

Circle
round and round
and
never stop.

Well constructed Armatures in well designed motors resemble them in many respects.

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MANUFACTURERS,

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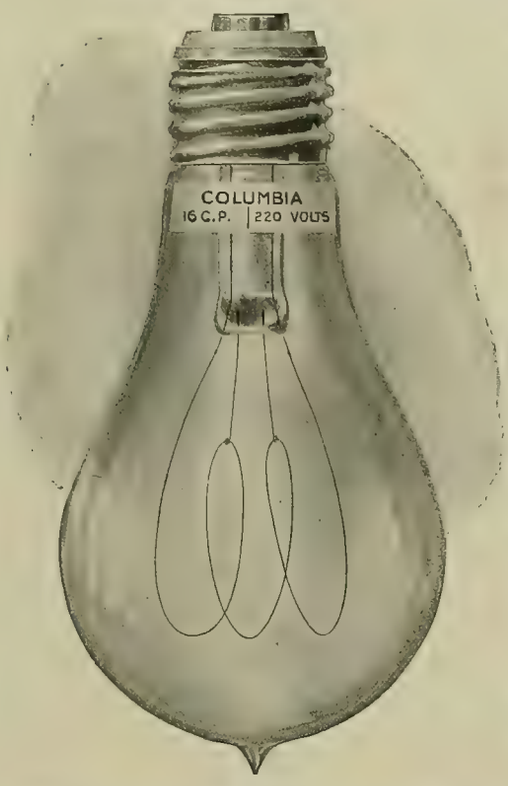

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Made in All Candle Powers and All Voltages.

220-Volt Lamps a Specialty.

No Delay in Shipments.

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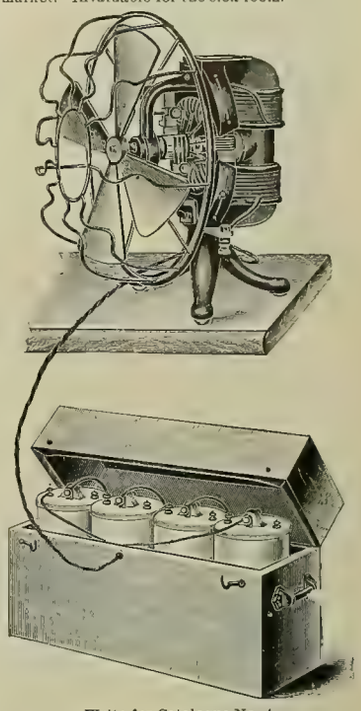
...WITH...

EDISON LALANDE CELLS

Are the only efficient battery fan outfits on the market. Invaluable for the sick room.



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We build complete subways.

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INTERIOR UNDERGROUND CONDUIT AND ALL FITTINGS

RICHMONDT CONDUIT CO.

MILWAUKEE U.S.A.

ONE of OUR SPECIALTIES

HERE IT IS - EVERY OTHER WEEK -

AND ITS LITTLE STORY - ALL THE FINE POINTS

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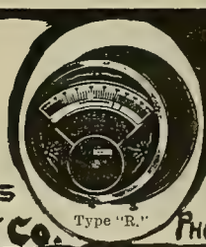

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The most popular type of Switchboard Instrument on the market. Size, appearance, system, accuracy, durability and price are right. All ranges, either series or shunt Ammeters. Particularly adapted to isolated plants and feeder panels.

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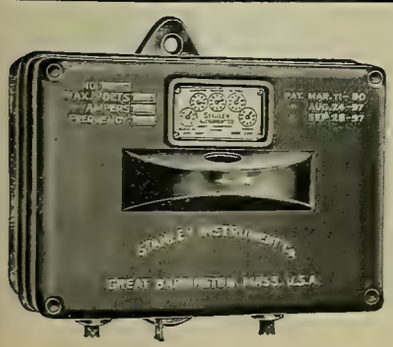

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JEWELED METERS AND LOSE MONEY WHEN STANLEY METERS ARE PERMANENTLY ACCURATE?

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Electric Elevators, Railroad Signal Apparatus, Telegraphs, Telephones, Electric Fire Alarms.

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ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

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Sturtevant Co., B. F.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Fibre.
Kartavert Mfg. Co.
Vulcanized Fibre Co.
Files.
Barnett Co., G. & H.
Fire Extinguishers.
Monarch Fire Appliance Co.
Flexible Shafts.
Stow Mfg. Co.
Forges.
Sturtevant Co., B. F.
Foundry Equipments.
Whiting Foundry Equip. Co.
Fuses and Fuse Wire.
American Elec. Fuse Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.
Electric Appliance Co.
Western Elect. Supply Co.
Western Electric Company.
Gears.
Besly & Co., Chas. H.
General Elec. Supplies.
Bissell Company, The F.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Garl Electric Co.
General Electric Co.
Heath Electric Company.
Manhattan Elec. Supply Co.
Missouri Electrical Mfg. Co.
Ohio Electric Works.
Stewart & Co., Frank H.
Viaduct Mfg. Co.
Western Electric Co.
Western Elect. Supply Co.
Globes and Electrical Glassware.
Holophane Glass Co.
Phœnix Glass Co.
Western Elect. Supply Co.
Graphite Specialties.
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.
Heating and Ventilating Apparatus.
Sturtevant Co., B. F.
Holders, Inc. Lamp.
Crescent Mfg. Co.
Incandescent Electric Light Manipulator Co.
Stewart & Co., Frank H.
Igniters.
Carlisle & Finch Co.
Columbus Batt. & Spec. Co.
Inspection & Insurance.
Hartford Steam Boiler Inspection & Insurance Co.
Insulators and Insulating Materials.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Brunt Porcelain Works, G. F.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Chicago Edison Co.
Chicago Mica Co.
Electric Appliance Co.
General Inc. Arc Light Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
Kartavert Mfg. Co.
Mica Insulator Co.
Missouri Electrical Mfg. Co.
Mogadore Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
Raven Mining Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Western Electric Co.
Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
Insulated Wires and Cables—Magnet Wires.
American Elec. Fuse Co.
American Electrical Works.
American Steel & Wire Co.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Indiana Rub. & Ins. Wire Co.
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Miller-Knoblock El. Mfg. Co.
Missouri Electrical Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elec. Supply Co.
Western Electric Company.
Junction Boxes.
Bossert Elect. Const. Co.
D. & W. Fuse Company.
General Inc. Arc Light Co.
Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Kentucky Electrical Co.
Missouri Electrical Mfg. Co.
Ohio Electric Works.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
Lamps, Inc., Adjusters.
Crescent Manufacturing Co.
Inc. El. Lt. Manipulator Co.
Smith, Theo.
Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.
Lightning Arresters.
American Elec. Fuse Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.
Linemen's Climbers.
Anderson & Sons, W. H;
Klein & Son, Mathias.
Smith & Hemenway Co.
Magnet Wires.
(See Insulated Wires.)
Meters.
Diamond Meter Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Mica.
Chicago Mica Co.
Munsell & Co., Eugene.
Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.
Motors—See Dynamos and Motors.
Mouldings, Electrical.
Wright & Craycroft.
Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.
Patent Attorneys.
Barnacle, F. W.
Johnston, Thomas J.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.
Platinum Bought and Sold.
Baker & Company.
Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Poles and Ties.
Benham, George W.
Berthold & Jennings.
Coolidge Fuel & Supply Co.
Davis & Stitt Co.
Fowler, John H.
Huebel & Co., C. J.
Lindsley Bros. Co.
Maltby Lumber Co.
Ozan Lumber Company.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
Porter-Morse Co.
Smith, O. W.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.
Porcelain.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Brunt Porcelain Works, G. F.
Mogadore Insulator Co.
Peru Elec. Mfg. Co.
Power Transmission Machinery.
Jeffrey Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Pulleys.
Harris Machinery Co.
Rockwood Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Rail Bonds.
American Steel & Wire Co.
Rail Joints.
Continuous Rail Joint Company of America.
Refiners.
Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
Smith, Theo.
Re-Winding—Repairs.
Becker Bros.
Chicago Edison Co.
Cleveland Armature Works.
General Electrical Repair Co.
Gregory Electric Co.
Schureman & Hayden.
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Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Sage & Bro., F. B.
Westinghouse El. & Mfg. Co.
Second-Hand Mach'y.
Alexander, Thomas.
Chicago House Wrecking Co.
Gregory Electric Co.
Harris Machinery Co.
Illinois Maintenance Co.
Matthews & Bro., W. N.
Rose Electric Company.
Schureman & Hayden.
Walsh's Sons & Co.
Shades.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
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Soldering Flux.
Cream Flux Co.
Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.
Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.
Springs.
American Steel & Wire Co
Barnes Co., The Wallace.
Manross, F. N.
Steel Boxes.
Bossert Elec. Const. Co.
Storage Batteries.
American Battery Co.
Columbus Batt. & Spec. Co
Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.
Structural Iron Work.
American Bridge Co.
Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.
Telegraph Supplies.
Bunnell Telegraphic & El. Co.
Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Central Tele. & Elec. Co.
Century Telephone Cons. Co.
Chicago Telephone Sup. Co.
Co-Operative Tel. Const. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Supply Co.
Globe Automatic Tel. Co.
Horix Mfg. Co., The
Independent Tel. Const. Co.
Independent Tel. Supply Co.
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Manhattan Elec. Supply Co.
Mason Telep. Pay Station Co.
Missouri Electrical Mfg. Co.
National Tel. Equipm. Co.
North Electric Co.
Palmer Bros.
R. I. Telephone & Elec. Co.
Scott, Charles W.
Standard Construction Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Swedish-American Tel. Co.
Thomas, Wilcox & Dietz.
Union Switchboard Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Western Tel. Const. Co
Yurgae Signalphone Mfg. Co.
Telephone Service.
Chicago Telephone Co.
Tools.
Anderson & Sons, W. H.
Klein & Son, Mathias.
Missouri Electrical Mfg. Co.
Smith & Hemenway Co.
Transformers.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Stanley Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co
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General Electric Co.
Westinghouse El. & Mfg. Co
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Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Varnishes.
Sterling Varnish Co.
Vulcanized Fibre.
Vulcanized Fibre Co.
White-Washing M'ch's.
Star Brass Works.
Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

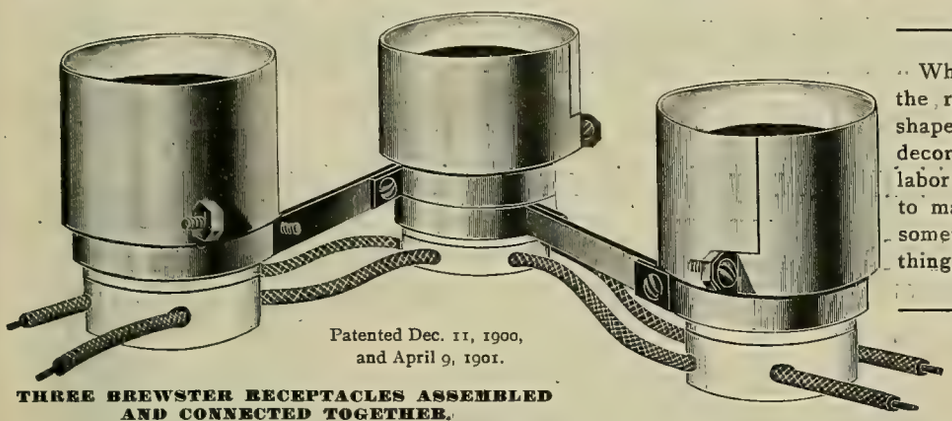
For Alphabetical Index of Advertisements See Page 8.

BREWSTER UNIVERSAL SIGN RECEPTACLES.

A SYSTEM OF UNITS

From which may quickly be formed, wired and installed anything in the shape of thoroughly weatherproof

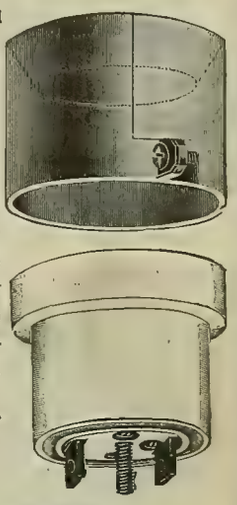
ELECTRIC SIGNS or ELECTRICAL DECORATIONS of any style or variety.



Patented Dec. 11, 1900, and April 9, 1901.

THREE BREWSTER RECEPTACLES ASSEMBLED AND CONNECTED TOGETHER.

When through using the receptacles in the shape of one sign or decoration, a very little labor only is necessary to make them up into something else—something entirely different.



Illustrating method of use and simplicity of means by which a perfectly rigid, yet readily adjustable, construction in any form or design desired is provided.

Just the thing for theaters, or for merchants who want to keep abreast of the times by electrical advertising and yet require variety.

PARTS OF THE UNIT READY TO ASSEMBLE.

"THE CONNECTING LINK."

THE ELECTRIC MOTOR AND EQUIPMENT CO.,

SOLE MANUFACTURERS AND SALES AGENTS. 12-14 Beaver Street, NEWARK, N. J.

HIGH-GRADE

PORCELAIN TUBES

300 DIFFERENT LENGTHS AND SIZES

SHOW HIGHEST TESTS YET MADE ON TUBES.

BATTERY BUSHINGS IN ALL SIZES.

ASK YOUR DEALER FOR "BRUNT" TUBES, INSULATORS AND CLEATS.

THEY COMPLY WITH THE UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

THE G. F. BRUNT PORCELAIN WORKS,

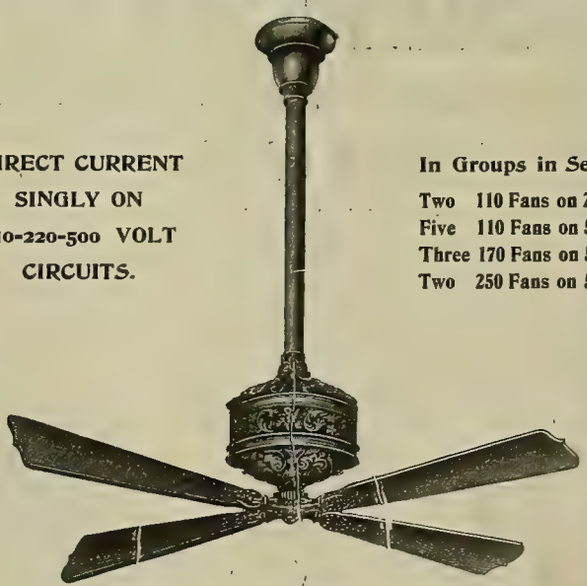
EAST LIVERPOOL, OHIO.

FAN MOTORS

DIRECT CURRENT SINGLY ON 110-220-500 VOLT CIRCUITS.

In Groups in Series.

Two 110 Fans on 220 V.
Five 110 Fans on 550 V.
Three 170 Fans on 500 V.
Two 250 Fans on 500 V.



ARCTIC CEILING FAN MOTORS.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.

MERCANTILE ELECTRIC CO., 810 Spruce St., St. Louis, Mo.

STANDARD ELECTRIC CO., Cincinnati, Ohio.

CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

ANTWERP, 32 Rue Boudewyns.

LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.

PARIS, 46 Avenue de Breteuil.

New Continental Lamp

FOR

110 Volt Direct Current Circuits

AN IMPORTANT ADVANCE IN ARC LIGHTING

A Gain in Light Economy of 35% over all other Arc Lamps

97	Volts	at	Arc	with	110	Volts	at	Mains
102	"	"	"	"	115	"	"	"
107	"	"	"	"	120	"	"	"

Will guarantee 3¾ Ampere Lamp to give the same light as an ordinary 5 Ampere Lamp

NO DEAD RESISTANCE

The Patents are fundamental and are owned by this Company

HELIOS-UPTON COMPANY, PHILADELPHIA, PA.

CEILING DIEHL FANS

STANDARD OF THE WORLD.

We are the original and largest manufacturers of ceiling fans in the world. Many seasons of constant use have absolutely demonstrated the superiority of Diehl fans, and the large and constantly increasing demand for them throughout this and other countries is one of the best recommendations for their adoption that we can offer.

Diehl fans are copied, but never equaled. They are without question the most perfect fans on the market. Electrically and mechanically perfect, attractive in appearance, splendidly finished, highly efficient, noiseless in operation, free from repairs—are some of their important features. Fourteen years' experience in the manufacture of ceiling fans assures perfection in all respects.

OUR CEILING AND ELECTROLIER FAN PATENTS SUSTAINED BY U. S. COURT DECISION.

Use or sale of infringements stopped by injunctions March 8th and December 5th, 1900.

We furnish two types of ceiling fans, two or four blades. We carry the largest line of designs and finishes to meet all possible requirements.

Cut illustrates ceiling fan No. 13 with switch. It has a very ornamental corona and basket, also switch controlling fan when operated on 110 or 220 volt circuits.

All standard fans wound for direct arc circuits of any amperage at same price as 110 volt. All ceiling fans have blades with 60-inch sweep.

Investigate the merits of Diehl fans before placing your orders.

DIEHL MANUFACTURING CO.,

SHOW ROOMS { NEW YORK, 561-563 Broadway.
CHICAGO, 192-194 Van Buren St.
BOSTON, 128-132 Essex St.
PHILADELPHIA, W. Irwin Cheyney & Co.
NEW ORLEANS, Newman-Spranley Co., Ltd.

MAIN OFFICE AND WORKS:
ELIZABETHPORT, N. J.

NOW IS THE TIME

. . . TO BUY . . .

CONSTRUCTION MATERIAL.

Paranite Rubber Covered Wires and Cables.
Warren Alternating Apparatus.
Eddy Direct Current Generators and Motors.
Roebling's Wires and Cables.
Telephones, Switchboards and Line Supplies.
Electric Railway Supplies.
Largest and Most Complete Line of
"Everything Electrical" in America.
Prompt Shipments from St. Louis Stock.

WESTERN ELECTRICAL SUPPLY CO.

ST. LOUIS, U. S. A.

Write us for Prices, Descriptive Matter and Catalogues.

MAY 17TH

WILL BE PRESS DAY FOR THE FIRST SPECIAL NUMBER OF THE WESTERN ELECTRICIAN, COVERING THE NIAGARA FALLS MEETING OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

COPY FOR ADVERTISEMENTS CANNOT BE RECEIVED AFTER MAY 16th, AND SHOULD BE FORWARDED MUCH EARLIER TO SECURE THE BEST ATTENTION AND GOOD LOCATION. IT IS NOT TOO EARLY NOW TO FORWARD COPY.

THIS SPECIAL INTERNATIONAL NUMBER, BESIDES CIRCULATING THE WORLD OVER, WILL BE MUCH IN EVIDENCE AT THE CONVENTION ITSELF AND AT THE PAN-AMERICAN EXPOSITION, AND WILL CONTAIN MANY SPECIAL FEATURES INTERESTING TO THE DELEGATES AND VISITORS TO THE CONVENTION AND TO THE PAN-AMERICAN EXPOSITION.

MAY 24TH

WILL BE PRESS DAY FOR OUR SPECIAL CONVENTION REPORT NUMBER (COPY RECEIVED UP TO MAY 23d), IN WHICH WILL APPEAR A FULL REPORT OF THE NIAGARA MEETING, INCLUDING A FULL ACCOUNT OF THE PROCEEDINGS, NEWS AND GOSSIP OF THE CONVENTION, NAMES OF THE NEW OFFICERS, AND OF THE DELEGATES AND OTHERS ATTENDING THE MEETING, AND EVERYTHING OF VALUE AND INTEREST RELATING TO THIS NOTABLE GATHERING OF LEADING ELECTRIC LIGHT AND POWER MEN.

BOTH OF THESE NUMBERS WILL BE ILLUSTRATED IN THE WESTERN ELECTRICIAN'S BEST STYLE, AND UNDOUBTEDLY THEY WILL BE THE MOST VALUABLE AND WIDELY CIRCULATED ELECTRIC LIGHT AND POWER NUMBERS ISSUED BY ANY JOURNAL DURING THE ENTIRE YEAR.

BENEFIT YOUR BUSINESS BY PLACING A LIBERAL ADVERTISING ANNOUNCEMENT IN BOTH OF THESE

SPECIAL INTERNATIONAL NUMBERS.

AS GOOD AS THE NAME.

COLUMBIA CARBONS

FOR ENCLOSED AND OPEN ARCS.

A FEW YEARS AGO PRACTICALLY ALL THE HIGH GRADE CARBONS CONSUMED IN THE U. S. WERE SUPPLIED BY IMPORTERS. TODAY WE ARE SUPPLYING THE BULK OF THE TRADE IN THIS COUNTRY REQUIRING HIGH GRADE CARBONS BECAUSE COLUMBIA CARBONS ARE

GUARANTEED SUPERIOR

TO ANY IMPORTED CARBON. SEND US A TRIAL ORDER. IF THEY ARE NOT ALL WE CLAIM FOR THEM, YOU CAN RETURN THEM AT OUR EXPENSE. THE PRINCIPAL CENTRAL STATIONS HAVE DISCARDED IMPORTED CARBONS FOR THE COLUMBIA BECAUSE THEY ARE ACKNOWLEDGED FAR SUPERIOR

TO IMPORTED CARBONS.

SAMPLES FURNISHED FREE OF EXPENSE.

NATIONAL CARBON COMPANY,

1198 W. Madison Ave., CLEVELAND, OHIO.

American Bridge Company

DESIGNERS
MANUFACTURERS
AND ERECTORS OF

Steel Bridges
Steel Buildings
and All Classes of
Metallic Structures

WE have decided to carry at all our plants a large stock of Raw Material, from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc.

The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

General Offices: 100 BROADWAY, NEW YORK

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Albany, N. Y.	Canton, Ohio.	Lafayette, Ind.	Seattle, Wash.
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Buffalo, N. Y.	Duluth, Minn.	New Orleans, La.	Sydney, N. S. W.
Baltimore, Md.	East Berlin, Conn.	Pencoyd, Pa.	Trenton, N. J.
Butte, Mont.	Elmira, N. Y.	Philadelphia, Pa.	Wilmington, Del.
Columbus, Ohio.	Groton, N. Y.	Pittsburg, Pa.	Youngstown, Ohio.
Chicago, Ill.	Horseheads, N. Y.	Rochester, N. Y.	

European Office: LONDON

LELLBRIDGE, N. Y., 21-00.

DON'T Use our Engine and Dynamo Oils without collecting and filtering same through a good filter. These oils are high priced but do not wear out.

DON'T use our Cylinder Oils on small, cheap Engines and Pumps.

We do not carry or make cheap oils. Use our oils only on your high grade, high duty plants.

WRITE US
Make of Engine,
Kind of Plant,
Steam Pressure, and
State your troubles.

LUBRICATING OIL DEPARTMENT.

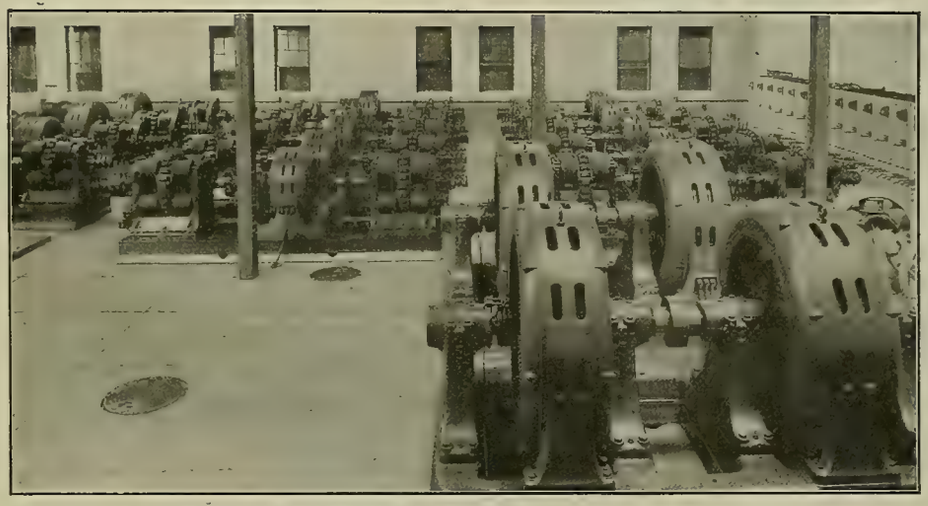
DEARBORN DRUG AND CHEMICAL WORKS,

27, 28, 29, 30, 31, 32, 33 and 34 RIALTO BUILDING,

Wm. H. Edgar, President. CHICAGO, ILL. TELEPHONE, HARRISON 1358 AND 1373.

THE GENERAL ELECTRIC COMPANY'S

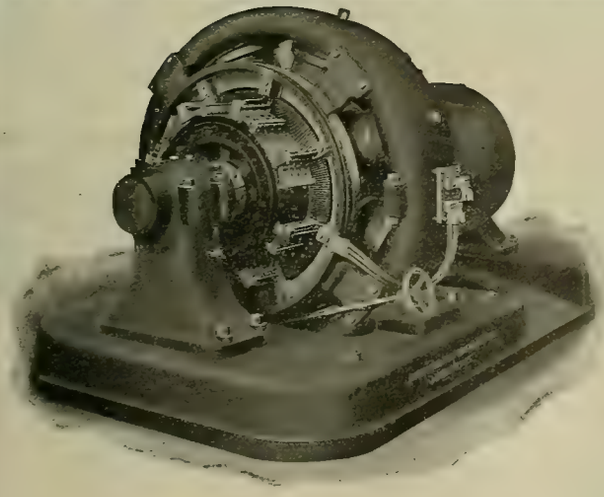
INSTALLATIONS



SUB-STATION OF THE BUFFALO GENERAL ELECTRIC COMPANY.

GENERAL OFFICES, SCHENECTADY, N. Y.

Chicago Office, Monadnock Block. Sales Offices in all Large Cities.



Alternating or Direct Current Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co.,
Pittsfield, Mass.

Northern Electrical Mfg. Co.,
Madison, Wis.

HOOT MON!

You hae heard nae doot o' the Gutmann wattmeter. There's no sic anither. For alternating current work it's the very best, an' you couldna do ony better than to try it.

The makers guarantee it, an', for the matter o' that, so do we.

SEND TRIAL ORDER. SEND IT NOW.

ELECTRIC APPLIANCE COMPANY,

ELECTRICAL SUPPLIES,

92 and 94 West Van Buren St., Chicago.

DEWAR BULBS FOR LIQUID AIR

Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
(General Electric Co.) Harrison, N. J.

EMPIRE CLOTH AND PAPER

A high-grade insulator, composed of specially woven muslin or prepared bond paper, treated with two evenly distributed coats of linseed oil, purified by our own process and thoroughly baked. Average breakdown test, 506 volts per mil.

MICA INSULATOR COMPANY,

CHICAGO. "Originators" NEW YORK.

ENGINEERING.

HERBERT A. WAGNER,
Consulting Engineer
Railway Lighting and Power Plants,
415 LOCUST ST., ST. LOUIS, MO.

YOU NEED IT!

GALE'S COMMUTATOR COMPOUND

Gale's Commutator Compound.

The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

50c. per stick. $5.00 per dozen Send 50c. for trial stick.

FOR SALE BY ALL SUPPLY HOUSES OR

K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, - CHICAGO.

ESTABLISHED 1877

"MANROSS" HAIR SPRINGS FOR ELECTRIC INDICATING AND RECORDING GAUGES STEAM GAUGES, ETC.

Largest Manufacturers of Hair Springs in the United States.

Non-Magnetic Hair Springs of Phosphor Bronze and other non-magnetic metals. Hair springs of any description manufactured to order.

F. N. MANROSS, Forestville, Conn.

GENERAL INCANDESCENT ARC LIGHT CO.,

Factory and General Offices: 572-578 FIRST AVENUE, NEW YORK.

TRADE G. I. MARK.

Manufacturers of HIGH-GRADE ELECTRICAL SUPPLIES.

WRITE FOR ATTRACTIVE BULLETINS.

Branch Offices:

Chicago, Philadelphia, Boston, Cleveland, St. Louis, Milwaukee, Cincinnati, Denver, St. Paul.

G. I. INCANDESCENT LAMPS.

No need to worry if your cables are in McRoy conduits.

McROY CLAY WORKS
BRAZIL, INDIANA
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

SPRINGS

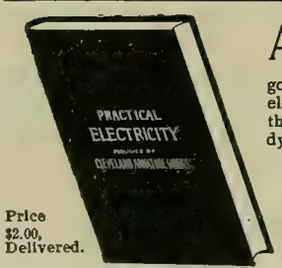
All Small Springs Used by Electrical Trade.

The Wallace Barnes Co.,
Bristol, Conn.

ESTABLISHED 1857.

Submit samples for prices.

Complete assortment, high-grade cold rolled steel always in stock. Catalog upon application.



Price $2.00, Delivered.

A THOROUGH school for the beginner—a valuable reference book for the expert. If not found satisfactory money refunded upon return of book in good condition. Contains a dictionary defining 1,500 electrical words, terms and phrases. It carries you from the fundamental principles of electricity to the finished dynamo

E. R. WAUGAMAN, Electrical Wireman. KITTANNING, PA.

Cleveland Armature Works, Cleveland, Ohio.

Gentlemen:—I received your book, Practical Electricity, and would not part with it for four times its cost if I could not get another copy. Yours truly, E. R. WAUGAMAN.

CLEVELAND ARMATURE WORKS, 1281 Hamilton St., Cleveland, O.

VOLT-AMMETERS,

POCKET SIZE.

For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.

RELIABLE. ACCURATE.

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CREAM FLUX

AN ABSOLUTELY NON-CORROSIVE INSULATING SOLDERING FLUX FOR ALL METALS.

Contains no acid or any element injurious to electrical connections.

ENDORSED BY THE NATIONAL BOARD OF FIRE UNDERWRITERS AND ALL USERS.

YOU CAN make more than double the number of perfect connections in one-half the time with Cream Flux than you can with the same amount of any other flux Put up in cans at 15c., 25c., 50c. and 75c. Special prices in quantity. Send 15c. for trial box. *We guarantee it and if not satisfactory money will be refunded.*

THIS IS WHAT ONE USER HAS TO SAY OF IT:

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For fastening all kinds of structure to brick and stone work
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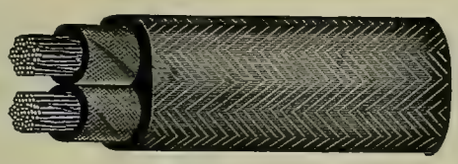

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Subject to previous sale at 15c. per lb. for 6, and 16c. for No. 10.
No orders accepted for less than 500 lbs.

This Wire has all been thoroughly overhauled, the bad places in the insulation cut out and soldered and taped connections made where necessary.

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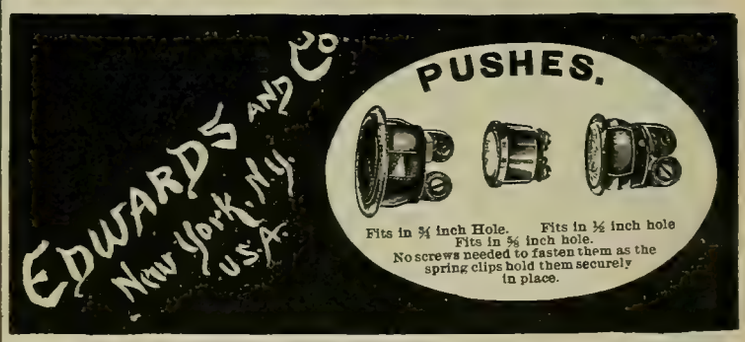

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

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Silver-Plated Mirror Reflectors.

A deep cone, for use with any system of incandescent electric light, where it is desired to concentrate a very powerful light on a small space. Lined with silver-plated mirror-plate glass. Increases the light from twelve to fifteen times. Most valuable in show windows and over machines, work-benches, type cases, etc., etc.

Thousands of this style used in show windows.
Get our Catalogue and Prices.

American Reflector & Lighting Co.,
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WANTED.

A case of a reception paid in a growing western town; [illegible] of years. Would like to hear from parties having a plant for sale or lease. Address G. P. D., 1,000 Ld. 2820 Western Ave., Mattoon, Ill.

WANTED.

A good, temperate, industrious man for a small electric light plant. Must understand boilers, engines and dynamos and be able to do line work. Address "W. T.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Salesman for an electrical supply house in Michigan. Would be part of the time in the house and part of the time on the road. State qualifications, salary expected, where last employed, etc. Address BOX 310, care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Position by engineer who has had 12 years' practical experience with Corliss and high speed engines, boilers, pumps, dynamos (both alternating and direct current), line work and wiring. Can furnish good references. Will call and see parties in need of an engineer. Address "ENGINEER," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Experienced and thoroughly competent mechanical draftsman and designer. Permanent position to the right person. Address MILWAUKEE ELECTRIC CO., 286 Reed Street, Milwaukee, Wis.

WANTED.

First-class experienced mechanical draftsmen wanted at once; some of them acquainted with electrical work. Those with shop experience preferred. Apply by letter to Chief Draftsman, P. O. Box 911, Pittsburg, Pa., stating experience in full and giving references.

WANTED.

By an electric construction company in Michigan, a competent man to act as general foreman in charge of construction work. Must be experienced and active. State age, qualifications, references, etc. Address "Box 210," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

A position is offered with a firm of electrical contractors to an educated man capable of making estimates and getting business. Apply, giving experience and full particulars, to "Box 110," care Western Electrician, 510 Marquette Building, Chicago.

U. S. ENGINEER OFFICE, 735 N. Capitol St., Washington, D. C., April 10, 1901. Sealed proposals will be received here until noon, May 9, 1901, and then publicly opened, for furnishing cast iron and steel cable racks, porcelain insulator clamps, insulators and accessories, for electrical installation for New Building for Government Printing Office. Information furnished on application. JOHN STEPHEN SEWELL, Capt. Engrs.

WANTED.

Situation by an all-around engineer, electrician and machinist; 18 years' experience in the care of electric light, waterworks and electric power plants, electric and compressed air and mining machinery. At present master mechanic of a large mining plant. Good reasons for leaving. Steady, honest and strictly temperate. Best of references. Competent to take charge of any plant. Would like steady position. Address Y., care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

A young man of experience to manage a telephone exchange of 150 subscribers in a Southern Kentucky town of 3,000 inhabitants. Must have first-class recommendations. Address "KENTUCKY," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Partner or company wanted with some money to extend and complete an A1 Mutual Telephone plant in Iowa. All new and paying 18%. We invite close investigation. Or would not object to going into a mutual consolidation on equitable terms, which we believe could be effected by, and made to pay in, our vicinity. Address "TELEPHONE," care Western Electrician, 510 Marquette Bldg., Chicago.

TO EXCHANGE.

Telephony scholarship in the International Correspondence School, for buggy. Must be in good condition. Address J. J. SHELTON, Poseyville, Ind.

NOTICE TO CONTRACTORS.

St. Joseph, Mich., April 12, 1901.

Sealed proposals will be received by the Board of Public Works of St. Joseph, Mich., until 1 o'clock p. m., May 9, 1901, for furnishing all labor and material necessary to construct a complete electric light plant for lighting the streets of the city of St. Joseph, Mich. Propositions will be considered on constant current arc dynamo, also on alternating dynamo.

The plant will consist of the following:

One dynamo, capacity 125 enclosed arc lamps each.

One 100-horsepower gas engine.

One hundred and twenty enclosed arc lamps.

One gasoline tank to hold 5,000 gallons.

About 11 miles pole and wire line.

Bids must be made upon blank forms furnished by the city. Each bid must be accompanied by a certified check for the sum of $500. The Board of Public Works reserves the right to reject any and all bids. Plans and specifications are on file with the Board of Public Works, St. Joseph, Mich. Also with H. D. Hallett, engineer, 108 Grand avenue, Aurora, Ill.

FRANK N. WILKINSON,
Chairman Lighting Committee.

Franchise and Grounds

For a term of years will be given by the village of Cabery, Ill., for electric-light purposes and pumping water for the village. Cabery is a prosperous town of about 600 people. A good patronage can easily be obtained. For full particulars address P. M. RAVENSKILDE, Trustee of the village of Cabery, Ill.

ELECTRIC LIGHTS AND WATER

Bids will be received by the City Council of Carrollton, Ill., up to May 9, 1901, for lighting city with 45 arc lights, of 2,000 candlepower each, and for operating city waterworks.

Propositions for lighting must be submitted under Common Sense schedule, and per 1,000 lamp hours, and must be accompanied by a certified check for $250.00. A 5-year contract and a 10-year franchise will be given. Bids to be sealed and addressed to D. E. Fox, chairman of Waterworks Committee, Carrollton, Ill. The City reserves the right to reject any and all bids, and to terminate pumping contract on thirty days' notice.

M. E. McMAHON, Mayor.
ROY PENDT, Clerk.

Carrollton, Ill., April 20, 1901.

WANTED.

Situation by practical electrician who is capable of doing general electrical work; electrical construction superintendency solicited. Address "E. J.," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

One 100 to 120 K. W., 500 volt, D. C. generator. Also an engine, either Corliss or high speed, to operate same. Apparatus must be in good operative condition and reasonable in price. BELLEVILLE DEEP WELL WATER CO., Belleville, Ill.

FOR SALE.

150,000 pounds second-hand insulated copper wire, sizes 6, 8 and 10 G. MATHES' SONS RAG COMPANY, 1533 No. Broadway, St. Louis, Mo.

FOR SALE.

MOTORS

in 110 volt, 220 v. and 500 v. d. c. All sizes from ½ h. p. to 200 h. p. Alternating motors from 1 to 15 h. p.

GENERATORS

125 v., 250 v. and 550 v. d. c. from 1 k. w. to 300 k. w. 550 v., 1,100 v. and 2,200 v. alternating from 18 k. w. to 240 k. w. Single phase, two phase and three phase.

Every machine listed in our Bargain Sheet is actually in stock in our works. Every machine is guaranteed. We have the largest stock of electrical apparatus in the world. Send for our monthly Bargain Sheet with lowest *net cash* prices.

GREGORY ELECTRIC CO.,
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ALL ARC LAMPS, $3.00.

DIRECT CURRENT:

T.-H., M 2, K 2 and Type D; Wood, single clutch; Brush, double; W. E., 14 hour; American, single; Ball, double.

ALTERNATING CURRENT: Helios, No. 3; Helios, No. 4; Helios, No. 5; A. B., No. 6.

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FOR SALE.

One M. P. 80 T. H. 500 V. Railway Generator.
One D. 62 T. H. 500 V. Railway Generator.
Three 13 in. x 52 ft. Heavy Double Leather Belts.
Two Tubular Boilers, 16 ft. x 60 in., with 44 4-in. Flues.
Two Tubular Boilers, 14 ft. x 60 in., with 64 3½-in. Flues.

These boilers have full fronts and complete with necessary fixtures, including U. S. Rocking Grate Bars.

With the generators are included circuit breaker, current indicator, rheostat and three-pole switch.

All of the above equipment is in good operative condition, having been in service up to the day we started our new power station.

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DECATUR, ILLINOIS.

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150 hard rubber cells, 7x7x10¼ inches. THOMAS ALEXANDER, 183 E. Randolph St., Chicago.

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2—100 K. W. 140 volt Edison Bipolars.
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2—120 K. W. Atype General Electric Alternators.
4—100 K. W. Westinghouse, 1,100 volt Alternators.
1—120 K. W. Slattery, 1,100 volt Alternator.
2—45 K. W. 125 volt Edison Bipolars.
1—90 K. W. Standard, 2,200 volt Alternator.
1—50 K. W. National, 2,200 volt Alternator.
1—26 x 48 Allis Corliss.
1—15 x 23 x 15 Armington & Sims Cross-compound.
1—13 x 19 x 15 McIntosh & Seymour Tandem-compound.
1—18½ x 18 Ideal, and many other items in

ELECTRICAL AND STEAM APPARATUS.

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ILLINOIS MAINTENANCE CO.,
E. H. CHENEY, Manager.
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Universal Cord Spools

Offer so many advantages that everybody wants them.

They are Cheap, Strong and Ornamental.

Finished in Cherry, Green, Mahogany, Black Enamel and Natural Wood.

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Smith's Patented Incandescent Lamp Adjuster

AND CONTROLLER.

SIMPLE, NEAT AND ATTRACTIVE.

Adjusts lamp up or down, or throws reflection to side of room, or just where you want it.

THEO. SMITH,
Manufacturer,
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High Speed Engine Bargains

No.	H. P.	Maker.	Cylinders.
1	200	Buckeye	16¼ x 27
1	90	Atlas G.	14 x 20
1	75	Westinghouse	12 x 11
1	65	Beck-Taylor	10¼ x 12
1	60	Hall	10 x 12
1	40	A. & S.	8½ x 12

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Dynamos and Motors.

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SCHUREMAN & HAYDEN,
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The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

SCRAP COPPER
WANTED

We pay highest market prices for old copper wire. Electric light and electric railway managers who desire to realize on material of this kind will find it to their advantage to communicate with us.

CHICAGO'S LEADING METAL HOUSE. ESTABLISHED 1885.

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References: Foreman Bros. Banking Co., Dun's Agency, Bradstreet's Agency.

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ALWAYS ON HAND.

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Get our price on this instrument.

When you start your spring construction, START RIGHT by buying good material at right prices.

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Electric Light and Telephone Supplies.

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Splendid bargains in standard make telephones of which exchange managers and others should avail themselves. By special arrangement with various telephone companies we have come into possession of a large number of "used" telephones. While they have seen more or less service, they are, nevertheless, in first-class condition. They have been thoroughly tested and overhauled and are in perfect working order. They are complete, and of standard make. Will be sold for $5.25 each while they last. We also have several hundred 'phones ranging in price from $5.75 to $7.50 each. These are also of standard make and of a slightly better grade than our leader. They are the biggest bargains ever offered to users of telephones.

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We are also in position to furnish anything in telephone supplies — wire, batteries, tools, brackets, pins, cross-arms, insulators, etc., at prices that will astonish you. We can also furnish a number of high-grade switchboards, of various capacities, in fine condition, at ridiculously low figures. Let us tell you about them.

DYNAMOS AND MOTORS.

We sell the "Chicago" noiseless dynamos and motors at one-third the price of other makes. They range in size from 12 to 200 lights and from ¼ to 12 horsepower. We sell them under an absolutely binding guarantee for two years' service. They are as good as any machine on the market. It will pay you to look into them.

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We carry in stock for immediate shipment a large quantity of short lap, oak tanned leather belting, fully guaranteed, all widths, single and double thick, at 70 and 5 per cent discount from standard prices.

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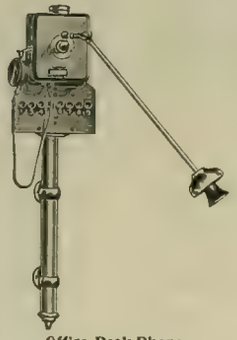
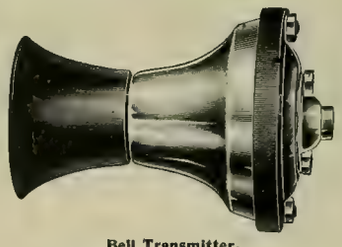
For Stores, Warehouses and Residences, or wherever inter-communicating phones are needed.



Office Desk Phone, Style "H."



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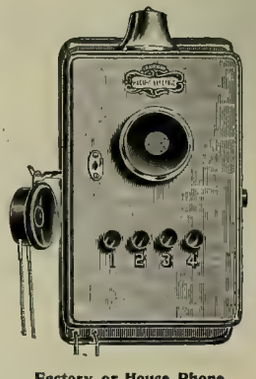
For particulars and prices, address

PACIFIC ELECTRIC CO.,

LA CROSSE, WIS.



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EVERYBODY!

YOU CAN SAVE TIME AND MONEY BY USING THE CENTRAL ENERGY OR INTERCOMMUNICATING

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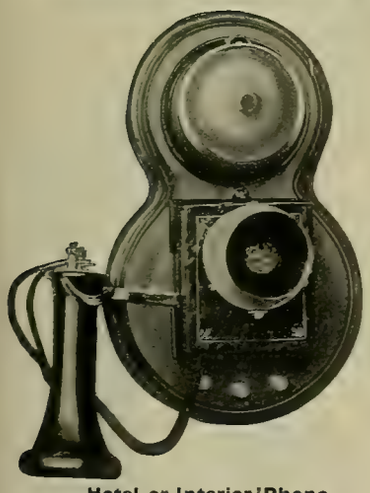

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SIMPLE IN CONSTRUCTION,
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ECONOMICAL
IN MAINTENANCE,
NO LOCAL BATTERIES.

IF YOU DON'T BELIEVE IT
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Signalphone and Fire Alarm.

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PARTY LINE, SELECTIVE SIGNAL, NON-INTERFERING

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GUARANTEE SUCCESSFUL OPERATION.

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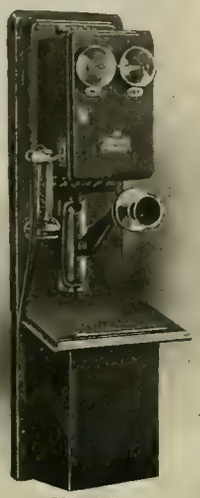
EXCLUSIVE PATENTS.



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YOUR BELL, ONLY, RINGS.

NO BELLS CONTINUALLY RINGING.

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WE ARE THE ONLY MANUFACTURERS OFFERING
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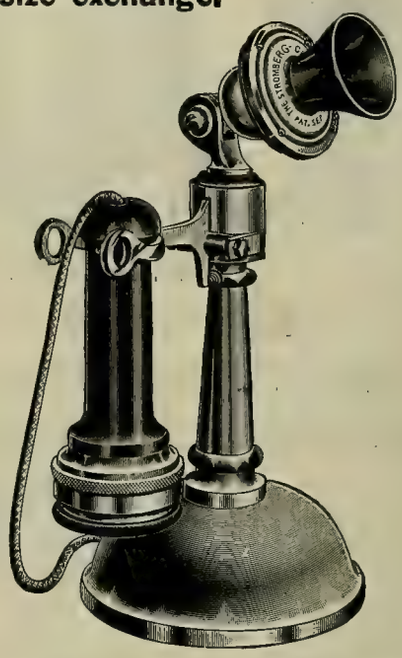
TELEPHONES AND SWITCHBOARDS

for any size exchange.

"CENTRAL ENERGY" SYSTEM.



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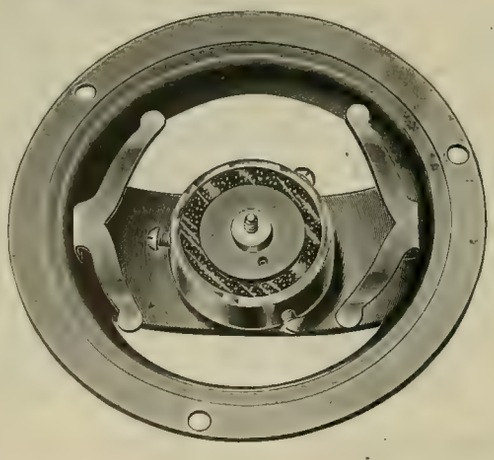
IF BUT

You bought a bicycle, you would not choose one with iron tires and cone bearings.
You bought a clock, you would not choose one with wooden wheels.
You want a light, you don't use a dish of grease with a rag.
You want to travel, you don't go on a canalboat.
You take your girl for a ride, you don't use an ox team.
You want the latest news, you don't look in the almanac.
You get sick, the doctors don't bleed (?) you (that is, your veins).
You harvest your wheat, you don't cut it with a scythe.
You want to talk from one point to another, you don't want to be compelled to use a megaphone.
You buy a telephone you should not want one equipped with antiquated Transmitters and Receivers—Transmitters that have ancient and crude methods for retaining carbon granules, such as corn plasters, felt, flannel rags, etc., etc.; also carbon diaphragms,

YOU DO WANT AN UP-TO-DATE SCIENTIFIC DEVICE, AS SHOWN HEREWITH.
PAT. SEPT. 5th, 1899, No. 632,355. PAT. FEB. 5th, 1901, No. 667,327.

OUR TRANSMITTERS AND RECEIVERS ARE GUARANTEED FOR 5 YEARS.



WRITE US FOR FULL PARTICULARS.

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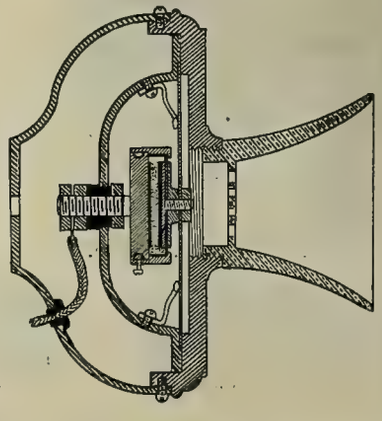

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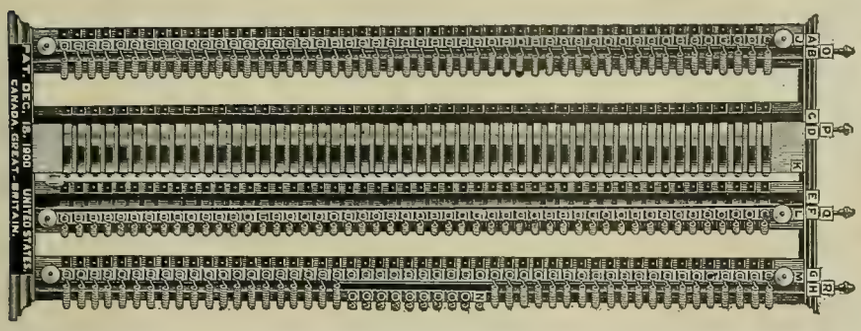

On the 18th day of December 1900, the United States Government granted a patent to the undersigned which, in the opinion of every practical man who has examined it, is the safest, surest and most complete protection to electrical apparatus, and more especially to telephone switchboards and telephone property generally, that has ever been attempted. This patent is known as an "ELECTRIC SWITCH," patent No. 664,061, and has recently been patented in foreign countries.

WHAT THE INVENTION ACTUALLY ACCOMPLISHES.

First: Instead of the universal annoying disadvantage of the uncertain contact of the old style screw and washer, a certain safe and sure contact is secured.

Second: All practical men realize that no lightning arresters nor diverters of high pressure currents give perfect immunity from damage and destruction to switchboards and telephone property; this device makes all such property as safe as any other property. Under the old style, the tedious labor, and the long time required to disconnect the conductors, made it practically impossible to do so, and for these reasons failed absolutely to avert serious loss. The damage in nine cases out of ten had been sustained before the switchboards could possibly be disconnected. With this switch one thousand subscribers can be easily disconnected within ten seconds, and every conductor grounded, making the telephone property as well as the building perfectly secure. Another strong feature of the invention is that every conductor can be as quickly connected as disconnected, requiring no loss of time whatsoever. The switch is as readily attached to metallic circuits as to common returns, and ground and wire.

Fourth: The very strongest feature of this important invention, and the one of paramount importance to all telephone property holders, is the quick and sure means to shield telephone property positively and without doubt from the storm, and to obviate terrific damage and often absolute destruction, for however appalling the storm, and however distressing the anxiety and the solicitude for the exchange, the most obtuse and inexperienced operator can instantly disconnect and ground every conductor of the exchange. Again, we care not what voltage from arc circuits or from trolley lines are poured into the exchange, this switch diverts the currents to earth, and all is safe. This fact being true, it is worth many times more than its cost for the quietude and peace of mind it affords. Surely, from a business and commercial standpoint, no exchange can afford to be without this safeguard to valuable property.

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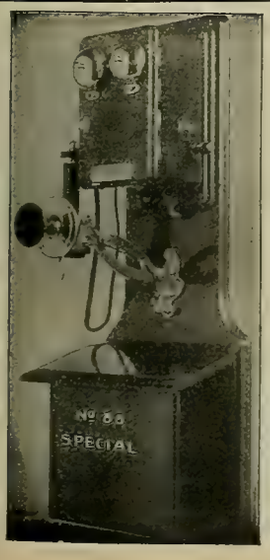

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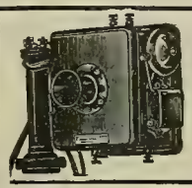

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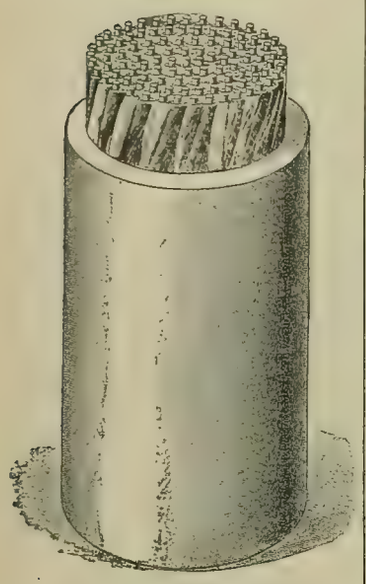

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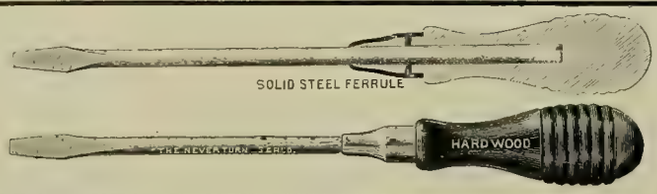

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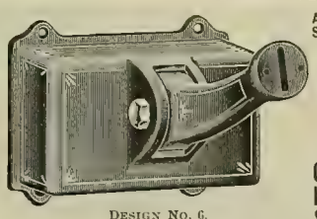

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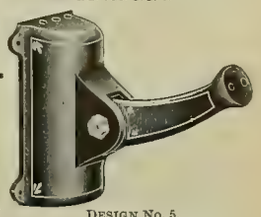

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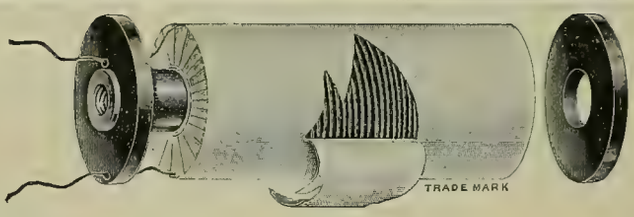

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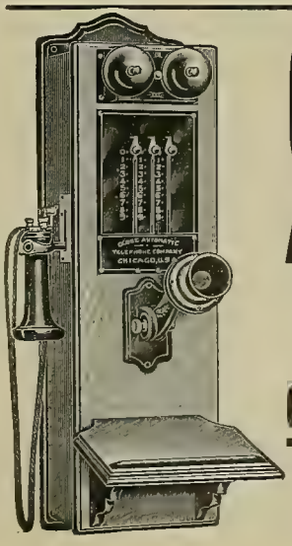

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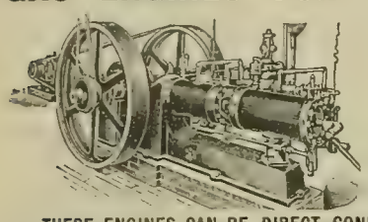

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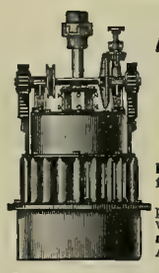

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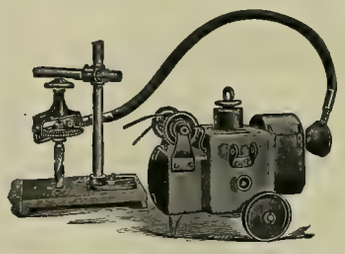

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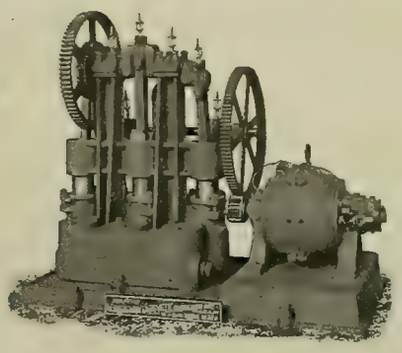

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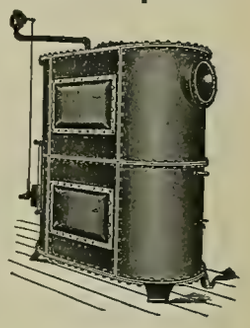

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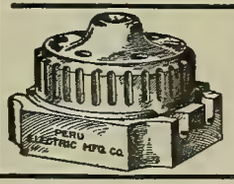

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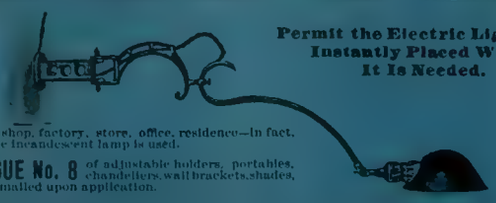

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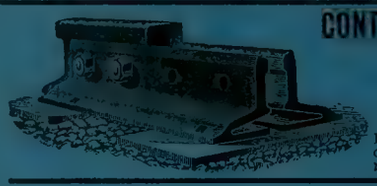

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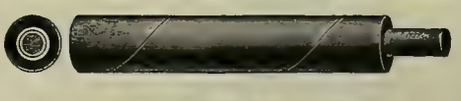

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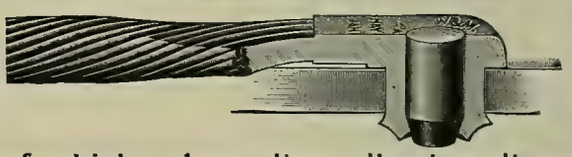

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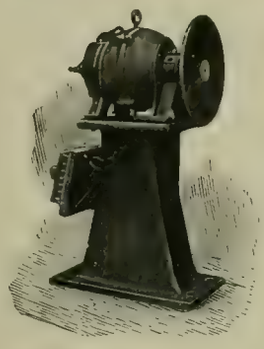

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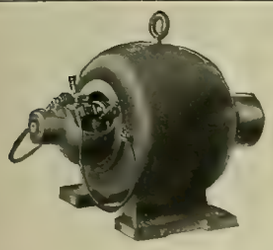

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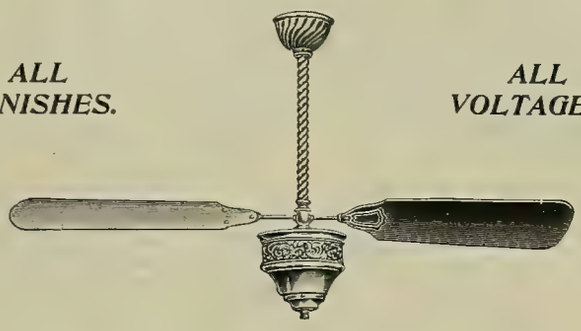

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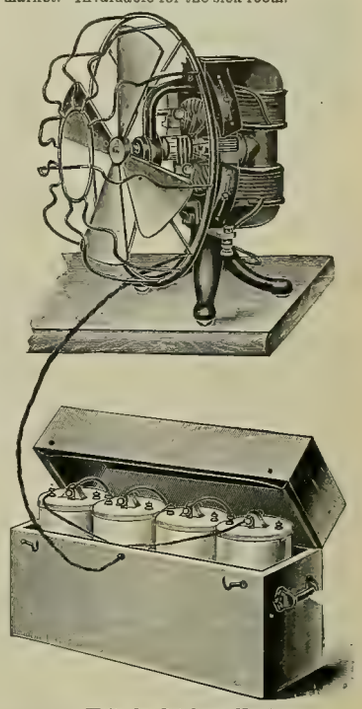

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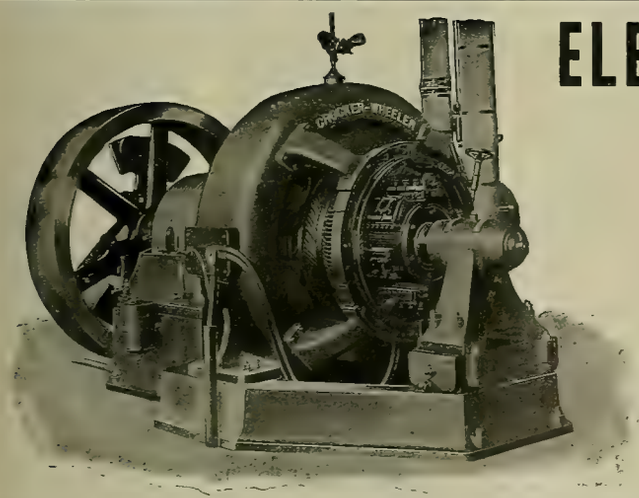

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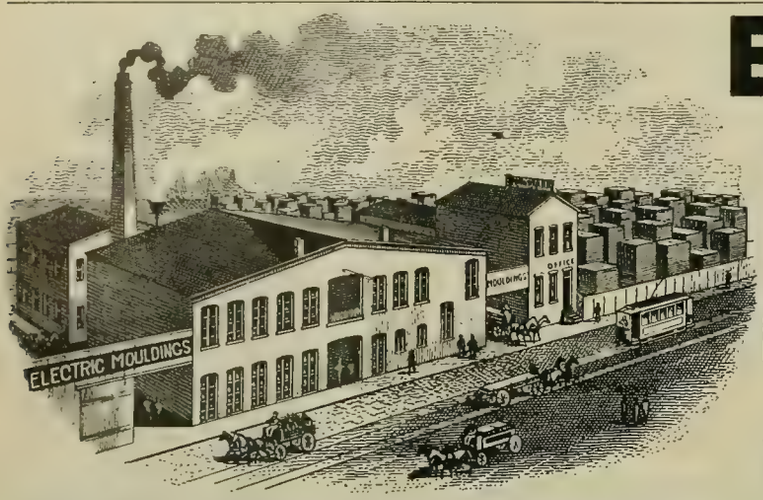

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Besly & Co., Chas. H.
Queen & Co.
Robertson & Sons, Jas. L.
Weston Electrical Inst. Co.
Springs.
American Steel & Wire Co.
Barnes Co., The Wallace.
Manross, F. N.
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Bossert Elec. Const. Co.
Storage Batteries.
American Battery Co.
Columbus Batt. & Spec. Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Hellos-Upton Co.
Structural Iron Work.
American Bridge Co.
Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.
Telegraph Supplies.
Bunnell Telegraphic & El. Co.
Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Central Tele. & Elec. Co,
Chicago Telephone Sup. Co.
Couch & Seeley Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Supply Co.
Globe Automatic Tel. Co.
Horix Mfg. Co., The
Independent Tel. Const. Co.
Independent Tel. Supply Co.
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Manhattan Elec. Supply Co.
Mason Telep. Pay Station Co.
Missouri Electrical Mfg. Co.
National Tel. Equipm. Co.
Palmer Bros.
R. I. Telephone & Elec. Co.
Scott, Charles W.
Standard Construction Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
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Thomas, Wilcox & Dietz.
Union Switchboard Co.
Western Electric Co.
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Western Tel. Const. Co.
Yurgae Signalphone Mfg. Co.
Telephone Service.
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Klein & Son, Mathias.
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Ft. Wayne Elec. Works, Inc.
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Stilwell-Bierce Smith-Vaile.
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Sterling Varnish Co.
Vulcanized Fibre.
Vulcanized Fibre Co.
White-Washing M'ch'e.
Star Brass Works.
Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co,
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

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The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."

Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

HELIOS-UPTON STORAGE BATTERIES

FOR STREET RAILWAYS, POWER AND LIGHTING PLANTS, FOR ELECTRICAL VEHICLES, TELEGRAPH, TELEPHONE AND ELECTRIC ELEVATORS.

BATTERY SUPPLIES AND REPAIRS.

We make very low prices for repairs of batteries manufactured by the **Electric Storage Battery Company.** Send us dimensions of plates required and the number and **we will make you a quotation that will save you money.** We will guarantee that our plates can be used with better results in installations of the Electric Storage Battery Co. than the plates of their own manufacture. To sustain our claims we refer you to the Kansas City Electric Light Company, who have a large installation, manufactured and installed by this Company.

HELIOS-UPTON COMPANY,

PHILADELPHIA, PA. CHICAGO, ILL. PEABODY, MASS.

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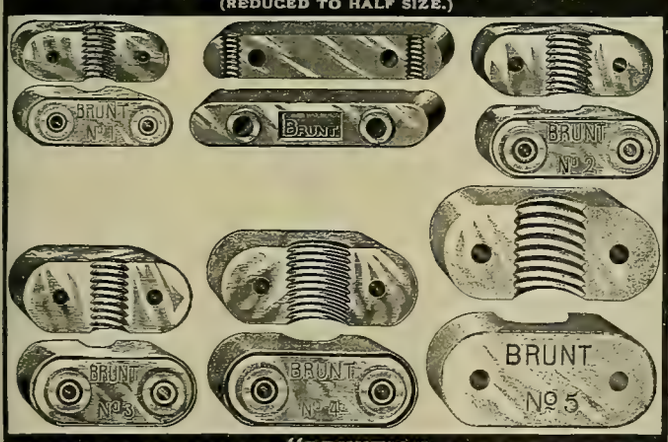
High-Grade Porcelain Cleats.

(REDUCED TO HALF SIZE.)



INSIST ON HAVING "BRUNT'S" CLEATS, TUBES AND INSULATORS. YOU REQUIRE THEM IN DOING FIRST-CLASS WORK.

THEY COMPLY WITH ALL UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

THE G. F. BRUNT PORCELAIN WORKS,

EAST LIVERPOOL, OHIO.

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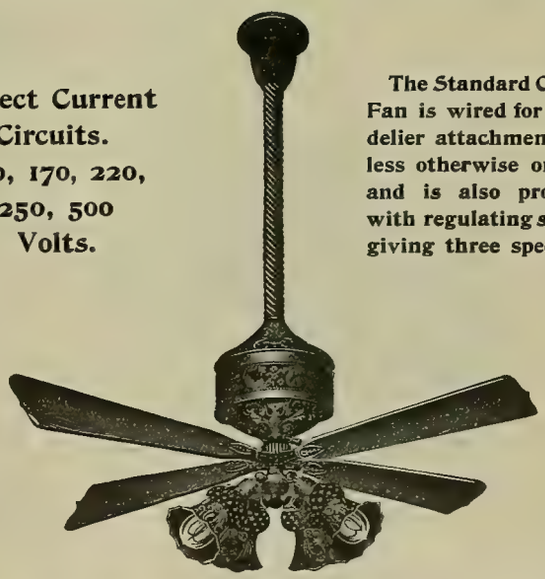
Direct Current Circuits.
110, 170, 220, 250, 500 Volts.

The Standard Ceiling Fan is wired for chandelier attachment unless otherwise ordered and is also provided with regulating switch giving three speeds.



STANDARD CEILING FAN WITH CHANDELIER ATTACHMENT.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.
MERCANTILE ELECTRIC CO., 810 Spruce St., St. Louis Mo.
PHILADELPHIA, 933 Market St.

STANDARD ELECTRIC CO., Cincinnati, Ohio.
CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

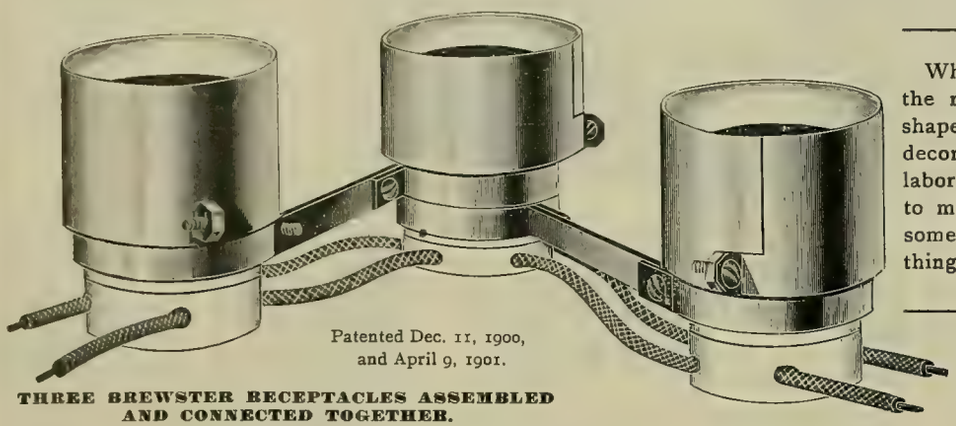
ANTWERP, 32 Rue Boudewyns.
LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.
PARIS, 46 Avenue de Breteuil.

BREWSTER UNIVERSAL SIGN RECEPTACLES.

A SYSTEM OF UNITS

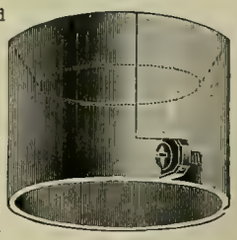
From which may quickly be formed, wired and installed anything in the shape of thoroughly weatherproof

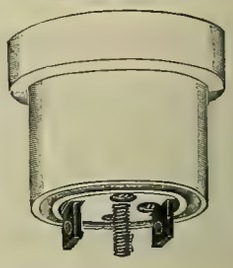
ELECTRIC SIGNS or ELECTRICAL DECORATIONS of any style or variety.



Patented Dec. 11, 1900, and April 9, 1901.

THREE BREWSTER RECEPTACLES ASSEMBLED AND CONNECTED TOGETHER.





When through using the receptacles in the shape of one sign or decoration, a very little labor only is necessary to make them up into something else—something entirely different.

Illustrating method of use and simplicity of means by which a perfectly rigid, yet readily adjustable, construction in any form or design desired is provided.

Just the thing for theaters, or for merchants who want to keep abreast of the times by electrical advertising and yet require variety.

PARTS OF THE UNIT READY TO ASSEMBLE.

"THE CONNECTING LINK."

THE ELECTRIC MOTOR AND EQUIPMENT CO.,

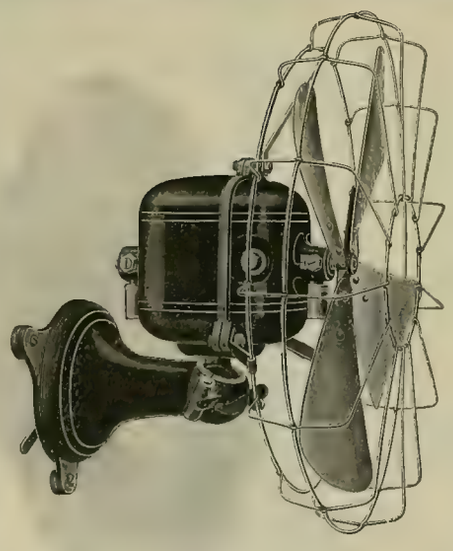
SOLE MANUFACTURERS AND SALES AGENTS. 12-14 Beaver Street, NEWARK, N. J.

USE OR SALE OF

Infringements stopped by Injunctions.

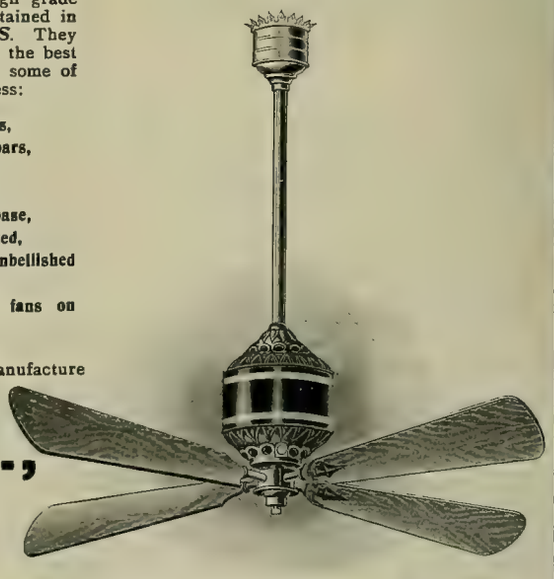
Our ceiling and electrolier fan patents sustained by U. S. court decision. Use or sale of infringements stopped by injunction March 8th and December 5th, 1900.

DIEHL DESK FAN MOTORS.



The enviable reputation we have established in the manufacture of high grade ceiling fans has been fully maintained in our production of *DESK FANS*. They are acknowledged by users to be the best ever produced. Following are some of the important features they possess:

Silk insulation on armature wires,
Hard-drawn copper commutator bars,
Self-aligning bronze bearings,
Improved self-oiling oil cup,
Unbreakable three-speed switch base,
Very strong guards—no solder used,
Body of fan richly enameled and embellished with fine gold stripes.
Absolutely the highest efficient fans on the market.



Endorsed and approved by thousands of users throughout the world. 14 years in the manufacture of fans assures perfection in all respects.

DIEHL MFG. CO.,

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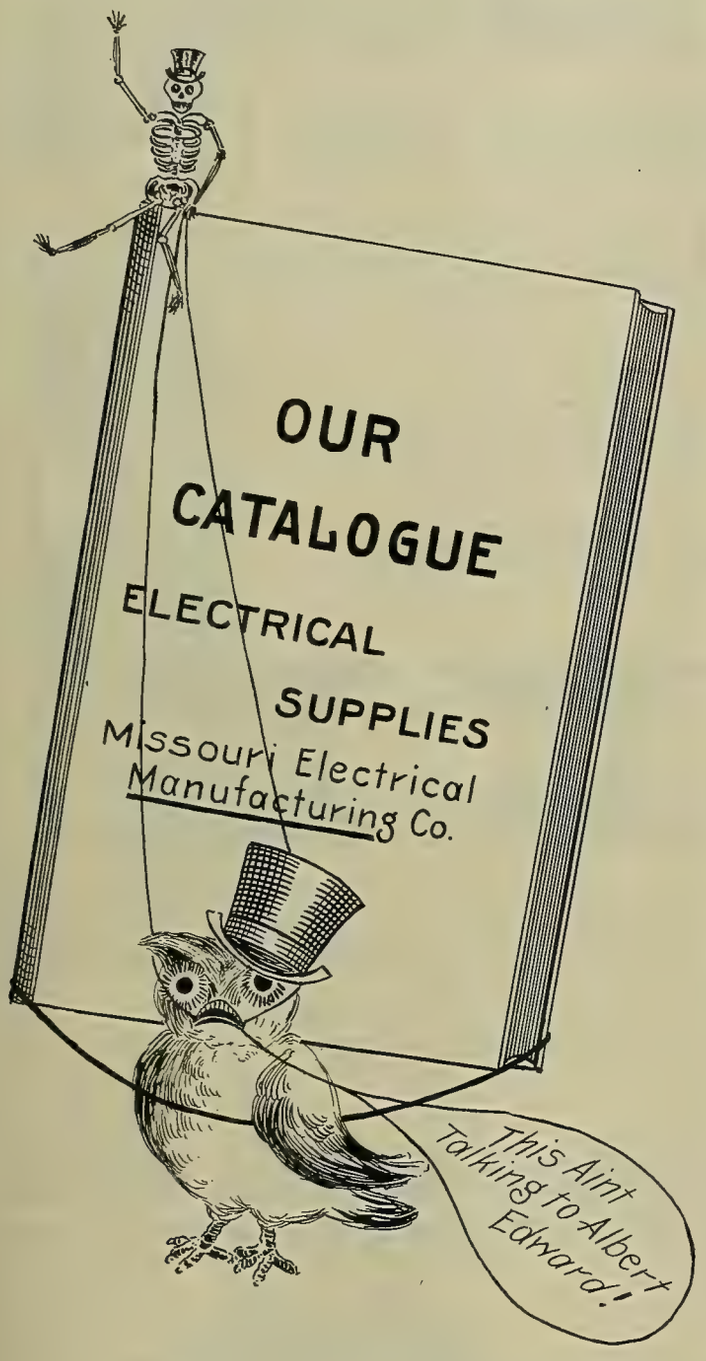
BOSTON, 128-132 Essex St. PHILADELPHIA, W. Irwin Cheyney & Co.
NEW ORLEANS, Newman-Spranley Co., Ltd.

AD STUDIO



WE'RE GOING TO "DRIVE" THAT CATALOGUE ALL OVER THE UNITED STATES—WRITE FOR ONE—AND DON'T FORGET

WE ARE THE—

MISSOURI ELECTRICAL MANUFACTURING CO.

P. D. CABLE, President. F. B. LITTLE, Vice-Pres't. R. W. MOORE, Secretary. W. F. LITTLE, Treasurer.

General Offices, 1216 Washington Avenue, ST. LOUIS, MO.

MAY 17TH

WILL BE PRESS DAY FOR THE FIRST SPECIAL NUMBER OF THE WESTERN ELECTRICIAN, COVERING THE NIAGARA FALLS MEETING OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

COPY FOR ADVERTISEMENTS CANNOT BE RECEIVED AFTER MAY 16th, AND SHOULD BE FORWARDED MUCH EARLIER TO SECURE THE BEST ATTENTION AND GOOD LOCATION. IT IS NOT TOO EARLY NOW TO FORWARD COPY.

THIS SPECIAL INTERNATIONAL NUMBER, BESIDES CIRCULATING THE WORLD OVER, WILL BE MUCH IN EVIDENCE AT THE CONVENTION ITSELF AND AT THE PAN-AMERICAN EXPOSITION, AND WILL CONTAIN MANY SPECIAL FEATURES INTERESTING TO THE DELEGATES AND VISITORS TO THE CONVENTION AND TO THE PAN-AMERICAN EXPOSITION.

MAY 24TH

WILL BE PRESS DAY FOR OUR SPECIAL CONVENTION REPORT NUMBER (COPY RECEIVED UP TO MAY 23d), IN WHICH WILL APPEAR A FULL REPORT OF THE NIAGARA MEETING, INCLUDING A FULL ACCOUNT OF THE PROCEEDINGS, NEWS AND GOSSIP OF THE CONVENTION, NAMES OF THE NEW OFFICERS, AND OF THE DELEGATES AND OTHERS ATTENDING THE MEETING, AND EVERYTHING OF VALUE AND INTEREST RELATING TO THIS NOTABLE GATHERING OF LEADING ELECTRIC LIGHT AND POWER MEN.

BOTH OF THESE NUMBERS WILL BE ILLUSTRATED IN THE WESTERN ELECTRICIAN'S BEST STYLE, AND UNDOUBTEDLY THEY WILL BE THE MOST VALUABLE AND WIDELY CIRCULATED ELECTRIC LIGHT AND POWER NUMBERS ISSUED BY ANY JOURNAL DURING THE ENTIRE YEAR.

BENEFIT YOUR BUSINESS BY PLACING A LIBERAL ADVERTISING ANNOUNCEMENT IN BOTH OF THESE

SPECIAL INTERNATIONAL NUMBERS.

85% Loss 85% Loss 85% Loss 85% Loss 85% Loss

An Endless Chain of Losses!

Electric Light and Power Companies all over the country are losing **85** per cent. of their profits by not utilizing their exhaust steam. Their more progressive brethren, who have installed the ***Holly System of Underground Mains,*** are enabled to pay their *entire coal and labor bill for the year and 6 per cent. on the investment* from the sale of exhaust steam.

Under the circumstances, can you longer afford to turn a deaf ear to our wishes to let us explain our system thoroughly? A word from you will bring facts and figures that will astonish you. Write for our new pamphlet.

AMERICAN DISTRICT STEAM CO.,

Mention Western Electrician. LOCKPORT, N. Y.

85% Loss 85% Loss 85% Loss 85% Loss 85% Loss

85% Loss 85% Loss 85% Loss

American Bridge Company

DESIGNERS
MANUFACTURERS
AND ERECTORS OF

Steel Bridges
Steel Buildings
and All Classes of
Metallic Structures

WE have decided to carry at all our plants a large stock of Raw Material, from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc.

The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

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Baltimore, Md.	East Berlin, Conn.	Pencoyd, Pa.	Trenton, N. J.
Butte, Mont.	Elmira, N. Y.	Philadelphia, Pa.	Wilmington, Del.
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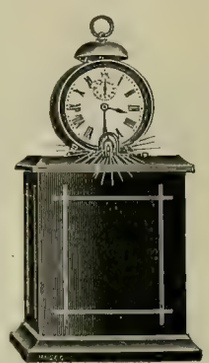
European Office: LONDON

LALIBRIDGE, N. Y., 81-90.

Manhattan Electrical Supply Co.

Manufacturers, Wholesale and Retail Dealers.

MATCHLESS TIME FINDER AND EARLY RISER OUTFIT.



We manufacture a number of styles of early risers, some without the electric light attachment, which are cheaper, yet answer the purpose.

We are the largest manufacturers of General Electrical Supplies in this Country.

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We have completed our Assay Laboratory in conjunction with our Analytical Laboratories—one of the most perfect in the world. All kinds of Assay work; also wet processes in experimental determinations.

WE DO NOT GO OUT INSPECTING. WHEN IN CHICAGO CALL AND SEE US.

DEARBORN DRUG & CHEMICAL WORKS,

27, 28, 29, 30, 31, 32, 33 and 34 Rialto Building, CHICAGO, ILL.

WM. H. EDGAR, President. TELEPHONE, HARRISON 1358 and 1373.

THE GENERAL ELECTRIC COMPANY'S

FOR LINES.

Alternating-Current Lightning Arresters

MAY BE DEPENDED UPON IN A CRISIS.

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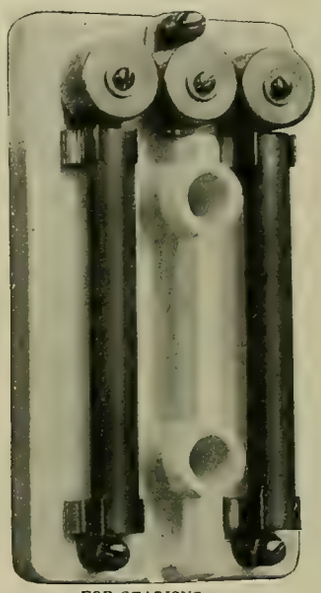

FOR STATIONS.

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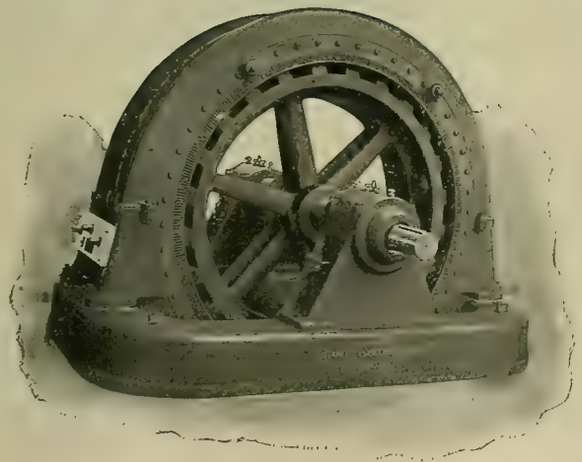
Sales Offices in All Large Cities. Chicago Office, Monadnock Bldg.



Alternating or Direct Current Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co., Pittsfield, Mass.

Northern Electrical Mfg. Co., Madison, Wis.

THIS IS AN ADVERTISEMENT

We wish to call your attention to the Cutmann Integrating Wattmeter, for alternating current. It is the best wattmeter made. Thousands are being sold. You will adopt it when you have tried one. Write us or send trial order.

ELECTRIC APPLIANCE COMPANY,

92-94 West Van Buren St., Chicago.

FUSE

McIntire and American Joints, Fuse Wire, Lightning Arresters, Fuse Blocks.

Cheap, Good. **MAGNET WIRE.** Guaranteed.

TWO BIG STORES.

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We import directly from India and handle the output of the best mines. A large stock constantly on hand enables us to make prompt shipments. ALL OTHER QUALITIES. Prices low.

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Consulting Engineer
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VOLT-AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET.
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Suite 1305, Chemical Bldg., St. Louis.

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Plans and specifications for Electric Lighting and Power Plants. Designer of Electrical Machinery.
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YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, - CHICAGO.

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A handsome, complete and compact catalogue of standard electrical material mailed to the trade upon application. Every article has special merit. Every article is worth your while investigating.

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YOUNG AMERICAN TOOL MAKERS. The GREEN BOOK is full of good Tools. Ask for it.
SMITH & HEMENWAY CO., Utica Drop Forge & Tool Co., 296 Broadway, NEW YORK CITY.

Don't fail to see the McRoy Conduit Exhibit at the Buffalo Exhibition.

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BRAZIL, INDIANA
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THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of **BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES,** FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.

CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.

Columbus Storage Batteries

Are being thoroughly tested in splendidly equipped laboratories of some of the largest electrical manufacturing establishments in the United States. Supply houses, telephone exchanges, universities, etc., are likewise making complete tests. They all confirm the claims which we make for high efficiency, low internal resistance and unusually uniform discharge.

The tests prove conclusively that the cells have a capacity equal to their rating.

The active material will not disintegrate, for, due to the special treatment which it receives, it has a consistency resembling limestone.

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The Columbus Battery and Specialty Co.,

25 N. Scioto St., COLUMBUS, OHIO.

DEWAR BULBS FOR LIQUID AIR

Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

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(General Electric Co.) Harrison, N. J.

JESSE H. PHILLIPS, President. EUGENE F. PHILLIPS, General Manager. E. ROWLAND PHILLIPS, Vice-Pres. & G. B. WAGENSEIL, Treasurer. G. B. REMINGTON, JR., Sec.

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BARE AND INSULATED ELECTRIC WIRE,
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INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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IDEAL AUTOMATIC ANNUNCIATORS.
The Best on the Market.
Write for Prices.
Manufactured by
THE HEATH ELECTRIC CO.,
DETROIT, MICH.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
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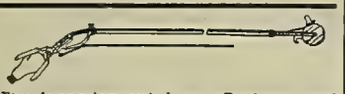
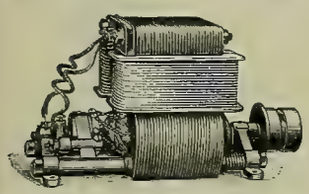
Expansion Bolts

For fastening all kinds of structure to brick and stone work
Patentee and M'f'r. ISAAC CHURCH,
Send for catalogue C. TOLEDO, OHIO.



The Incandescent Lamp Replacer and Cleaner replaces and cleans any c. p. lamp at any height or angle.
Incandescent Electric Light Manipulator Co.,
116 Bedford St., Boston, Mass.

THE FRANKLIN MODEL DYNAMO



10 Volts, 5 Amperes.
Shunt or Series Winding.

We furnish all Castings, Punchings and Materials in sets with Blue-prints and Directions.
To the electrical student, amateur or ingenious person these machines are of the greatest interest, as they furnish practical experience in construction and winding.

WRITE FOR DYNAMO CIRCULAR NO. 16.

PARSELL & WEED, 129-131 West 31st St., New York City.

INSULATED RUBBER WIRES AND CABLES.

JOHN A. ROEBLING'S SONS CO.

WORKS AT
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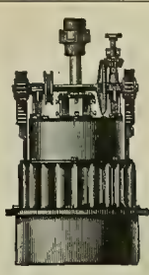
NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.



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On Vertical or Horizontal Shaft.
Especially Adapted for Electrical Work.

Gives a higher percentage of useful effect than any other water-wheel heretofore made. All sizes, right and left hand, are built from patterns perfected under systematic tests in the Holyoke Testing Flume.
Parties having power plants which are unsatisfactory, and those contemplating the improvement of powers, will find it to their interest to confer with us, as we are willing to guarantee results where others have failed, no matter what make of turbine has been in use. STATE REQUIREMENTS AND SEND FOR CATALOGUE.

S. MORGAN SMITH CO., York, Pa.

Smith's Patented Incandescent Lamp Adjuster
AND CONTROLLER.

SIMPLE, NEAT AND ATTRACTIVE.

Adjusts lamp up or down, or throws reflection to side of room, or just where you want it.

THEO. SMITH,
Manufacturer,
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Lock Gravity Drop Annunciator.

Extra heavy, well finished case of ornamental design.
The drops being fastened to the back-board, the case may be removed without disconnecting wires.

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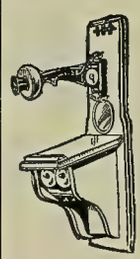

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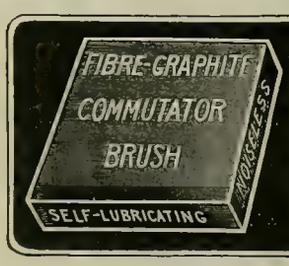

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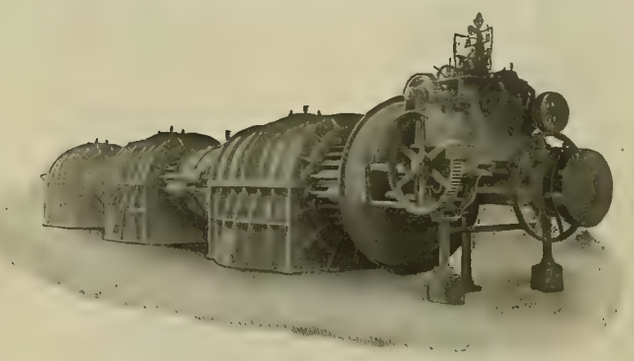

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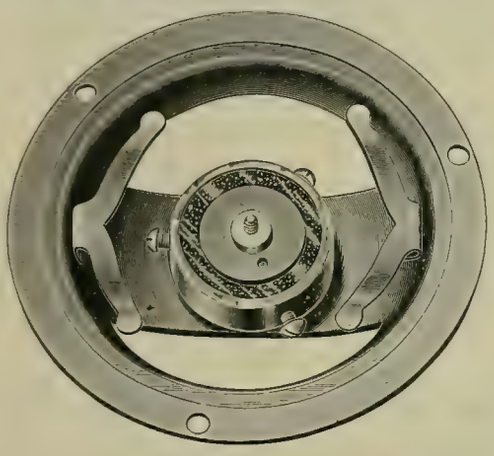

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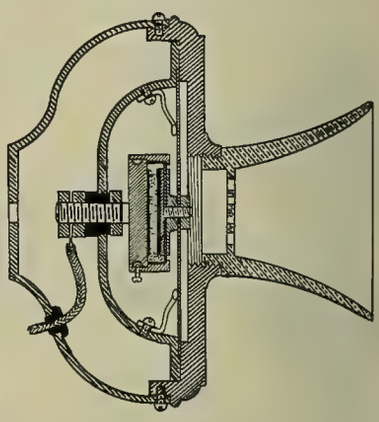

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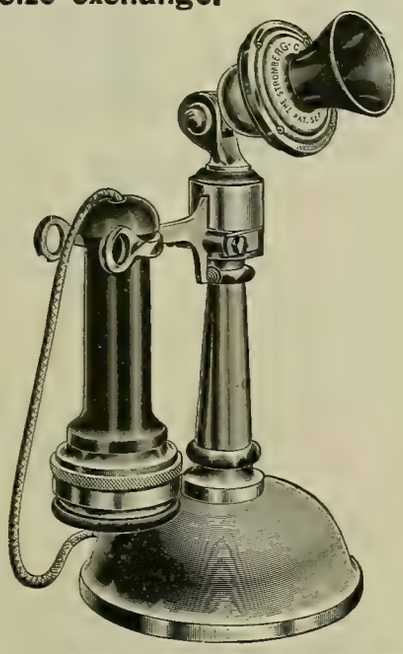

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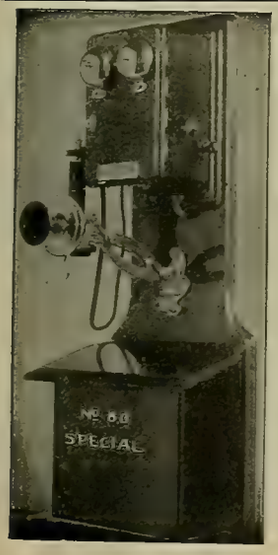

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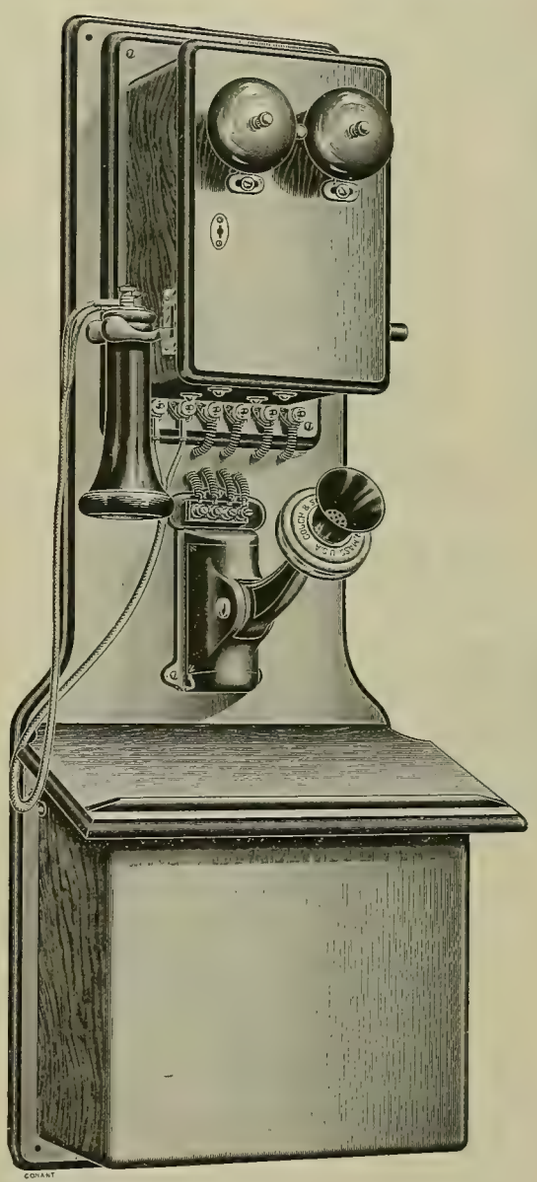

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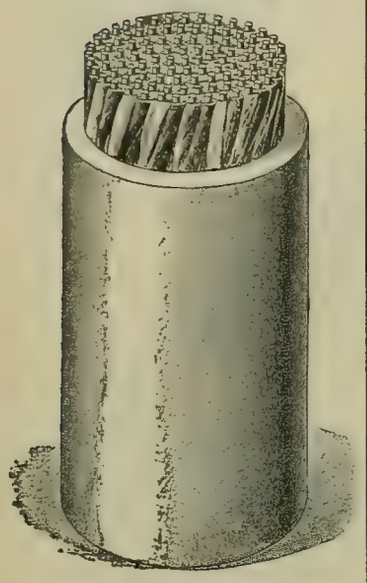

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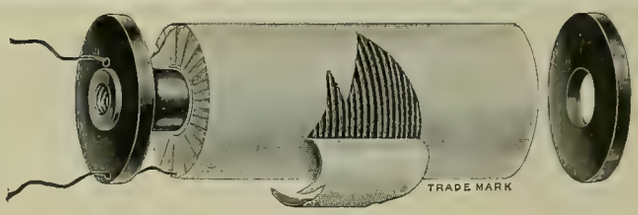

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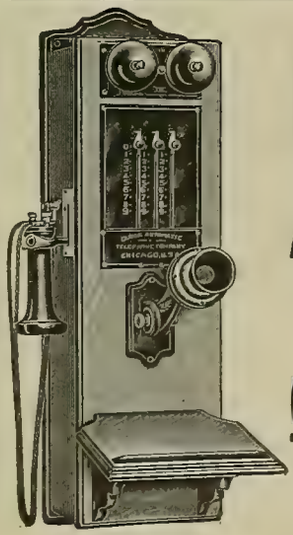

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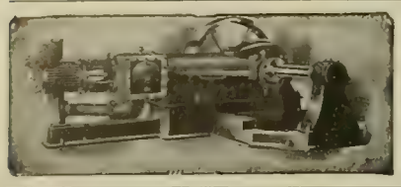

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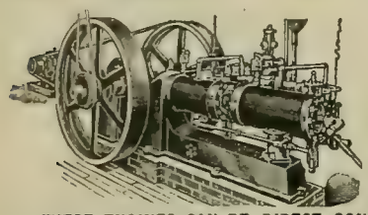

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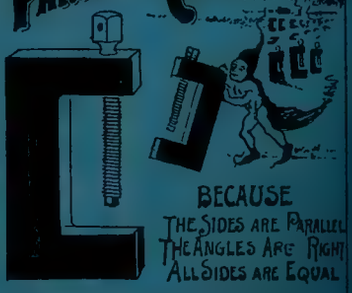

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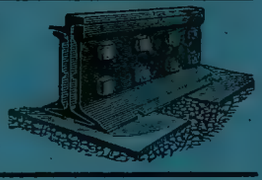

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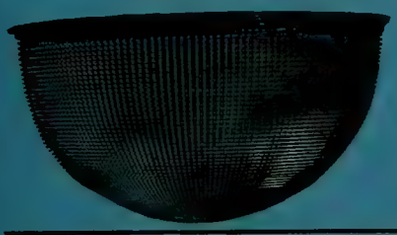

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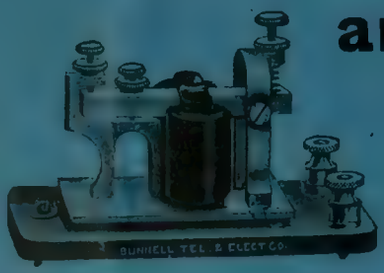

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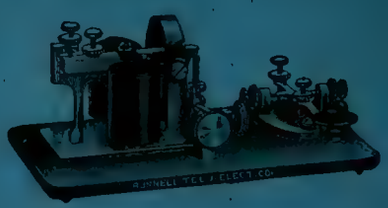

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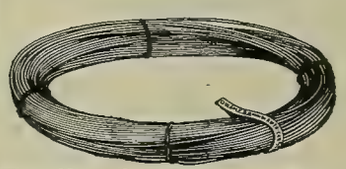

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AVOID SUBSTITUTION of inferior wires by seeing that every bundle is tagged (according to grade) with one of these seals.

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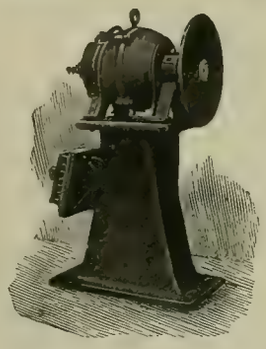

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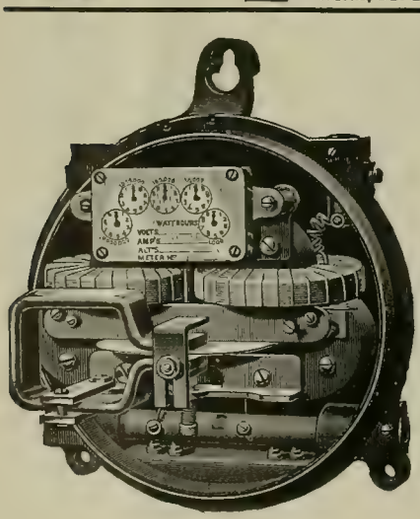

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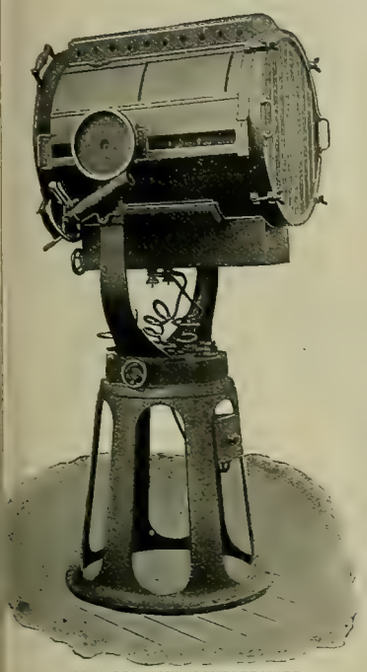
AND

STEAMBOAT HEADLIGHTS



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THE CARLISLE & FINCH CO.,

232 EAST CLIFTON AVE.,

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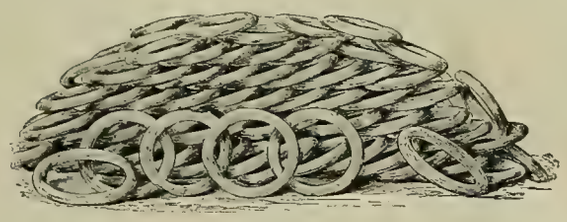

B. W. G.		Ex. BB.	BB.	Steel or Spec.
6	per lb.,	5⅛c	4½c	3½c
8	"	5⅛	4⅛	3⅛
9	"	5⅛	4⅛	3⅛
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12	"	5⅜	4¾	3¾
14	"	5⅝	5	4

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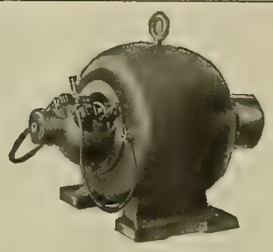
Central Electric Company,

OKONITE TRADE MARK.

264-266-268-270 Fifth Ave., CHICAGO.

OKONITE TRADE MARK.



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1, 2, 3, 5, 7½, 10 H. P.

Cheapness

Appeals to most of men.
Why not to YOU?
Our machines cost MORE to purchase,
But a good deal LESS to maintain.
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Guarantees complete protection from electrolytic action. Makes not only the best, but most inexpensive, subways. Best of insulators. Indestructible. Water, gas and frost proof. 100% better service over wires in them. No induction. 7-foot lengths, 3-inch and 3¼-inch bore. Weighs 2 lbs. to foot. Sizes made from 1½ to 8 inches.

WE BUILD COMPLETE SUBWAYS.

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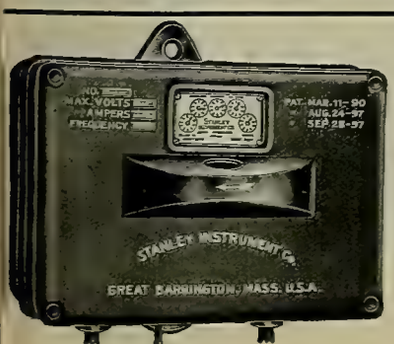
PHILA. PA



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OUR PEERLESS DIRECT CURRENT CEILING FANS

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ENCLOSED ARC LAMPS FOR ALL CIRCUITS.

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Ohio Electric Works.
Western Electric Co.
Western Elec. Supply Co.
Arc Lamps.
Central Electric Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
General Inc. Arc Lt. Co.
Gregory Electric Co.
Helios-Upton Co.
Manhattan Gen'l Const. Co.
Rose Electric Company.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
Automobiles.
DeDion-Bouton Motorette Co.
Lowell Model Co.
Babbitt Metal and Solder.
Gr. Western Sm. and Refg. Co.
Swarts Metal Refining Co.
Batteries and Jars.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Columbus Batt. & Spec. Co.
Edison Mfg. Co.
Edwards & Company.
Electric Appliance Co.
Gordon Battery Co.
Leclanche Battery Co., The
National Carbon Co.
Non-Polarizing Dry Batt. Co.
Ohio Electric Works.
Peru Elec. Mfg. Co
Western Electric Co.
Western Electric Supply Co.
Battery Solution.
Spahr & Swingle.
Bells, Buzzers, Etc.
Bunnell Telegraphic & El Co.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Spies Electric Company.
Western Electric Co.
Western Elec. Supply Co.
Belt Dressing.
Leather Preserver Mfg. Corp.
Belting.
Chicago House Wrecking Co.
Leather Preserver Mfg. Corp.
Blowers.
Sturtevant Co., B. F.
Boilers.
Chicago House Wrecking Co.
Bolts (Expansion).
Church, Isaac.
Books, Electrical.
Electrician Publishing Co.
Hyde & Co., W. H.
Bridges and Buildings (Steel).
American Bridge Co.
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Becker Bros.
Central Electric Co.
General Electrical Repair Co.
Hobart Elec. Mfg. Co.
Holmes Fibre-Graphite Co.
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Cables (See Insulated Wires.)
Cables, Electric (See Insulated Wires) **Copper, Sheet and Bar.**
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Central Electric Co.
General Electric Co.
Missouri Electrical Mfg. Co.
National Conduit & Cable Co.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elect. Supply Co.
Western Electric Company.
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Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
United States Carbon Co.
Western Elect. Supply Co.
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Sargent Co., The.
Smith Co., S. Morgan.
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Jeffrey Mfg. Co.
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Cutter Elec. & Mfg. Co.
Western Electric Company.
Coal & Ashes Handling Machinery.
Jeffrey Mfg. Co.
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Miller-Knoblock El. Mfg. Co.
Varley Duplex Magnet Co.
Western Electric Company.
Compound.
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McLennan & Co., K.
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Western Elect. Supply Co.
Conduit and Conduits.
Amer. Vitrified Conduit Co.
Central Electric Co.
Electric Appliance Co.
Electrolysis Proof Conduit Manufacturing Co.
McRoy, John T.
Richmondt El. Wire Cond. Co.
Sprague Electric Co.
Western Elect. Supply Co.
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Construction & Repairs.
Becker Bros.
Chicago Edison Co.
General Electrical Repair Co.
Parsell & Weed.
Spies Electric Company.
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Beardsley Gravity Dam & Construction Co.
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Sprague Electric Co.
Stanley Electric Mfg. Co.
Warren Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
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Swarts Metal Refining Co.
Copper Wires.
American Electrical Works.
American Steel & Wire Co.
Bridgeport Brass Co.
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Central Electric Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Independent Tel. Supply Co.
Missouri Electrical Mfg. Co.
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Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
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Correspondence Schools
Amer. School of Corresp.
Electrical Engineer Inst.
Int. Correspond. Schools.
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Cross-Arms, Pins and Brackets.
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Central Mfg. Co
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Kartavert Mfg. Co.
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Mogadore Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
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Okonite Co., The.
Peru Elec. Mfg. Co.
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Raven Mining Co.
Simplex Electrical Co.
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Sterling Varnish Co.
Vulcanized Fibre Co.
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American Electrical Works.
American Steel & Wire Co.
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Central Electric Co.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
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National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
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Phillips, Eugene F.
Phillips Insulated Wire Co.
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Standard Underground C. Co.
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Western Electric Company.
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Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
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General Inc. Lamp Co.
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Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
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Crescent Manufacturing Co.
Inc. El. Lt. Manipulator Co.
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Inc. El. Lt. Manipulator Co.
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Klein & Son, Mathias.
Smith & Hemenway Co.
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Diamond Meter Co.
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Mouldings, Electrical.
Wright & Craycroft.
Oiling Systems.
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Robertson & Sons, Jas. L.
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Johnston, Thomas J.
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Berthold & Jennings.
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Fowler, John H.
Hopkins & Co., A. P.
Huebel & Co., C. J.
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Maltby Lumber Co.
Ozan Lumber Company.
Perrizo & Sons.
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Valentine-Clark Co., The.
Wittenberg Cedar Co.
Worcester Co., C. H.
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Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Brunt Porcelain Works, G. F.
Mogadore Insulator Co.
Peru Elec. Mfg. Co.
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Stilwell-Bierce Smith-Vaile.
Pulleys.
Harris Machinery Co.
Rockwood Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
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Continuous Rail Joint Company of America.
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Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Faries Mfg. Co.
Smith, Theo.
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Becker Bros.
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Cutler-Hammer Mfg. Co.
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Harris Machinery Co.
Illinois Maintenance Co.
Matthews & Bro., W. N.
Rose Electric Company.
Schureman & Hayden.
Walsh's Sons & Co.
Shades.
Amer. Reflector & Ltg. Co.
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Pacific Electric Co.
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Central Electric Co.
Edwards & Company.
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Speed Indicators.
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Steel Boxes.
Bossert Elec. Const. Co.
Storage Batteries.
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Columbus Batt. & Spec. Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
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American Bridge Co.
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American Steel & Wire Co.
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New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
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Telegraph Supplies.
Bunnell Telegraphic & El. Co.
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American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Bunnell Telegraphic & El. Co.
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Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel Tel. & El. Mfg. Co., D. A.
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Mason Telep. Pay Station Co.
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National Tel. Equipm. Co.
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White-Washing M'ch's.
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Wire, Bare.
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Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
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Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

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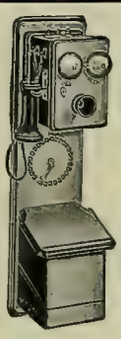

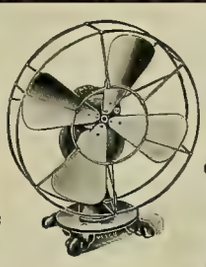

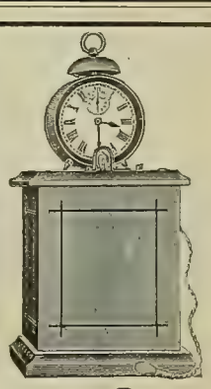

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We are the largest manufacturers of general electrical supplies in this country.

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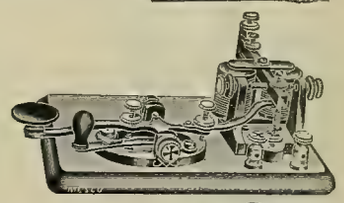
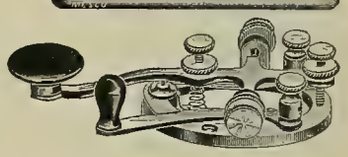

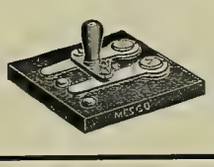

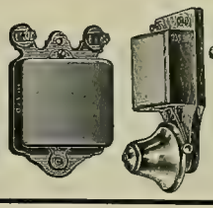
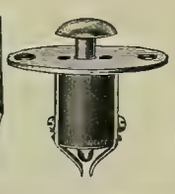
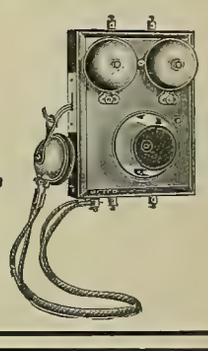

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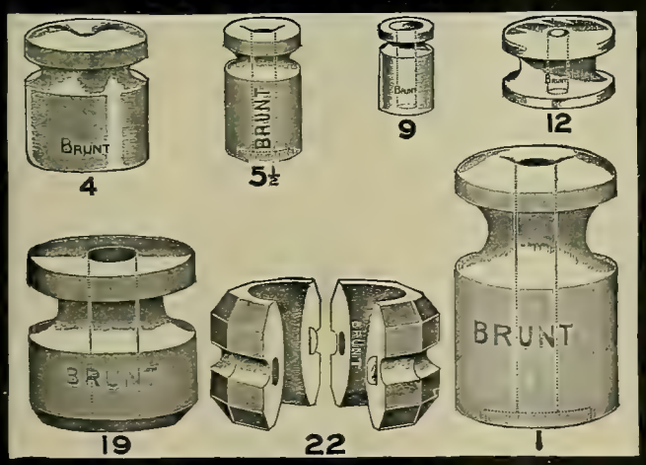

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BLADES ADJUSTABLE WHILE FAN IS IN MOTION.

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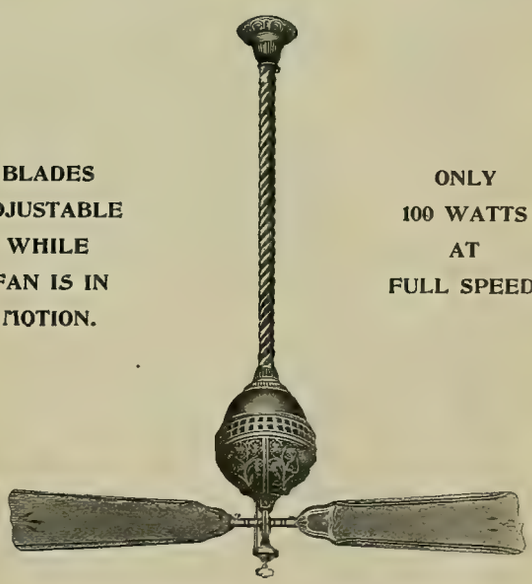

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FOR DIRECT CURRENT.

1901.

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CLEVELAND.

MAY 17TH

WILL BE PRESS DAY FOR THE FIRST SPECIAL NUMBER OF THE WESTERN ELECTRICIAN, COVERING THE NIAGARA FALLS MEETING OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

COPY FOR ADVERTISEMENTS CANNOT BE RECEIVED AFTER MAY 16th, AND SHOULD BE FORWARDED MUCH EARLIER TO SECURE THE BEST ATTENTION AND GOOD LOCATION. IT IS NOT TOO EARLY NOW TO FORWARD COPY.

THIS SPECIAL INTERNATIONAL NUMBER, BESIDES CIRCULATING THE WORLD OVER, WILL BE MUCH IN EVIDENCE AT THE CONVENTION ITSELF AND AT THE PAN-AMERICAN EXPOSITION, AND WILL CONTAIN MANY SPECIAL FEATURES INTERESTING TO THE DELEGATES AND VISITORS TO THE CONVENTION AND TO THE PAN-AMERICAN EXPOSITION.

MAY 24TH

WILL BE PRESS DAY FOR OUR SPECIAL CONVENTION REPORT NUMBER (COPY RECEIVED UP TO MAY 23d), IN WHICH WILL APPEAR A FULL REPORT OF THE NIAGARA MEETING, INCLUDING A FULL ACCOUNT OF THE PROCEEDINGS, NEWS AND GOSSIP OF THE CONVENTION, NAMES OF THE NEW OFFICERS, AND OF THE DELEGATES AND OTHERS ATTENDING THE MEETING, AND EVERYTHING OF VALUE AND INTEREST RELATING TO THIS NOTABLE GATHERING OF LEADING ELECTRIC LIGHT AND POWER MEN.

BOTH OF THESE NUMBERS WILL BE ILLUSTRATED IN THE WESTERN ELECTRICIAN'S BEST STYLE, AND UNDOUBTEDLY THEY WILL BE THE MOST VALUABLE AND WIDELY CIRCULATED ELECTRIC LIGHT AND POWER NUMBERS ISSUED BY ANY JOURNAL DURING THE ENTIRE YEAR.

BENEFIT YOUR BUSINESS BY PLACING A LIBERAL ADVERTISING ANNOUNCEMENT IN BOTH OF THESE

SPECIAL INTERNATIONAL NUMBERS.

...INTRODUCTORY...

MERCANTILE ELECTRIC CO.

CUPPLES STATION, 810-812 SPRUCE ST.,

SAINT LOUIS,

Exclusive Agents of the

WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

Introduce Their Business and Its Advantages to Users of General Electrical Supplies.

DYNAMOS For Lighting and Power Purposes for Central and Isolated Plants, for Municipal Series Arc Lighting Systems.

"QUALITY OF SUPPLIES AND PROMPT SERVICE."

MERCANTILE ELECTRIC CO.,

CUPPLES STATION, 810-812 SPRUCE ST.,

SAINT LOUIS.

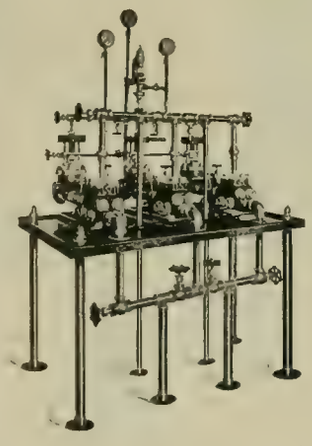
YOU TAKE NO CHANCES WHEN YOU BUY

THE SIEGRIST SYSTEM

WE HAVE EQUIPPED THE FOLLOWING PLANTS:

Metropolitan West Side Elevated Railway Co., Chicago, Ill.
St. Louis Transit Co., St. Louis, Mo. (3 Plants, 450,000 H. P.)
McCormick Harvesting Machine Co., Chicago, Ill. (2 Plants.)
Missouri Edison Electric Co., St. Louis, Mo. (2 Plants.)
Cudahy Packing Company, Kansas City, Mo.
Union Gas & Electric Co., Bay City, Mich.
B. F. Goodrich Company, Akron, Ohio.
Grand Crossing Tack Company, Grand Crossing, Ill.
Diamond Rubber Company, Akron, Ohio.
Armour Packing Company, Kansas City, Mo.
Milwaukee Harvester Company, Milwaukee, Wis.
Cleveland Electric Illuminating Co., Cleveland, Ohio.
Lacombe Electric Company, Denver, Colo.
Atlanta Railway & Power Co., Atlanta, Ga.
Elgin National Watch Co., Elgin, Ill.
Honolulu Rapid Transit and Land Co., H. I.
Imperial Electric Light, Heat & Power Co., St. Louis, Mo.
Armour & Company, South Omaha, Neb.
St. Joseph Railway, Light, Heat & Power Co., St. Joseph, Mo.
Havana Electric Railway Co., Havana, Cuba.
Anheuser-Busch Brewing Association, St. Louis, Mo.
Memphis Light & Power Co., Memphis, Tenn.
The Laclede Power Co., St. Louis, Mo.
Boston Elevated Railway Co., Boston, Mass.
Parsons Pulp & Paper Co., Parsons, W. Va.
Singer Manufacturing Co., Elizabethport, N. J.
Kingan & Company, Ltd., Indianapolis, Ind.

WRITE TO ANY OF THE ABOVE USERS AND SEE WHAT THEY HAVE TO SAY, OR ADDRESS SIEGRIST LUBRICATOR CO.



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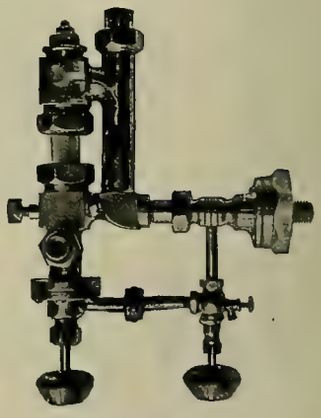
Automatic Oil Cup.



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It matters not what you THINK it is.
WRITE US
State size of plant and type of boilers; also send a gallon of Water for Analysis; our charge for Analysis of water is $10.00 but if favored with your order for a suitable compound, this charge will be cancelled.
Our LABORATORY is the place to decide your trouble. Call and see it or write us.

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27, 28, 29, 30, 31, 32, 33 and 34 RIALTO BUILDING,
CHICAGO, ILL.
WM. H. EDGAR, President. Telephone Harrison 1373 and 1358.

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MAY BE DEPENDED UPON IN A CRISIS.

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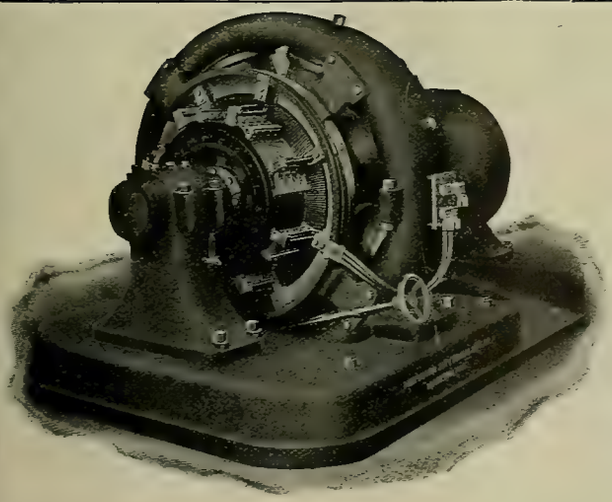

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Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

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ONE

JUST ONE ADAMS-BAGNALL arc lamp on trial order will allow you to become acquainted with it to a greater degree than all the advertising we can do. Suppose it does cost a little more. You don't want bargain-counter arc lamps, but the best.

We have many different kinds and will send literature regarding them if you wish it.

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DEWAR BULBS FOR LIQUID AIR

Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
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A SEMI-FIREPROOF INSULATION OF VERY HIGH RESISTANCE AND GREAT MECHANICAL EFFICIENCY

MICA INSULATOR COMPANY
"ORIGINATORS"
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ENGINEERING.

HERBERT A. WAGNER,
Consulting Engineer
Railway Lighting and Power Plants,
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VOLT-AMMETERS,

POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
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CENTRAL LIGHTING STATIONS,
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Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
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Like the Street Car.
"There is always room for one more" cable in McRoy Conduits

McROY CLAY WORKS
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THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.
CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.

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MANUFACTURERS OF
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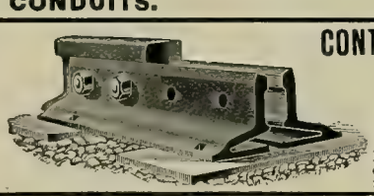
BRASS AND IRON.



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Millions in use on One Hundred and Forty-Five (145) railroads in the United States, on over Seven Thousand Five Hundred (7,500) miles of track.

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Is entirely encased in iron and is weather-proof. The mechanism is very powerful and gives 375 blows to each winding. Continuous ringing or single stroke.

"Clover Leaf" Test Battery.

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ARE ALWAYS ABREAST WITH
MOST ADVANCED SCIENCE.
WE ARE SPECIALISTS IN MEASUREMENT.
WE MAKE A FULL LINE OF
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Get on our mailing list; it is a liberal education. Circulars constantly being issued.
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The Franklin Model Gas Engine.
½-HORSE POWER. 450 REVOLUTIONS.
We furnish complete sets of Castings, Materials and Blue Prints for either horizontal or vertical types.
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Smith's Patented Incandescent Lamp Adjuster
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SIMPLE, NEAT AND ATTRACTIVE.

Adjusts lamp up or down, or throws reflection to side of room, or just where you want it.

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NEW TYPE
"Bug Proof"
RINGS WELL, LOOKS SWELL, SELLS WELL.
WRITE FOR PRICES.
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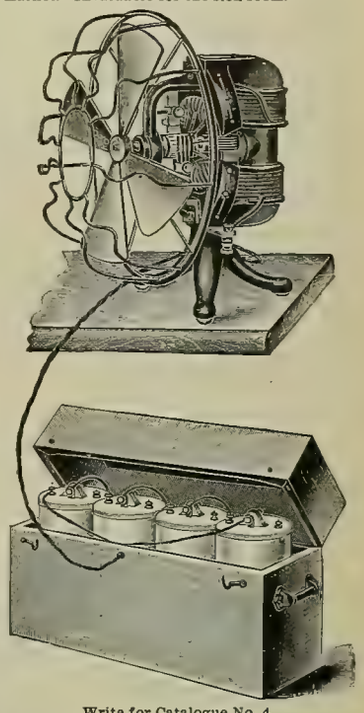
BATTERY FAN OUTFITS
...WITH...
EDISON LALANDE CELLS
Are the only efficient battery fan outfits on the market. Invaluable for the sick room.



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FOR STREET RAILWAYS, POWER AND LIGHTING PLANTS, FOR ELECTRICAL VEHICLES, TELEGRAPH, TELEPHONE AND ELECTRIC ELEVATORS.

BATTERY SUPPLIES AND REPAIRS. We make very low prices for repairs of batteries manufactured by the Electric Storage Battery Company. Send us dimensions of plates required and the number and we will make you a quotation that will save you money. We will guarantee that our plates can be used with better results in installations of the Electric Storage Battery Co. than the plates of their own manufacture. To sustain our claims we refer you to the Kansas City Electric Light Company, who have a large installation, manufactured and installed by this Company.

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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.
Prices and Samples on Application.

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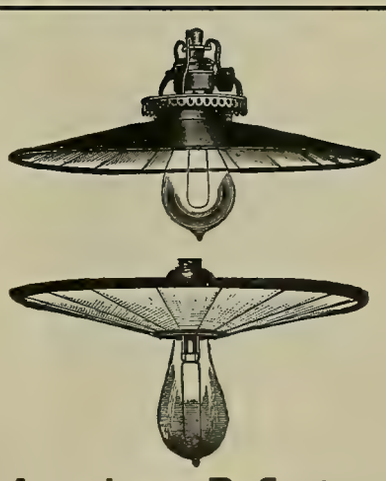

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A flat Reflector, for use with any system of incandescent electric light, where it is desired to spread the light considerably. Its silver-plated mirror plate lining makes it most effective and pleasing, and always as good as new.

Convex, reflecting slightly below the horizontal in all directions. Used in stores, etc., for general illumination.

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Partner or company wanted with some money to extend and complete an A1 Mutual Telephone plant in Iowa. All new and paying 18%. We invite close investigation. Or would not object to going into a mutual consolidation on equitable terms, which we believe could be effected by, and made to pay in, our vicinity. Address "TELEPHONE," care Western Electrician, 510 Marquette Bldg., Chicago.

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A man of experience to superintend construction of telephone system. A permanent position to the right man. Address, with references, THE HILLSBORO TELEPHONE CO., Hillsboro, Ohio.

WANTED, AT ONCE.

Two good all-around telephone men, wages $2.00 per day. Also three good telephone girls to operate switchboard, wages $15.00 per month and board. One girl to keep books and attend switchboard, practical operator preferred, wages from $20.00 to $25.00 per month and board. Address FINCH TELEPHONE EXCHANGE, Geo. W. Finch, prop., rooms 3 to 7 Daley Block, Escanaba, Mich.

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Position wanted by an industrious, well educated and temperate young man, with some good contracting or construction company where Sunday work is not required. Over two years' experience in electric plant work. Good references. Address "C," care Western Electrician, 510 Marquette Bldg., Chicago.

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First-class experienced mechanical draftsmen wanted at once; some of them acquainted with electrical work. Those with shop experience preferred. Apply by letter to Chief Draftsman, P. O. Box 911, Pittsburg, Pa., stating experience in full and giving references.

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150,000 pounds second-hand insulated copper wire, sizes 6, 8 and 10. G. MATHES' SONS RAG COMPANY, 1533 No. Broadway, St. Louis, Mo.

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High Speed Engine Bargains

No.	H. P.	Maker.	Cylinders.
1	200	Buckeye	16¼ x 27
1	90	Atlas C.	14 x 20
1	75	Westinghouse	12 x 11
1	65	Beck-Taylor	10¼ x 12
1	60	Ball	10 x 12
1	40	A. & S.	8½ x 12

Camp Engineering Co., 47 W. Lake St., Chicago, Ill.

TO AVOID MOVING TWICE,

We will make especially low prices on the following apparatus for a few days:

One 50 k. w. multipolar, Excelsior, 125-volt Generator, direct-connected to a New York Safety Engine, 12 x 13, practically new.
One 75 k. w. 125-volt multipolar, American Ball Generator, direct-connected to an American Ball Engine, complete with sub-base, used three months.
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Two 100 k. w. 6-pole, Triumph, 110-volt Generators.
Two 50 k. w. Triumph, multipolar, 110-volt Generators.
Two 50 k. w. Jenney, bipolar, 110-volt Generators.
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One 250 h. p. Worthington Water-tube Boiler, good for 135 pounds Hartford.
Three 100 h. p., 60 x 18, Phœnix Boiler, good for 95 pounds Hartford.
Write for Price-list No. 43 for other apparatus.

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Boilers, engines, pumps, iron and wood working machinery. Saw and planing mills a specialty. Pulleys, shafting, hangers, boxes, gearing, belting, etc. Everything guaranteed as represented. Our prices are the lowest. HARRIS MACHINERY CO., Minneapolis, Minn.

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Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
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220-250 volt Generators.
One 9-k. w. Gibbs multipolar.
One 12-k. w. Card.
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One 25-k. w. C & C.
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Send for our **Monthly Bargain Sheet,** with net prices on machines in stock at our works. All apparatus fully guaranteed.

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150 hard rubber cells, 7x7x10¼ inches. THOMAS ALEXANDER, 188 E. Randolph St., Chicago.

A NOVELTY!

Universal Cord Spools

Offer so many advantages that everybody wants them.

They are Cheap, Strong and Ornamental. Finished in Cherry, Green, Mahogany, Black Enamel and Natural Wood.

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Eastern Depot:
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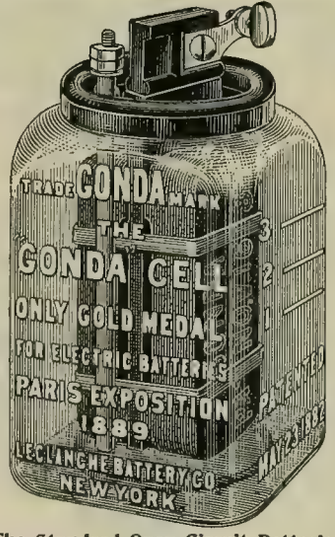

The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,
111 to 117 East 131st St., N. Y.

ALL ARC LAMPS, $3.00.

DIRECT CURRENT:
T.-H., M 2, K 2 and Type D; Wood, single clutch; Brush, double; W. E., 14 hour; American, single; Ball, double.
ALTERNATING CURRENT: Helios, No. 3; Helios, No. 4; Helios, No. 5; A. B., No. 6.
ROSE ELECTRIC CO., ST. LOUIS, MO.

400 "Used" Outriggers, good as new, complete with Eddy Windlass and Bracket shown in cut. By using our Outrigger you can save Pole and Suspension Pulleys—Strand for Suspension and get a GOOD Windlass and Iron Bracket free. Our price is very little more than twice the cost of new Windlass alone.

Also 150 Miles No. 6 "Used" W. P. Copper Wire.
175 Miles No. 10 "Used" W. P. Copper Wire.

Subject to previous sale at 15c. per lb. for 6, and 16c. for No. 10. No orders accepted for less than 500 lbs.

This Wire has all been thoroughly overhauled, the bad places in the insulation cut out and soldered and taped connections made where necessary.

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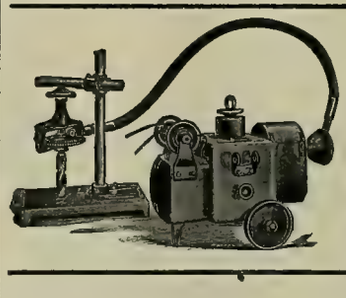
W. N. MATTHEWS & BROS.

320 N. 6th Street, ST. LOUIS.



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COMBINATION OF

Stow Flexible Shaft

—AND—

MULTI-SPEED MOTOR.

Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

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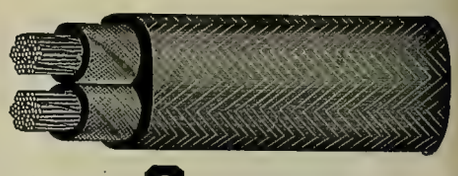
INSULATED RUBBER WIRES AND CABLES.



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WORKS AT TRENTON, N. J.

SCRAP COPPER
WANTED

We pay highest market prices for old copper wire. Electric light and electric railway managers who desire to realize on material of this kind will find it to their advantage to communicate with us.

CHICAGO'S LEADING METAL HOUSE. ESTABLISHED 1885.

SWARTS METAL REFINING CO.,

References: { Foreman Bros. Banking Co., Dun's Agency, Bradstreet's Agency.

Office and Works: 20 & 22 N. Des Plaines St., Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION

Niagara Falls, New York, May 21-24, 1901.

ROUTE: The Wabash R. R., "The Niagara Falls Short Line."

RATE: Fare and one-third ($16.00 from Chicago) on the Certificate Plan.

ACCOMMODATIONS: Finest Pullman Sleeping Cars and Wabash Dining Car.

TRAIN SERVICE: Party will leave Chicago on Wabash No. 6, leaving 3:15 P. M., May 20, arriving at Niagara Falls next morning at 7 o'clock.

For Tickets and Sleeping Car Reservations, Call on

N. C. KEERAN,

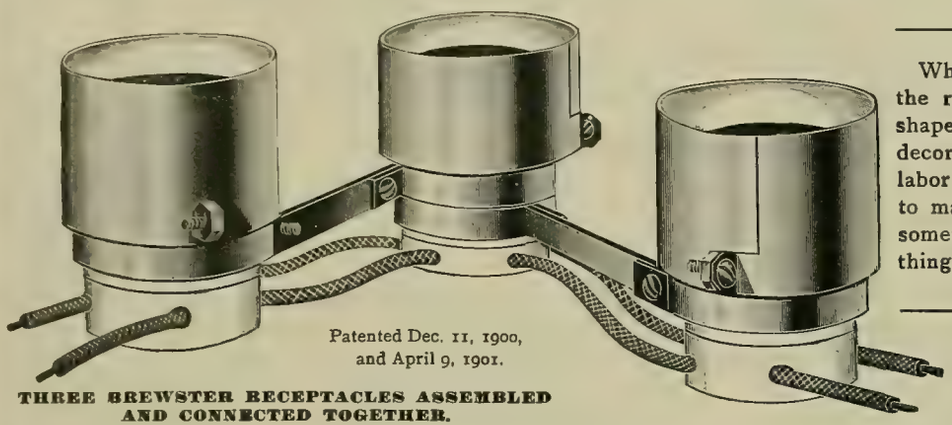
Wabash City Office, 97 Adams Street.

BREWSTER UNIVERSAL SIGN RECEPTACLES.

A SYSTEM OF UNITS

From which may quickly be formed, wired and installed anything in the shape of thoroughly weatherproof

ELECTRIC SIGNS or ELECTRICAL DECORATIONS of any style or variety.



Patented Dec. 11, 1900, and April 9, 1901.

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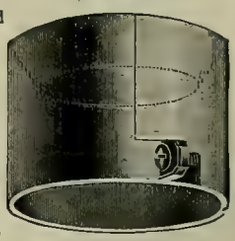

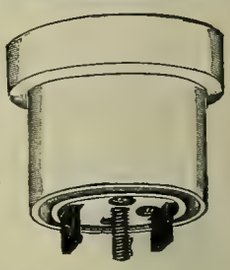

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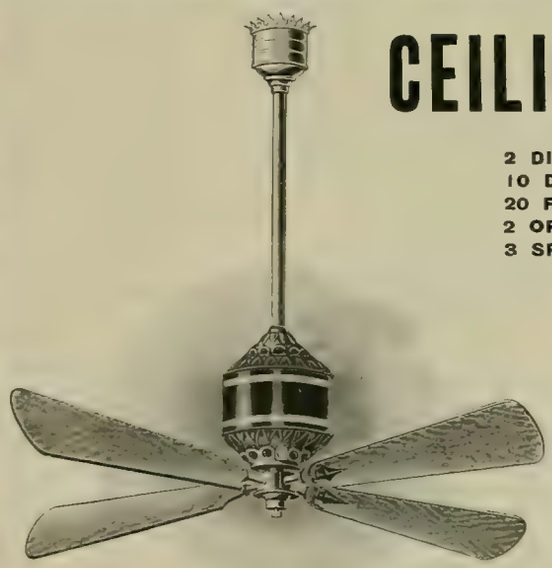
To suit all conditions and any voltage on direct current circuits.



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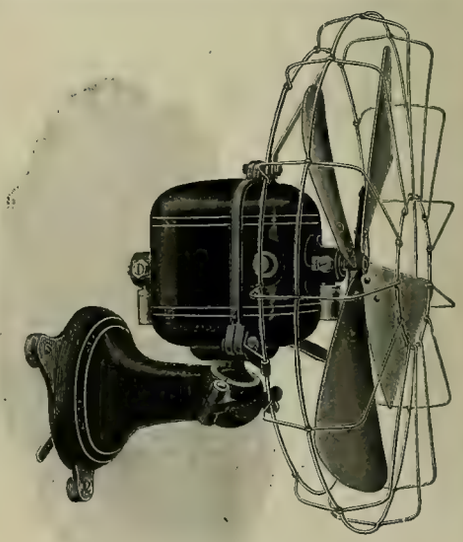

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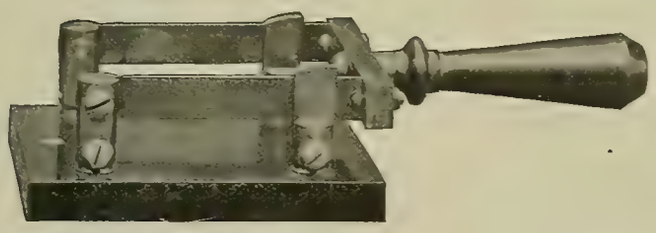
WESTERN KNIFE SWITCH.



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For 110 and 220 Volt Circuits.

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Trade No.	Amperes.	Price.	Code Word.	Price.	Code Word.	Price.	Code Word.
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19364	50	1.25	Strawcutter	1.75	Streamlet	2.30	Strengthening
19365	75	1.70	Streak	2.80	Street	3.90	Stress
19366	100	3.00	Streaked	4.90	Streetward	7.35	Strew
19367	150	4.80	Stream	8.25	Strength	12.38	Strewing

FUSE CONNECTIONS.

SINGLE POLE.				DOUBLE POLE.		TRIPLE POLE.	
Trade No.	Amperes.	Price.	Code Word.	Price.	Code Word.	Price.	Code Word.
19368	25	$1.30	Strewment	$ 1.30	Stride	$ 2.10	Strike
19369	50	1.90	Stricken	2.25	Striding	3 00	Striker
19370	75	2.55	Strict	3.85	Strife	5.20	Striking
19371	100	4.50	Strictly	6.50	Strifeful	9.80	String
19372	150	7.20	Strictness	10.80	Strigment	16.50	Stringboard

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19376	10 "	" " " 3.00	Stroke

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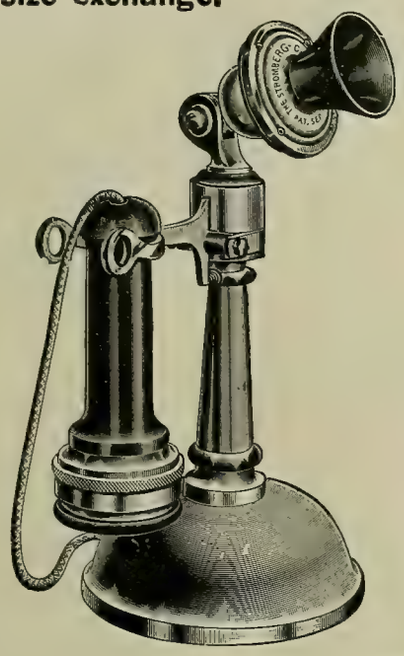

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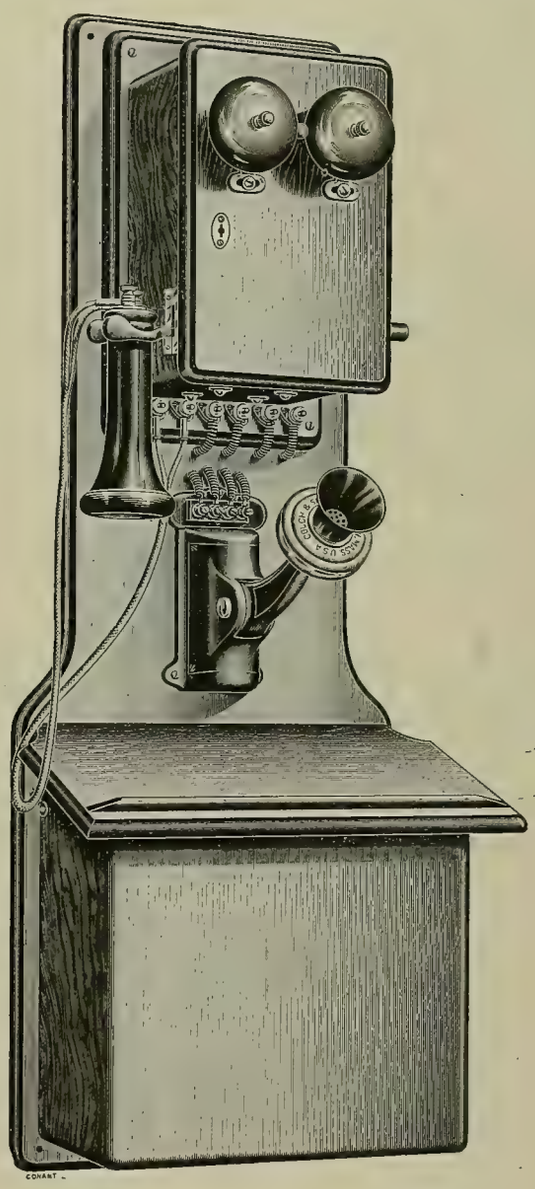

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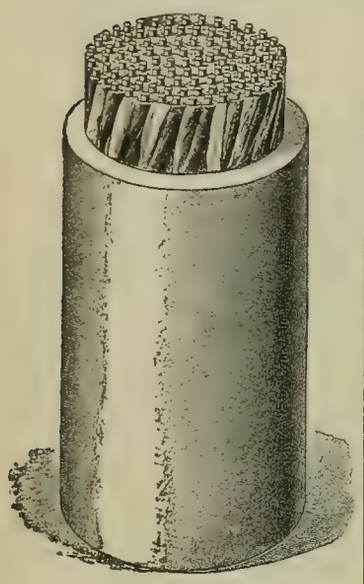

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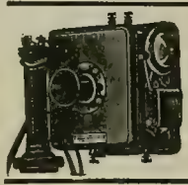

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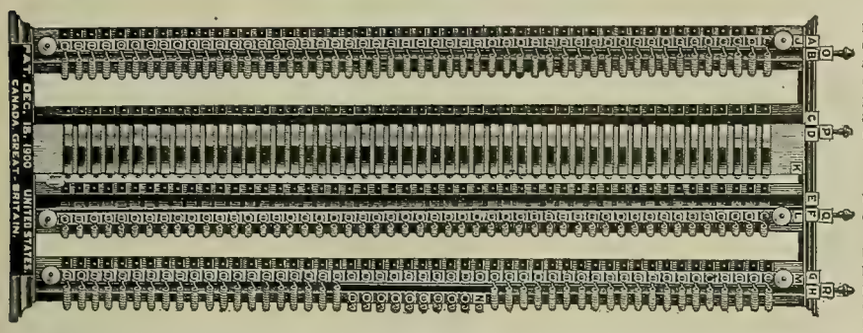

On the 18th day of December 1900, the United States Government granted a patent to the undersigned which, in the opinion of every practical man who has examined it, is the safest, surest and most complete protection to electrical apparatus, and more especially to telephone switchboards and telephone property generally, that has ever been attempted. This patent is known as an "ELECTRIC SWITCH," patent No. 664,061, and has recently been patented in foreign countries.

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First: Instead of the universal annoying disadvantage of the uncertain contact of the old style screw and washer, a certain safe and sure contact is secured.

Second: All practical men realize that no lightning arresters nor diverters of high pressure currents give perfect immunity from damage and destruction to switchboards and telephone property; this device makes all such property as safe as any other property. Under the old style, the tedious labor, and the long time required to disconnect the conductors, made it practically impossible to do so, and for these reasons failed absolutely to avert serious loss. The damage in nine cases out of ten had been sustained before the switchboards could possibly be disconnected. With this switch one thousand subscribers can be easily disconnected within ten seconds, and every conductor grounded, making the telephone property as well as the building perfectly secure. Another strong feature of the invention is that every conductor can be as quickly connected as disconnected, requiring no loss of time whatsoever. The switch is as readily attached to metallic circuits as to common returns, and ground and wire.

Fourth: The very strongest feature of this important invention, and the one of paramount importance to all telephone property holders, is the quick and sure means to shield telephone property positively and without doubt from the storm, and to obviate terrific damage and often absolute destruction, for however appalling the storm, and however distressing the anxiety and the solicitude for the exchange, the most obtuse and inexperienced operator can instantly disconnect and ground every conductor of the exchange. Again, we care not what voltage from arc circuits or from trolley lines are poured into the exchange, this switch diverts the currents to earth, and all is safe. This fact being true, it is worth many times more than its cost for the quietude and peace of mind it affords. Surely, from a business and commercial standpoint, no exchange can afford to be without this safeguard to valuable property.

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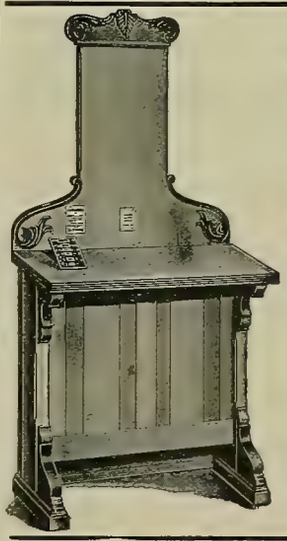

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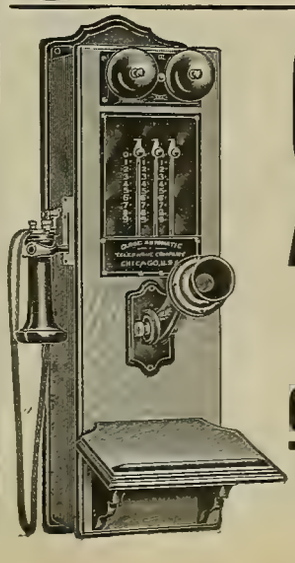

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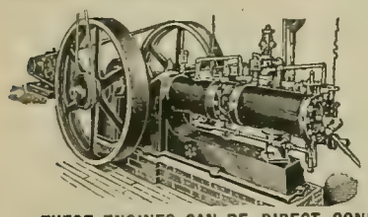

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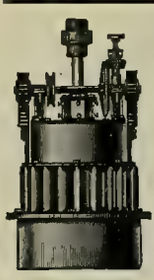

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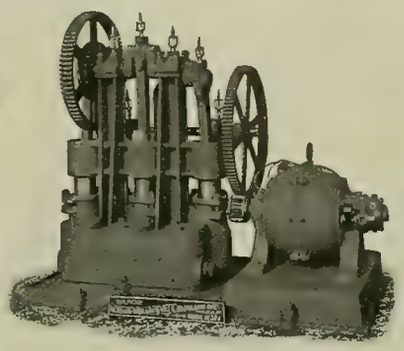

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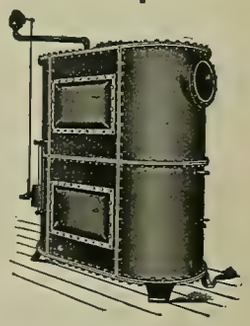

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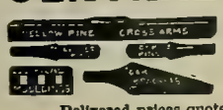

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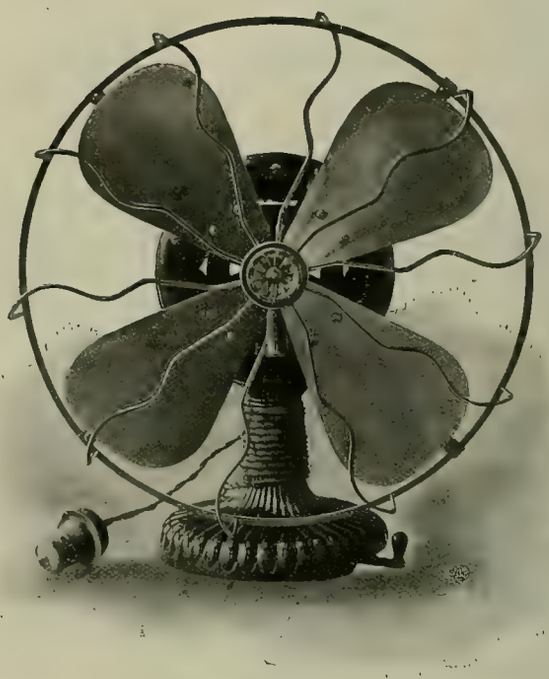

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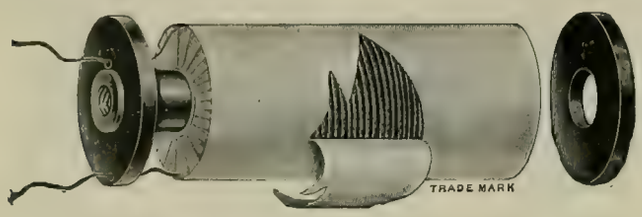

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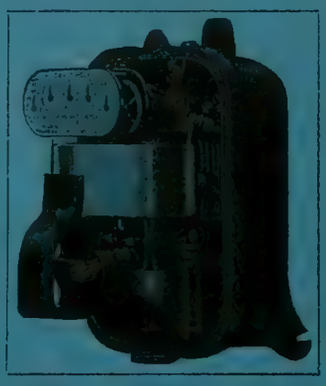

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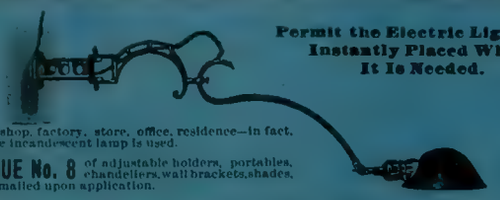

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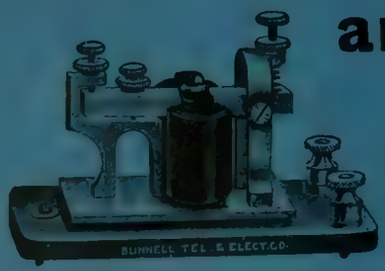

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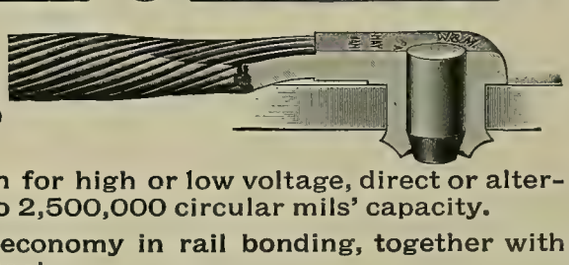

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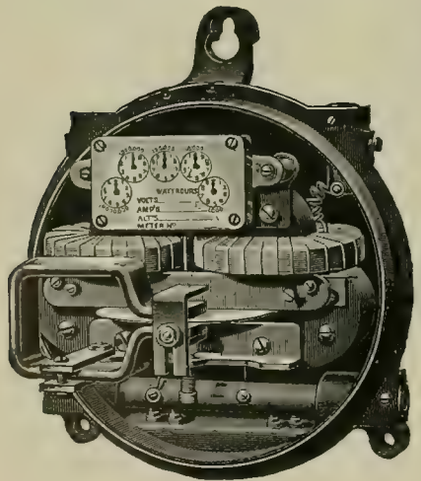

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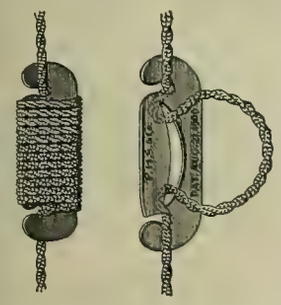

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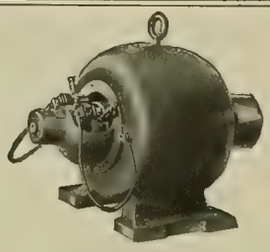

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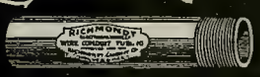

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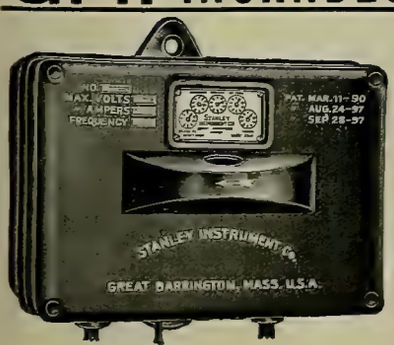

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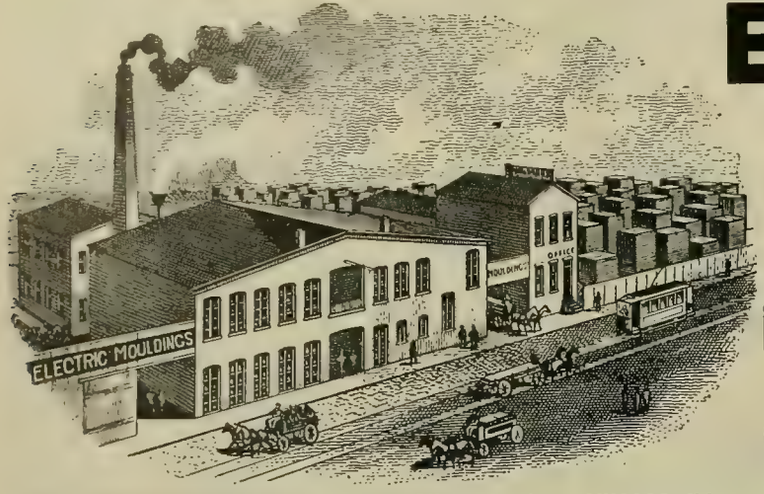

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Western Electric Company.
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Bissell Company, The F.
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Columbus Batt. & Spec. Co.
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Worcester Polytechnic Inst.
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Independent Tel. Supply Co.
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Kartavert Mfg. Co.
Mica Insulator Co.
Missouri Electrical Mfg. Co.
Mogadore Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Peru Elec. Mfg. Co.
Phillips Insulated Wire Co.
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Western Elect. Supply Co.
Westinghouse El. & Mfg. Co.
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American Electrical Works.
American Steel & Wire Co.
Bunnell Telegraphic & El. Co.
Central Electric Co.
Electric Appliance Co.
General Electric Co.
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New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
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Western Electric Company.
Junction Boxes.
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Mouldings, Electrical.
Wright & Craycroft.
Packing.
Besly & Co., Chas. H.
Robertson & Sons, Jas. L.
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Johnston, Thomas J.
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American El. Telephone Co.
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Bissell Company, The F.
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Century Telephone Const. Co.
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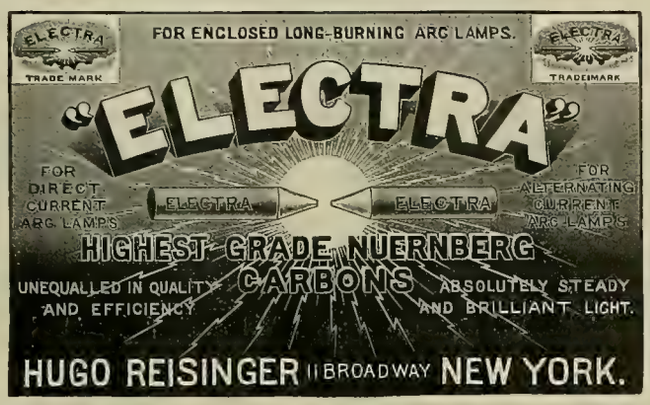
The "Electra" Carbons are the recognized standard all the world over.



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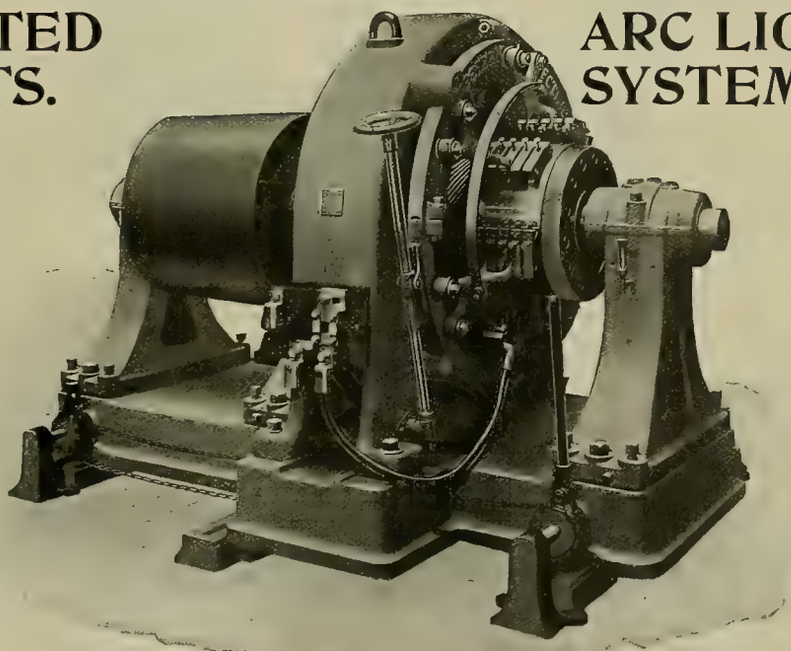

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PHILADELPHIA, 933 Market Street. STANDARD ELECTRIC CO., Cincinnati, Ohio. CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.
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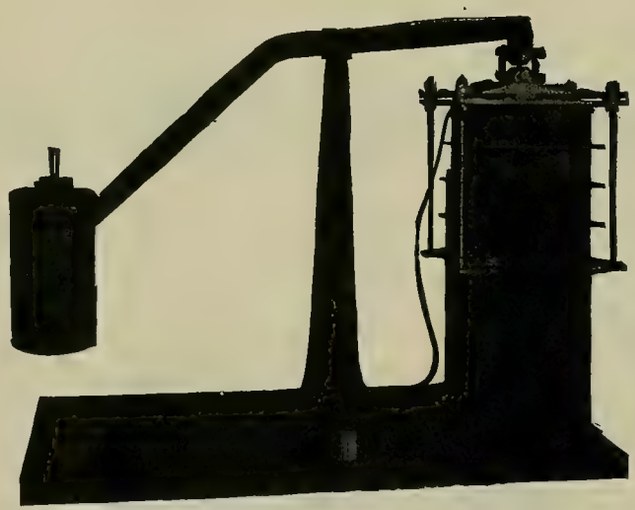
A·C·SERIES
ENCLOSED ARC SYSTEM

Highest Efficiency and Power Factor



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THE IDEAL FLEXIBLE CONDUIT

Approved by all Official Boards of Inspection

Throughout the United States

Indorsed and Used by the Leading Engineers

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Entirely NEW Types of
COOL BREEZE
Apparatus of Artistic Designs, Superior Workmanship and Modern Construction.

VENTILATING CHANDELIER.
Suitable for hotel sleeping rooms, cafés and large apartments.

ADJUSTABLE

BANQUET FANS

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New Departure Desk Fans.

Used as a Substitute for Ordinary Desk Fans and Especially Constructed for Hotels and Restaurants to be Placed on the Banquet Table.

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THIS IS OUR STANDARD

Northall Swinging Cover Enclosed Arc Lamp, which opens like this, simply by pressing a spring, and closes with a snap.

BUT

HOW'S THIS FOR A BABY?

If you want one I know where you can get it.

Just write

The Lea Electric Mfg. Co.,
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HIGH-GRADE PORCELAIN TUBES

300 DIFFERENT LENGTHS AND SIZES

SHOW HIGHEST TESTS YET MADE ON TUBES.

BATTERY BUSHINGS IN ALL SIZES.

ASK YOUR DEALER FOR "BRUNT" TUBES, INSULATORS AND CLEATS.

THEY COMPLY WITH THE UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

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EAST LIVERPOOL, OHIO.

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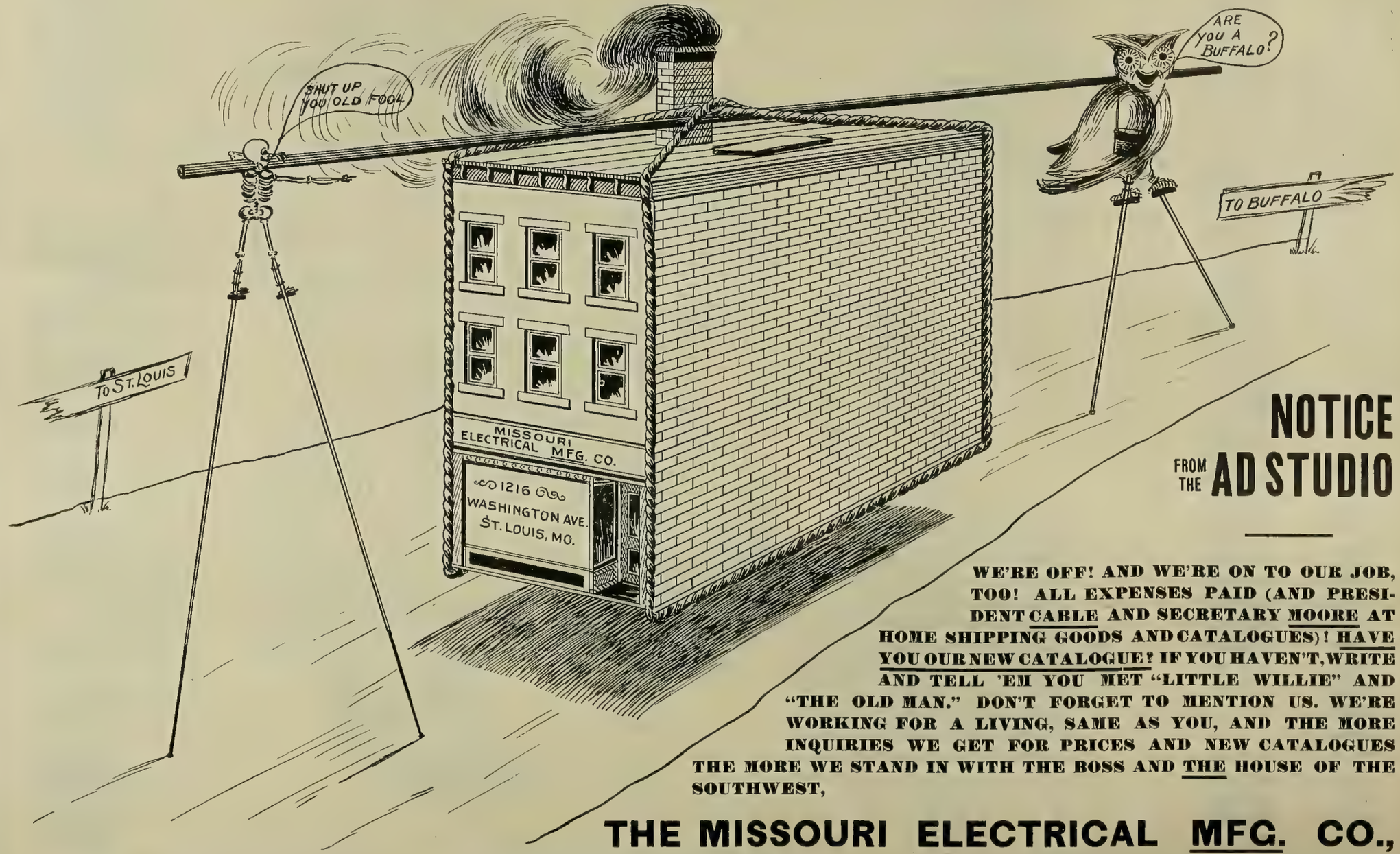


NOTICE FROM THE AD STUDIO

WE'RE OFF! AND WE'RE ON TO OUR JOB, TOO! ALL EXPENSES PAID (AND PRESIDENT CABLE AND SECRETARY MOORE AT HOME SHIPPING GOODS AND CATALOGUES)! HAVE YOU OUR NEW CATALOGUE? IF YOU HAVEN'T, WRITE AND TELL 'EM YOU MET "LITTLE WILLIE" AND "THE OLD MAN." DON'T FORGET TO MENTION US. WE'RE WORKING FOR A LIVING, SAME AS YOU, AND THE MORE INQUIRIES WE GET FOR PRICES AND NEW CATALOGUES THE MORE WE STAND IN WITH THE BOSS AND THE HOUSE OF THE SOUTHWEST,

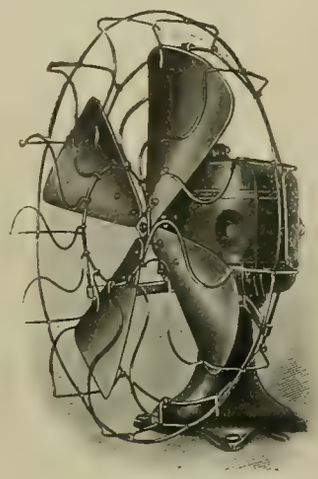
THE MISSOURI ELECTRICAL MFG. CO.,
ST. LOUIS, MO.

P. S. GIVE US A WHIRL ON AN ORDER. YOU DON'T KNOW WHAT THE NEW HOUSE CAN DO UNTIL YOU TRY IT. THEN TRY IT.

DIEHL ELECTRIC FANS

Attractive Appearance.
Perfect Construction.

Artistically Finished.
Highest Efficiency.



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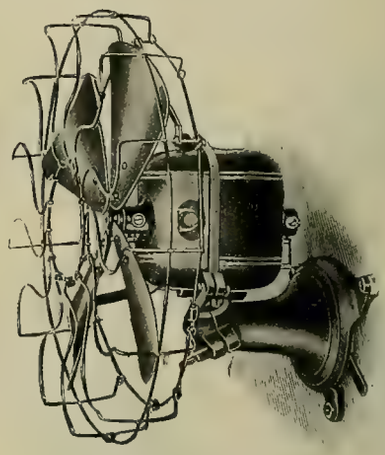
9-12-16 Inches.

110, 220, 250, 500 Volts.

3 Speeds.

Self-Aligning Bearings.



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9-12-16 Inches.

TWO TYPES OF CEILING FANS.

BOTH HIGH GRADE.

8 Designs and 20 Finishes.

TO SUIT ALL CONDITIONS.

No. 28. With Switch.
Moderate Price.

Made to operate singly on 110, 170, 220, 250, 500 volt circuits, or in series on 500 volt circuit.

2 or 4 blades, with or without speed regulators.

Perfect Lubrication.

Noiseless in Operation.

No. 17. Electrolier.
Exquisite Design.

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MAIN OFFICE AND WORKS:
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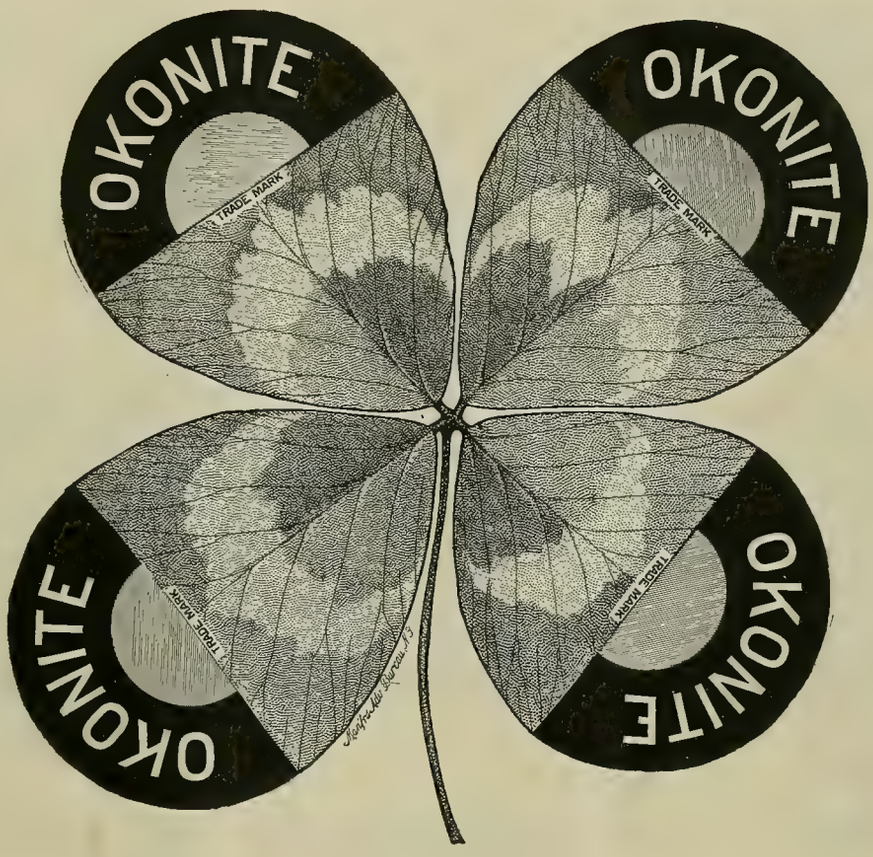
IT BRINGS GOOD LUCK.



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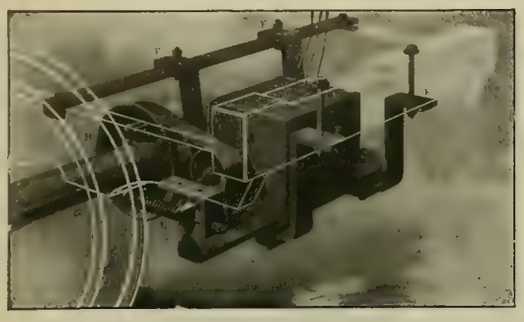
THE CONSOLIDATED "AXLE LIGHT" SYSTEM

OF

ELECTRIC LIGHTS AND FANS

FOR ALL KINDS OF

RAILWAY PASSENGER CARS.



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Electricity generated from the car axle while the car is in motion and supplied automatically from a storage battery when the car is stationary.

Each car carries its own electric lighting and ventilating apparatus, being entirely independent of all other cars and of any distant stationary plant.

Electric lights and fans keep a car bright and cool and avoid all discomfort from heat, smoke and glare, and all danger from fire or explosions where gas or oil lamps are used.

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Contractors and Builders of

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MR. E. R. BEARDSLEY, the President of the company, is one of the oldest dam builders in the United States.

Address **M. W. STARK, Secretary.**

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This is our latest production in Static Transformers, and, while our Type G proved superior to competing designs, we predict even greater success for this line. Bulletins will soon be ready for distribution.

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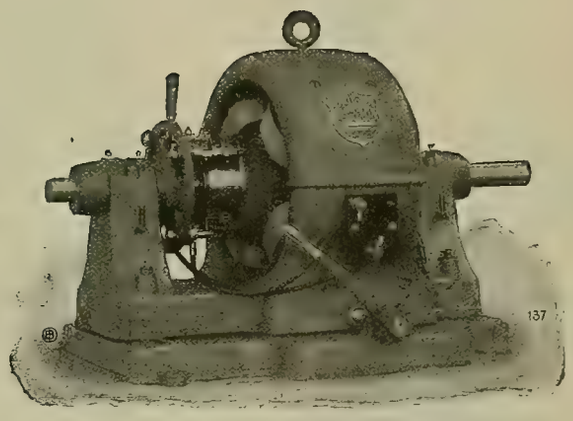

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Our Type "H" Motors and Generator are eminently adapted for all services where an open motor will do. Where machines are exposed to dirt, moisture, gases or other destructive elements, our "dust proof" Type "N" Motors are to be preferred. Send for bulletins.

WE CONTRACT TO FURNISH THE COMPLETE EQUIPMENT FOR PLANTS OF ANY SIZE.

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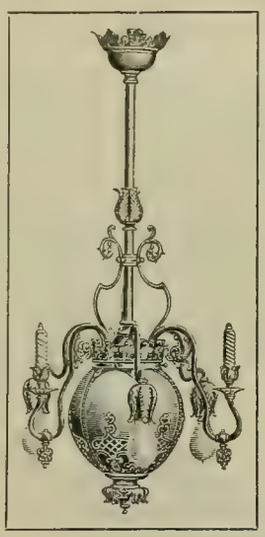

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Samples of our goods can be seen in Collective Exhibit, Section S, Electricity Building, Pan-American Exposition.

Better goods than ours are not made.

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Under the heat of an arc, it does not crumble - like slate or marble - It has others - too.

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Electric lighting supplies of all kinds constantly on hand at lowest market prices

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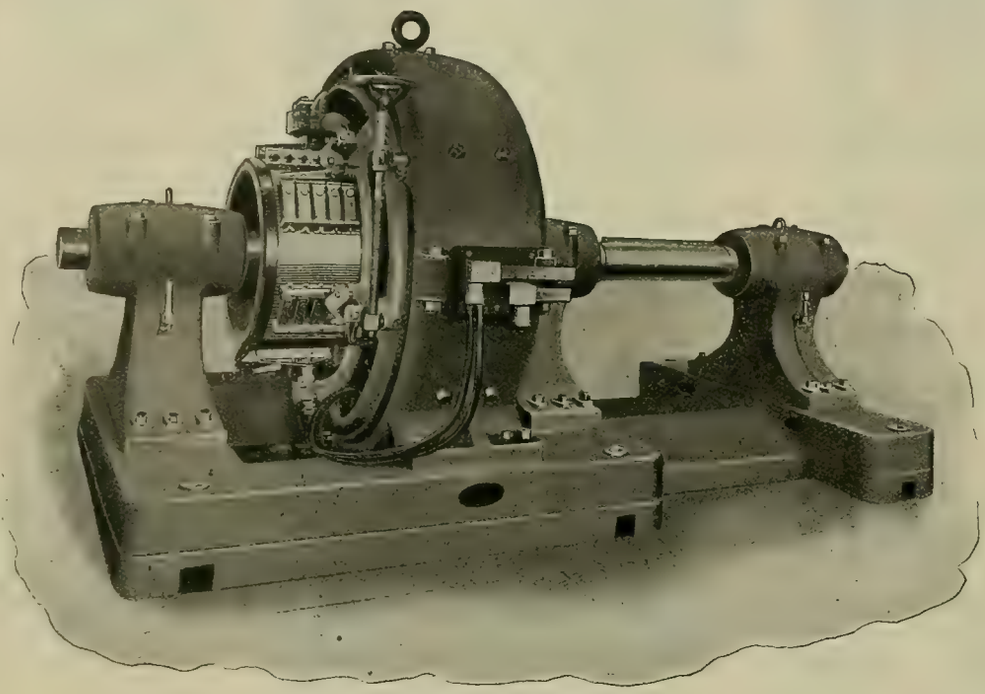

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EDISON LAMP

The Standard of the World

Represents the greatest experience. Therefore the highest quality. The lamp makes the light--not the dynamo.

Commands the highest price--is the cheapest to use. By the experience of customers buying TWELVE MILLION lamps a year.

FIVE MILLION LAMPS IN STOCK.

Prompt Shipments. All Kinds. Any Quantity.

Barrel Lots (200), 18 cents; 8, 10, 16, 20 Candle Power.
Edison and Westinghouse Base.

GENERAL ELECTRIC COMPANY,

HARRISON, N. J.

Northern Spherical Motor. Inclosed Type.

Northern Motors

are of such compact and symmetrical design that they are easily operated in any situation for any kind of work. They can be belted, geared or direct-connected to the driven machine. Our Engineering Corps has made an exhaustive study of the various wood and metal working machines in use by manufacturers for the purpose of determining the best methods of electric drive, and we have the results of years of patient investigation carefully compiled for the benefit of our customers. We have made some of the largest installations for complete electric drive in America and challenge a comparison of economical results.

We build all sizes of Generators and Motors for either Alternating or Direct Current. Ask for Bulletin No. 240.

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PITTSFIELD, MASS.

NORTHERN ELECTRICAL MFG. CO.,
MADISON, WIS.

2 x 2 = 4.

The problem of Arc Lighting has been reduced to just such a simple proposition. The A-B Arc Lamp has no complex features. It will be to you a source of profit, and then it is a comfort to know that you have the best. If your trial order has not been mailed, it is IMPORTANT that you send it at once.

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ELECTRICAL SUPPLIES,
92 and 94 West Van Buren Street, - CHICAGO.

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McIntire and American Joints, Fuse Wire, Lightning Arresters, Fuse Blocks.
Cheap, Good. MAGNET WIRE. Guaranteed.
TWO BIG STORES.
AMERICAN ELECTRIC FUSE CO.
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WE ARE DIRECT IMPORTERS FROM THE LARGEST AND BEST MINES IN CANADA AND ARE ESPECIALLY WELL EQUIPPED TO FURNISH A SUPERIOR QUALITY AT A LOW PRICE. ALL OTHER QUALITIES.
EUGENE MUNSELL & COMPANY. CHICAGO—NEW YORK.

ENGINEERING.
HERBERT A. WAGNER,
Consulting Engineer,
RAILWAY LIGHTING AND POWER PLANTS,
TIMES BLDG., NEW YORK CITY.
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VOLT-AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
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Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
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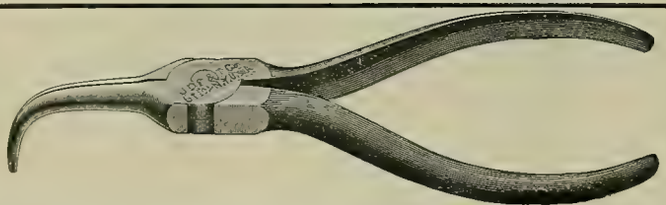
THE PEMCO FUSE ROSETTE
Has large, heavy contacts between cap and base, which have a knife-like action, making a solid, broad and long electrical connection that is so strong that it is impossible to pull cap from base. Send your jobber a sample order. Price, 13 cents; lots of 250, 10%.
PERU ELECTRIC MFG. COMPANY, PERU, INDIANA.



GOOD MONEY Is made by selling good tools. Quality is first with us See the GREEN BOOK.
SMITH & HEMENWAY CO., Utica Drop Forge & Tool Co., 296 Broadway, NEW YORK CITY.

McRoy Conduits
"Look like
good conduits;
Serve like
good conduits
and
all declare they
are good
conduits"

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THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.
CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.

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OUR PEERLESS DIRECT CURRENT CEILING FANS
CAN'T BE BEAT.
GUARANTEED FOR TWO YEARS.
TELEPHONES AND TELEPHONE SUPPLIES.
WRITE US.
ST. LOUIS ELECTRICAL SUPPLY CO.,
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DEWAR BULBS FOR LIQUID AIR

Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

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INCANDESCENT AND FLEXIBLE CORDS,
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CABLES FOR AERIAL AND UNDERGROUND USE.

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IDEAL AUTOMATIC ANNUNCIATORS.

The Best on the Market. Write for Prices.

Manufactured by
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Six Years with General Electric Company.

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Expansion Bolts

For fastening all kinds of structure to brick and stone work
Patentee and M'f'r, ISAAC CHURCH,
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For Porcelain or Clay Insulating Specialties, such as Bushings, Knobs or Cleats, Address,
THE AKRON SMOKING PIPE CO.,
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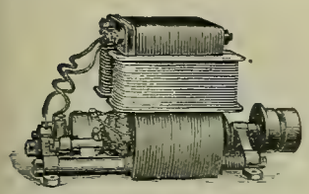
THE FRANKLIN MODEL DYNAMO



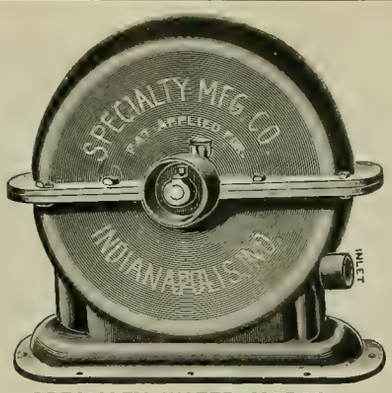
10 Volts, 5 Amperes.
Shunt or Series Winding.

We furnish all Castings, Punchings and Materials in sets with Blue-prints and Directions.

To the electrical student, amateur or ingenious per-on these machines are of the greatest interest, as they furnish practical experience in construction and winding.

WRITE FOR DYNAMO CIRCULAR NO. 16.

PARSELL & WEED, 129-131 West 31st St., New York City.



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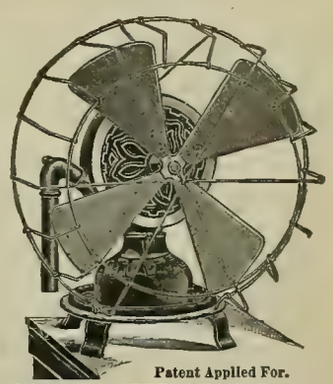
Sizes from 6 inches to 20 inches. Triple.
A highly efficient Water Motor at a price within the reach of all. Our motors are mechanically correct and well constructed. Suitable for all kinds of light machinery.



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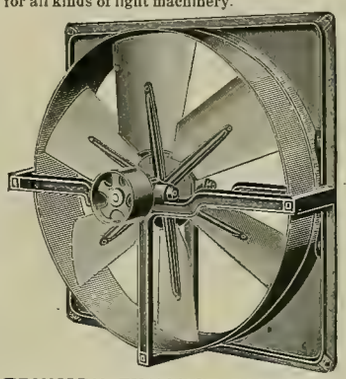
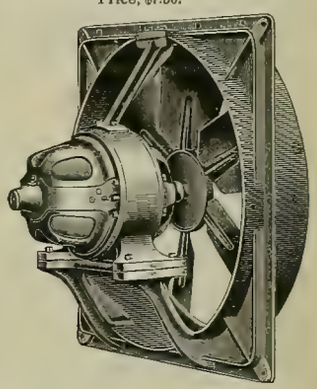
JUNIOR WATER DESK FAN.
Operated by water pressure of 30 pounds and above. Durable, efficient, attractive. Can be fitted up with rubber hose.
Price, $7.50.



TRIUMPH EXHAUST FAN—Belted.
The only Fan made with flat, square back, adjustable self-oiling boxes, with Phosphor Bronze Bearings. Most easily installed. Simply lagged or bolted to opening. Sizes, 14 to 96 in.

Catalogue and Discounts on Application.
Export quotations, F. O. B., N. Y. We manufacture Desk Fans, Counter and Floor Column Fans, direct-connected, for waterpower; Belted Ceiling Fans.



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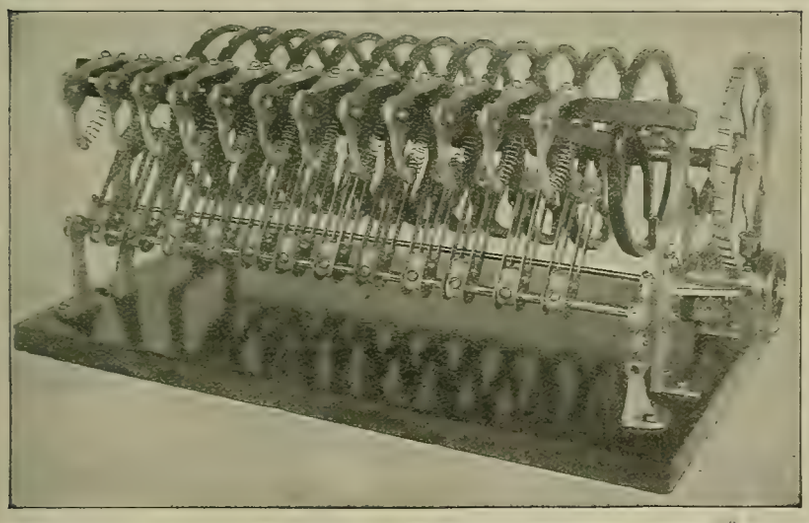
With Detachable Motor for all standard voltages of Direct Current, correct electrical and mechanical construction. Most efficient. Motor amply protected and convenient for inspection. Self-oiling boxes, carbon brushes and automatic feed, rheostat with automatic release. Motor may be detached and utilized for other purposes.
Motor and Fan Frame shipped separately, making installation simple and easy. Sizes, 30 inches, 36 inches, 42 inches and 48 inches.

SPECIALTY MFG. CO., 400 & 402 S. Meridian Street, INDIANAPOLIS, IND., U. S. A.



THE
New Reynolds
FLASHER

For giving the flashing and changeable effect to electric signs, show windows, outside displays, etc.

All that is perfect in flasher construction. Saves one-half the current in an electric sign and makes ten people see it where one would otherwise.

Adjustable to any conceivable combination and can be changed to any other in a few minutes.

WRITE FOR PRICES.

REYNOLDS MANUFACTURING CO.,
177 ADAMS STREET, CHICAGO.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.

REFLECTORS!

Light is useless if you can't have it where you want it.

Paragon Reflectors throw the light **just where you want it.**

Our Incandescent Reflectors are neat and are superior to all others. They are green outside, glossy enamel white inside. Reflecting surface. Made in various styles and sizes. Get our catalog.

American Reflector & Lighting Co.,
271-273 FRANKLIN ST., CHICAGO.

WANTED.

Three first-class traveling salesmen for electrical supplies. Address "300," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Owing to changes which the advertiser contemplates making in his electric light plant, will be in market for an additional alternator of from twelve hundred to fifteen hundred lights, 2,000 or 2,400 volts, 16,000 alternations, speed not over 1,000 and less preferred. Address "ALTERNATOR," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED—POSITION

As engineer in medium size plant or as assistant in large power plant. Am at present running a 150 K. W. plant, have six years' experience, am strictly temperate; good references; also a good reason for wanting to change. Address "TEMPERATE," care Western Electrician, 510 Marquette Bldg, Chicago.

WANTED.

First-class experienced mechanical draftsmen wanted at once; some of them acquainted with electrical work. Those with shop experience preferred. Apply by letter to Chief Draftsman, P. O. Box 911, Pittsburg, Pa., stating experience in full and giving references.

WANTED.

Position wanted by an industrious, well educated and temperate young man, with some good contracting or construction company where Sunday work is not required. Over two years' experience in electric plant work. Good references. Address "C," care Western Electrician, 510 Marquette Bldg., Chicago.

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As superintendent or electrician of lighting plant. Now operating station of over 700 K.W., using Corliss engines. Ten years' experience in all branches of electrical work, fifteen years with steam. Address "SUPERINTENDENT," care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE.

150,000 pounds second-hand insulated copper wire, sizes 6, 8 and 10. G. MATHES' SONS RAG COMPANY, 1533 No. Broadway, St. Louis, Mo.

FOR SALE.

An electric light plant, in town of 1,500. Plant in good shape and paying well, but present owners lack capital to increase to meet the growing demands of the town. Two boilers, engine and two dynamos. Has run six years; franchise has 19 years to run yet. City contract. Will sell for $4,000, part time. This is bargain for anyone, and especially so for a practical man who can own and operate it himself. Address "BARGAIN," care Western Electrician, 510 Marquette Bldg., Chicago.

FOR SALE. Lot of 52 volt fans for sale at very low prices.
Old Material Purchased. Walsh's Sons & Co., NEWARK, N. J.

FOR SALE.

3,000 lbs. of mercury. Address, stating what price you will pay, "MERCURY," care WESTERN ELECTRICIAN, 510 Marquette Building, Chicago.

TO AVOID MOVING TWICE,

We will make especially low prices on the following apparatus for a few days:
One 50 k. w. multipolar, Excelsior, 125-volt Generator, direct-connected to a New York Safety Engine, 12 x 13, practically new.
One 75 k. w. 125-volt multipolar, American Ball Generator, direct-connected to an American Ball Engine, complete with sub-base, used three months.
One 150 h. p. 16 x 15 Phœnix Engine.
One 300 h. p. 14 x 24 x 16 New York Safety Tandem Compound Engine.
One 100 h. p. 13 x 12 Phœnix Engine.
Two 100 k. w. 6-pole, Triumph, 110-volt Generators.
Two 50 k. w. Triumph, multipolar, 110-volt Generators.
Two 50 k. w. Jenney, bipolar, 110-volt Generators.
Two 25 k. w. Jenney, bipolar, 110-volt Generators.
One 250 h. p. Worthington Water-tube Boiler, good for 135 pounds Hartford.
Three 100 h. p., 60 x 18, Phœnix Boiler, good for 95 pounds Hartford.
Write for Price-list No. 43 for other apparatus.

ILLINOIS MAINTENANCE COMPANY,
E. H. Cheney, Mgr. 204 Dearborn St., Chicago.

EVERYTHING IN "SECOND-HAND MACHINERY."

Boilers, engines, pumps, iron and wood working machinery. Saw and planing mills a specialty. Pulleys, shafting, hangers, boxes, gearing, belting, etc. Everything guaranteed as represented. Our prices are the lowest. HARRIS MACHINERY CO., Minneapolis, Minn.

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Engineers of standing and acquaintance in Europe wish to arrange for handling several good inventions abroad. We want such as are adapted for the organization of companies, etc. Liberal propositions made.
ZERBE CO., Engineers, 11 Broadway, New York.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,

140 S. Clinton St., Chicago.

GREGORY ELECTRIC CO.

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FOR SALE.

220-250 volt Generators.
One 9-k. w. Gibbs multipolar.
One 12-k. w. Card.
One 20-k. w. T.-H.
One 25-k. w. C. & C.
One 30-k. w. Westinghouse multipolar.
Two 40-k. w. General Electric multipolars.
Two 50-k. w. General Electric multipolars.

Send for our **Monthly Bargain Sheet,** with net prices on machines in stock at our works. All apparatus fully guaranteed.

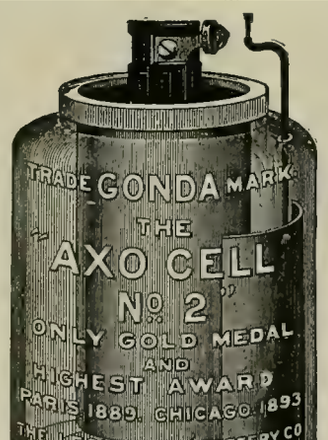
FOR SALE—A BARGAIN.

150 hard rubber cells, 7x7x10¼ inches. THOMAS ALEXANDER, 188 E. Randolph St., Chicago.

FOR SALE.

83—50 Volt Fan Motors.
2—100 Volt Fan Motors.
618—20 Ampere Shallenberger Meters.
230—40 Ampere Shallenberger Meters.
57—80 Ampere Shallenberger Meters.
All of the above for 16,000 Alternations.

ADDRESS
THE ALLEGHENY COUNTY LIGHT CO.
435 Sixth Avenue, PITTSBURG, PA.



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SEND FOR CIRCULAR AND PRICES.

THE LECLANCHÉ BATTERY CO.,

111 to 117 East 131st St., N. Y.

ALL ARC LAMPS, $3.00.

DIRECT CURRENT:
T.-H., M 2, 'K 2 and Type D; Wood, single clutch; Brush, double; W. E., 14 hour; American, single; Ball, double.
ALTERNATING CURRENT: Helios, No. 3; Helios, No. 4; Helios, No. 5; A. B., No. 6.

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The Worcester Polytechnic Institute,
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Write for our free illustrated book.
"Can I Become an Electrical Engineer?"
We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Mechanical Drawing, etc., at your home, by mail. Institute indorsed by Thos. A. Edison.
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High Speed Engine Bargains

No.	H. P.	Maker.	Cylinders.
1	200	Buckeye	16½ x 27
1	90	Atlas C.	14 x 20
1	75	Westinghouse	12 x 11
1	65	Beck-Taylor	10¼ x 12
1	60	Ball	10 x 12
1	40	A. & S.	8¼ x 12

Camp Engineering Co., 47 W. Lake St., Chicago, Ill.

Eldredge Battery Voltmeter,
For Testing Primary and Storage Batteries, 0 to 3 Volts.
DEAD BEAT.
The only low-price pocket instrument indicating in volts. Connecting posts have non-removable nuts. Light weight and neat in appearance.
Eldredge Electric Mfg. Co.,
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Fifteen years of continual practice before the U. S. Patent Office gives me the ability to render inventors valuable service in procuring their patents. I am an electrical and mechanical expert, thoroughly conversant with U. S. and foreign patent laws.
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Manfrs. of the well known "Perfection" Brushes for Dynamos and Motors.

SEND FOR DESCRIPTIVE CIRCULAR AND PRICE LIST.

REPAIRS for everything electrical, including..... National Electric Company's Machines.

Send your **BURNT-OUT TRANSFORMERS** to the

General Electrical Repair Co.,

141 SO. CLINTON ST., CHICAGO.
We can REPAIR them or will BUY them.

Why Not Make a Test Yourself?

Dead short circuit a

Columbus Storage Battery

Cell a number of times and see if the plates buckle. See if this severe treatment causes the filling to drop out. Test the cells for efficiency. Test them any way you like.

WE'RE NOT AFRAID.

The Columbus Battery & Specialty Co.,

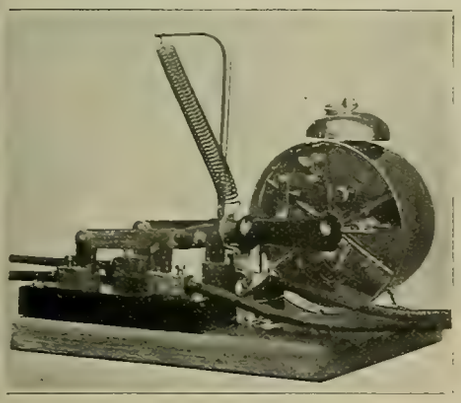
Write for a Catalogue. 25 N. Scioto St., COLUMBUS, OHIO.

THE BEST WAY

CLOCK SWITCH

TURNS OUT SHOW WINDOW LIGHTS ANY TIME DESIRED AFTER STORE IS CLOSED.

YOU ONLY NEED TO WIND THE CLOCK. SWITCH IS AUTOMATIC.



Perfectly Reliable.
Sent on ten days' trial.

RETAIL PRICES:

15 Amp., D. P., $4.50
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GALESBURG, ILL., Dec. 27, 1900.

We, the undersigned merchants of Galesburg, Ill., have in use one of the Clock Switches made by the College City Electric Company, and find it satisfactory in every way. It is easily set and does not get out of order.

NELSON, MARKS & CO., Dry Goods.
ANDERSON, DRAKE & CO., Wall Paper, Paints.
THE GALESBURG SHOE CO., Boots and Shoes.
W. A. ANDERSON & CO., Boots and Shoes.

COLLEGE CITY ELECTRIC CO.,
GALESBURG, ILL.

EDWARDS AND CO. New York, N.Y. U.S.A.

PUSHES.

Fits in ¾ inch Hole. Fits in ⅛ inch hole
Fits in ⅝ inch hole.
No screws needed to fasten them as the spring clips hold them securely in place.

THESE
OUR LITTLE

"SHOW WINDOWS,"

COMING OUT
EVEN AS THEY DO
EVERY WEEK, CAN'T GIVE
YOU AN ADEQUATE IDEA OF ALL
THE GOODS WE MANUFAC-
TURE, BUT

OUR CATALOGUE CAN!

SEND FOR IT!

EDWARDS & CO.,
NEW YORK.

WESTERN ELECTRIC CO.
NEW YORK,
Eastern Selling Agents.

EDWARDS AND CO.

The R. E.-A. I. Monitor Bell.
(Patented.)

Hammer rod supported in two places and thrown straight out and in by the armature, striking gong on inside, near edge, thus giving a full, clear tone.

All springs made of Phosphor Bronze and so formed that there is least possible strain.

Contacts are platinized, adjustment is made by pressure on the standard which supports one contact. No screws or nuts being used in the adjustment, bell does not get out of order by operation.

Ordinarily the weak point is the pivot, the unreliable one the adjusting screw and nut. As these defects have been eliminated, this bell will stand hard usage and operate under adverse conditions.

The hammer entirely concealed by gong and cannot be tampered with.

It is especially adapted for use on street cars, as, in addition to the advantages mentioned, it is dust, insect and moisture proof.

NEW YORK N.Y

Columbia Wins

COLUMBIA CARBONS
WILL BE USED EXCLUSIVELY BY THE

Pan-American Exposition.

SEE OUR EXHIBIT, WHICH WILL INTEREST YOU.

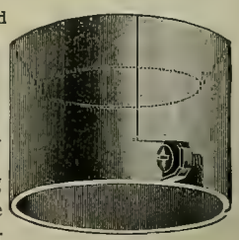
National Carbon Co., Cleveland, O.

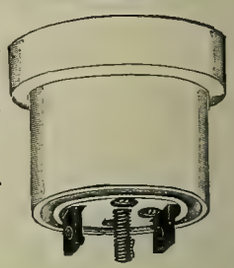
BREWSTER UNIVERSAL SIGN RECEPTACLES.

A SYSTEM OF UNITS

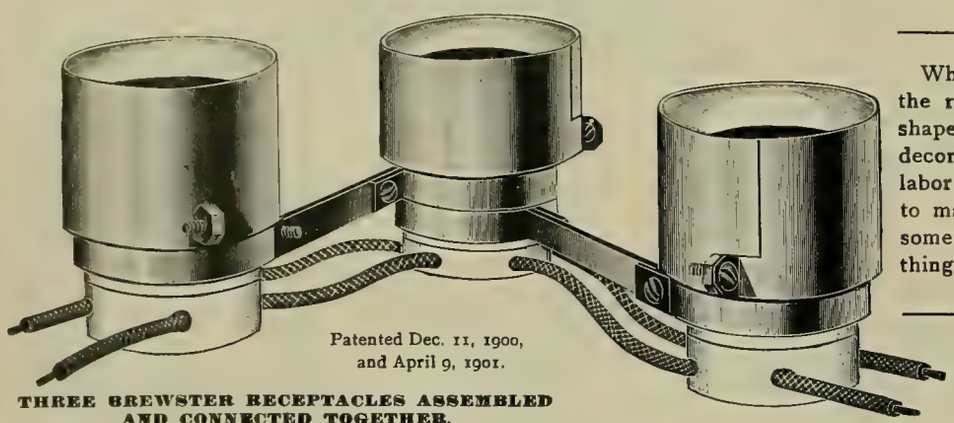
From which may quickly be formed, wired and installed anything in the shape of thoroughly weatherproof

ELECTRIC SIGNS or ELECTRICAL DECORATIONS of any style or variety.





When through using the receptacles in the shape of one sign or decoration, a very little labor only is necessary to make them up into something else—something entirely different.



Patented Dec. 11, 1900, and April 9, 1901.

THREE BREWSTER RECEPTACLES ASSEMBLED AND CONNECTED TOGETHER.

Illustrating method of use and simplicity of means by which a perfectly rigid, yet readily adjustable, construction in any form or design desired is provided.

Just the thing for theaters, or for merchants who want to keep abreast of the times by electrical advertising and yet require variety.

PARTS OF THE UNIT READY TO ASSEMBLE.

"THE CONNECTING LINK."

THE ELECTRIC MOTOR AND EQUIPMENT CO.,

SOLE MANUFACTURERS AND SALES AGENTS. 12-14 Beaver Street, NEWARK, N. J.

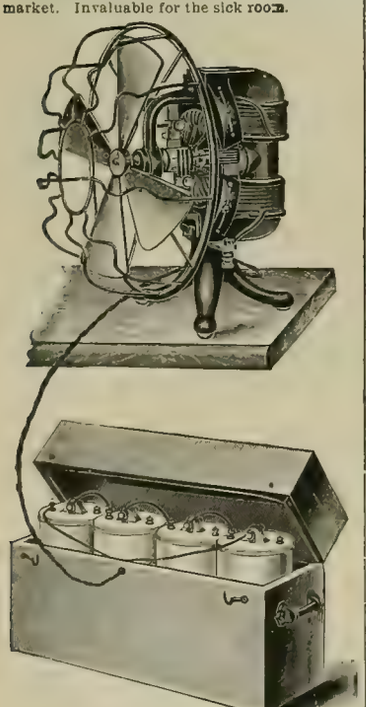
EDISON

BATTERY FAN OUTFITS

...WITH...

EDISON LALANDE CELLS

Are the only efficient battery fan outfits on the market. Invaluable for the sick room.



Write for Catalogue No. 4.

EDISON MFG. CO.,

135 5TH AVE., COR. 20TH ST., NEW YORK.

American Bridge Company

DESIGNERS
MANUFACTURERS
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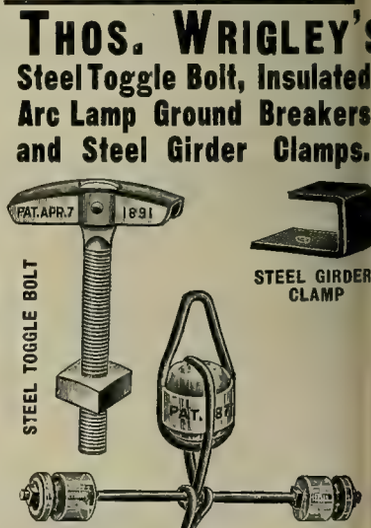

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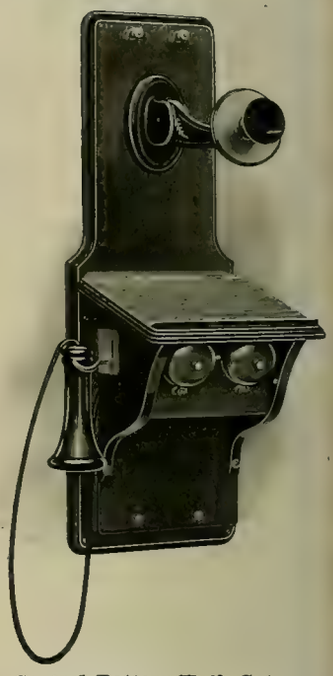

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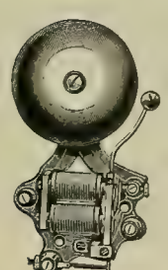

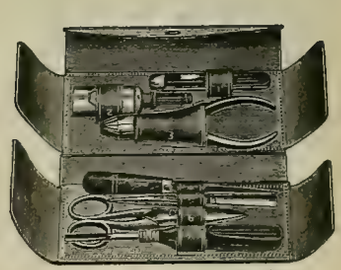

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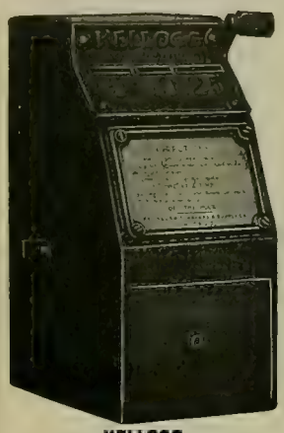

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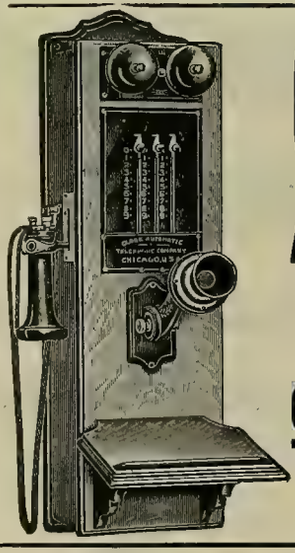

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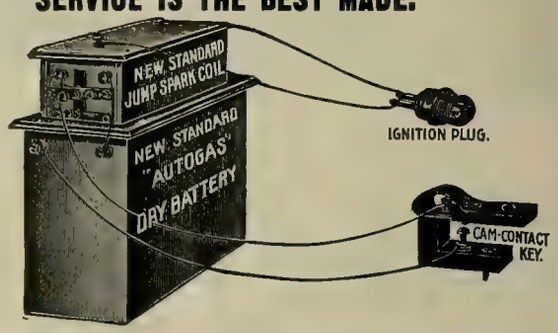

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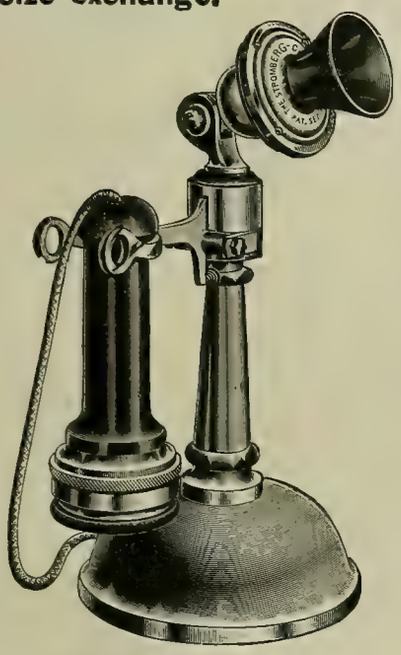

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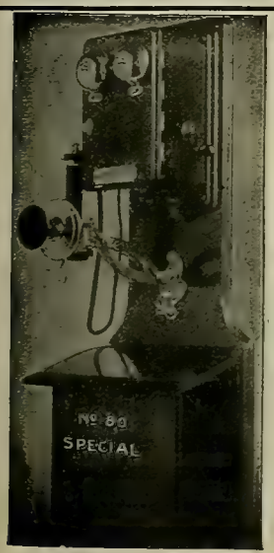

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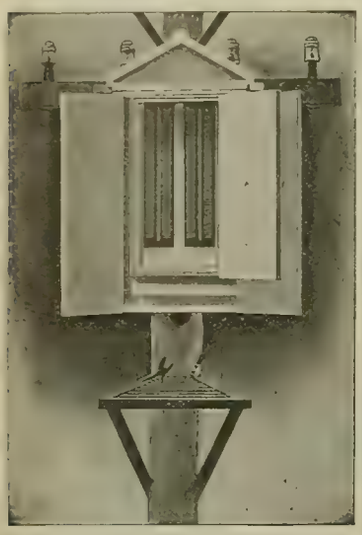

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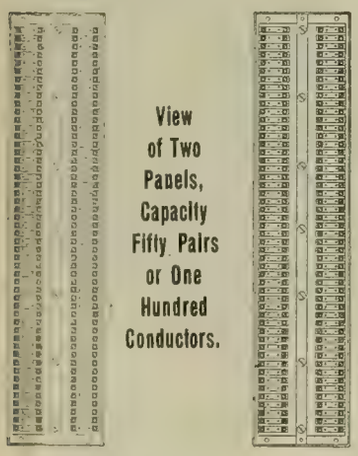

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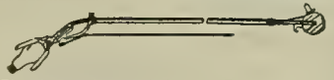

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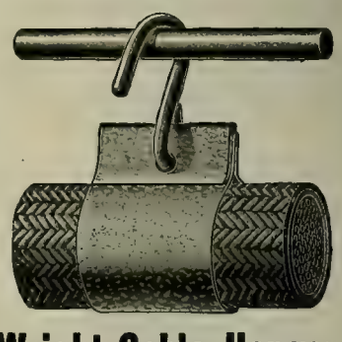

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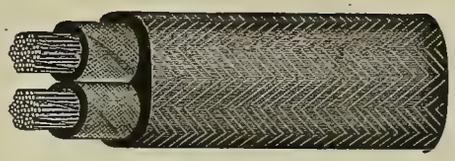

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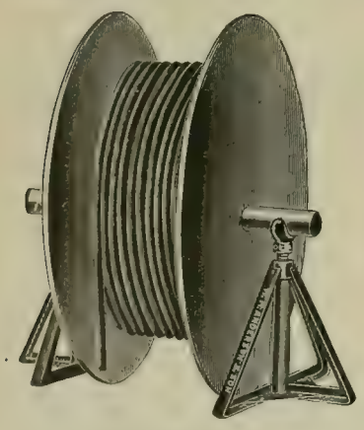

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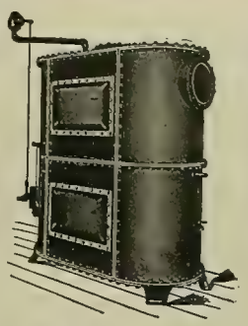

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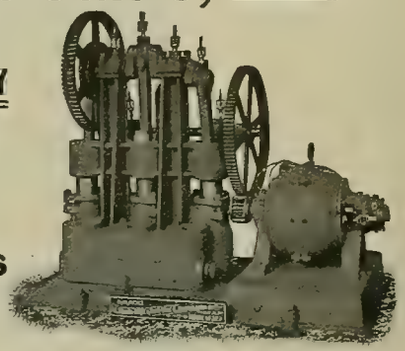

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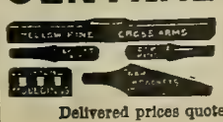

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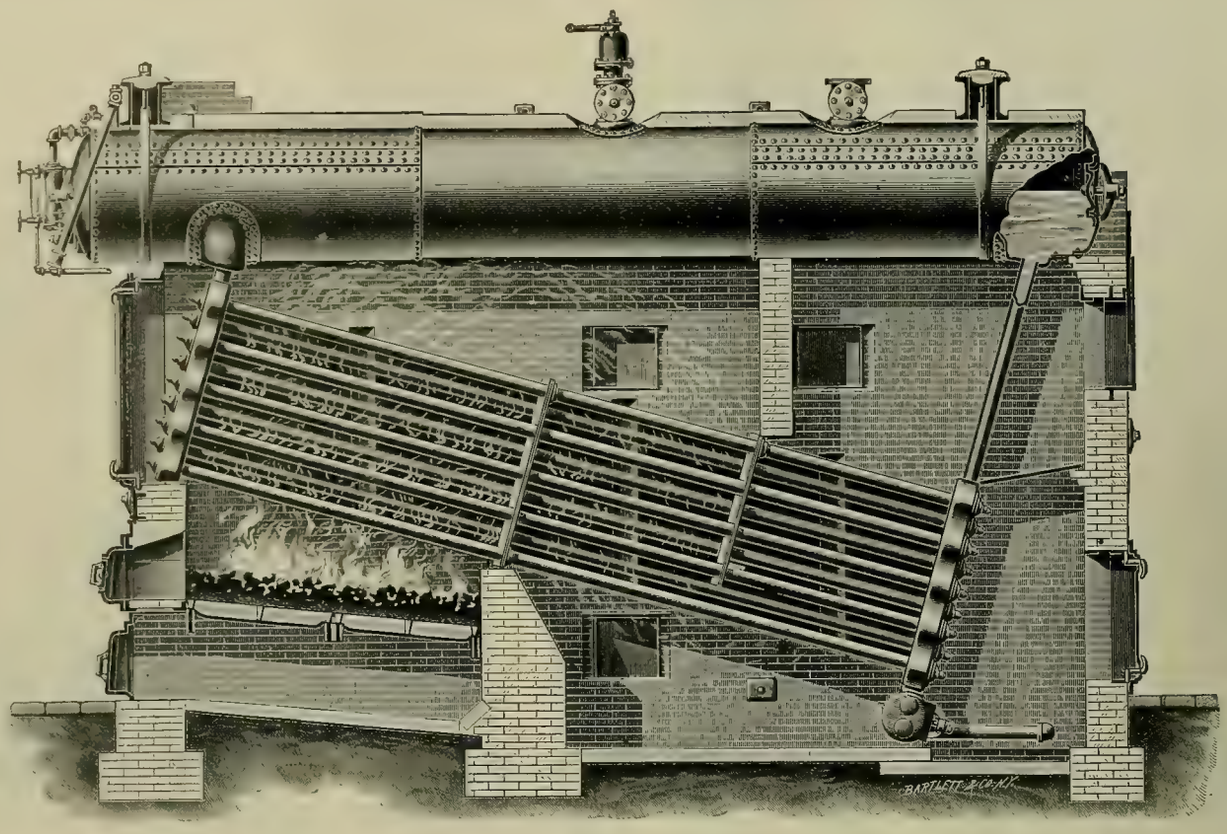

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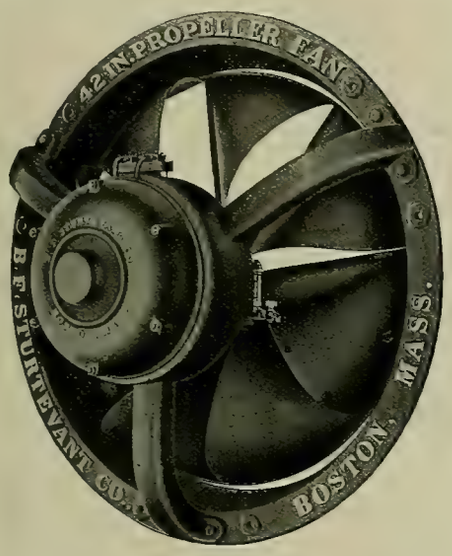

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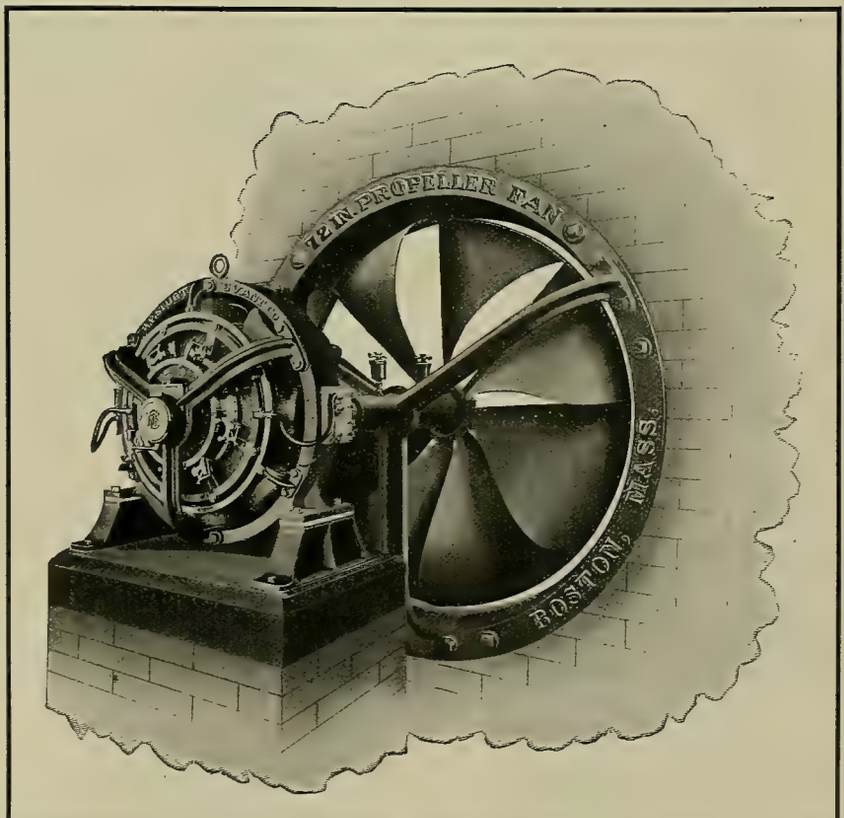

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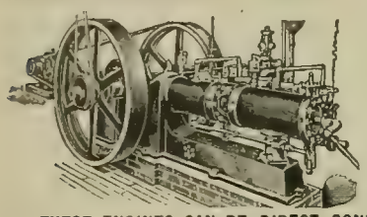

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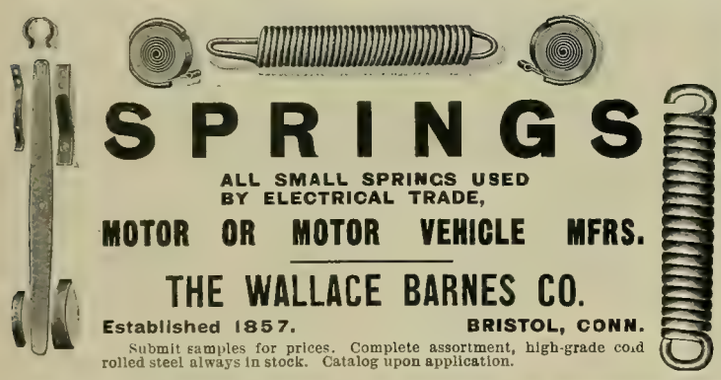

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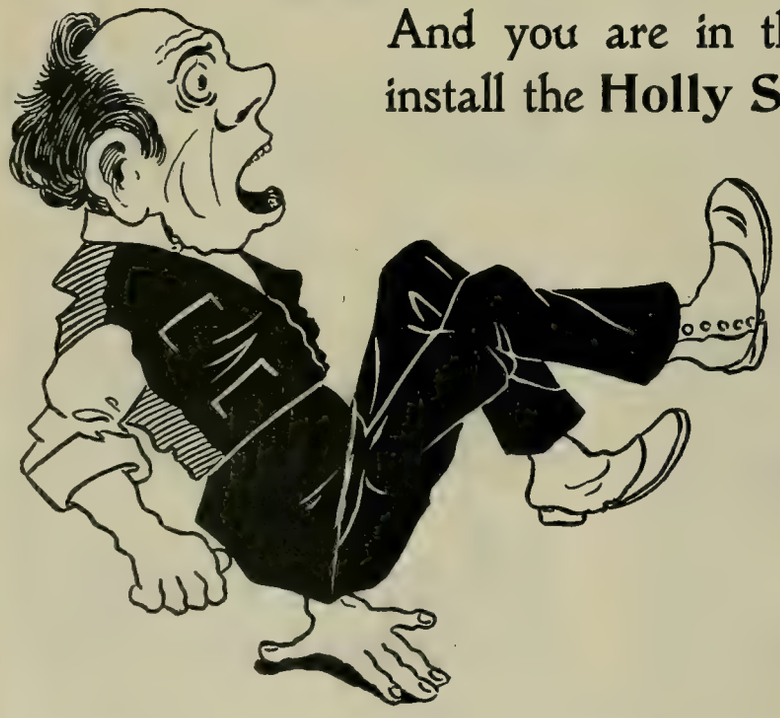

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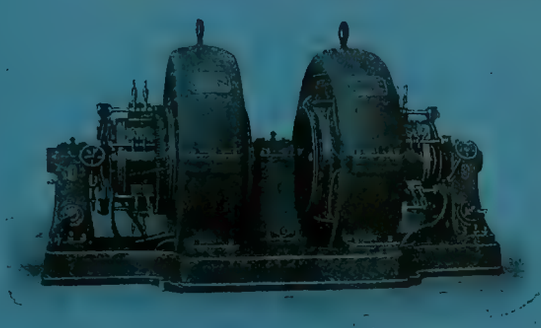

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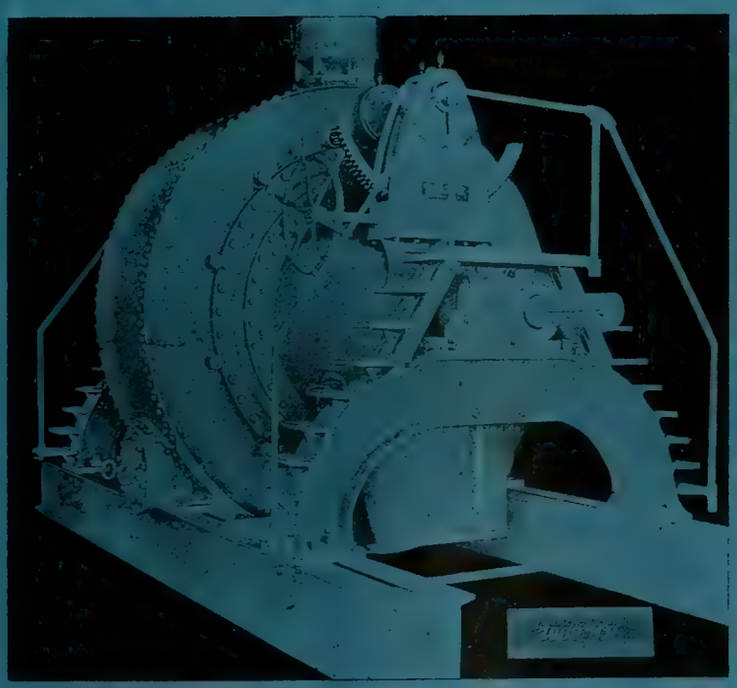

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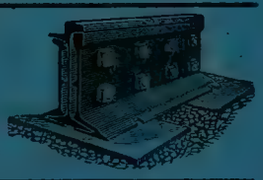

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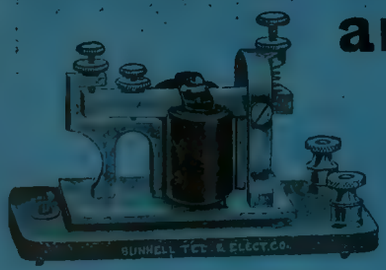

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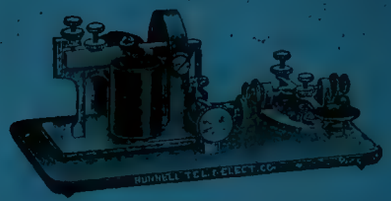

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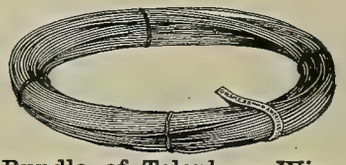

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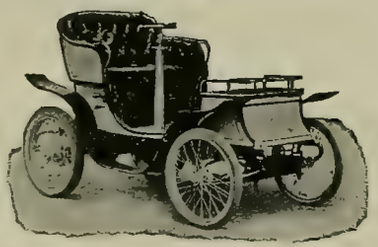

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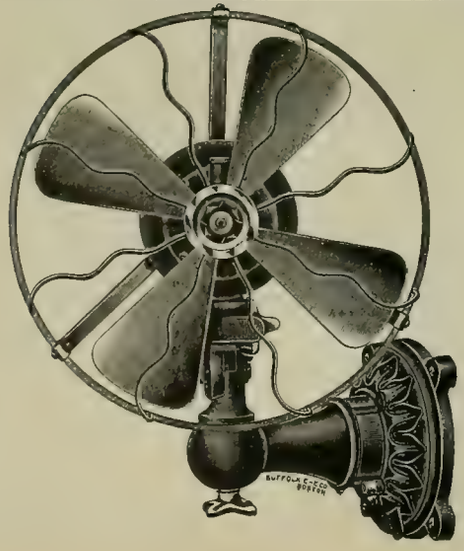

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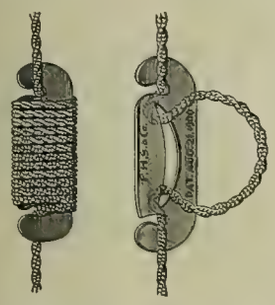

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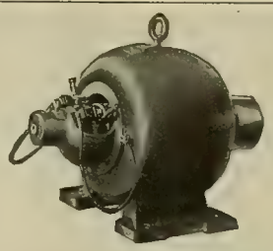

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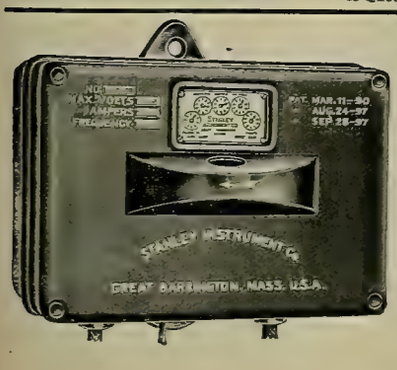

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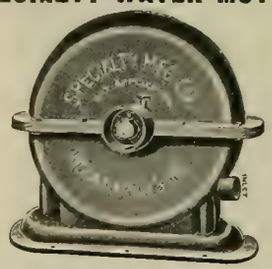

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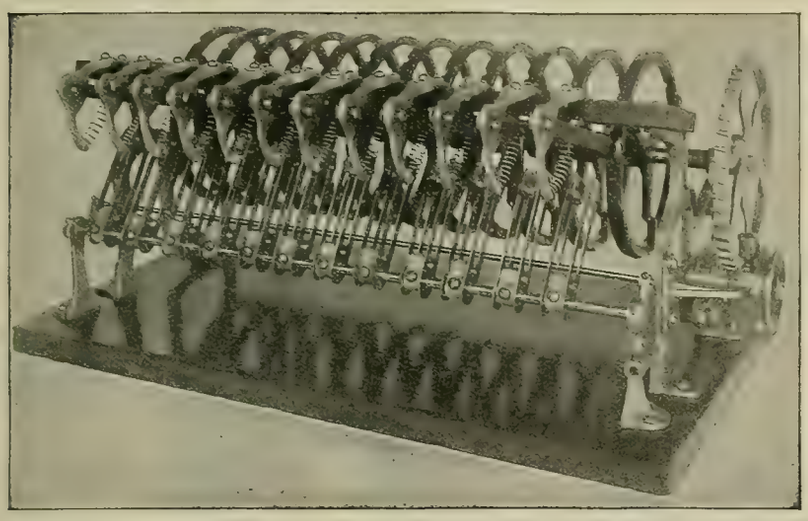

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All that is perfect in flasher construction. Saves one-half the current in an electric sign and makes ten people see it where one would otherwise.

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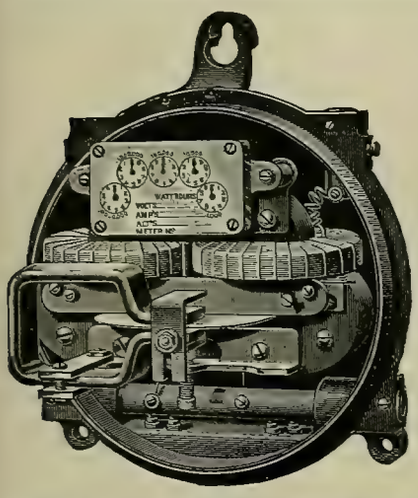

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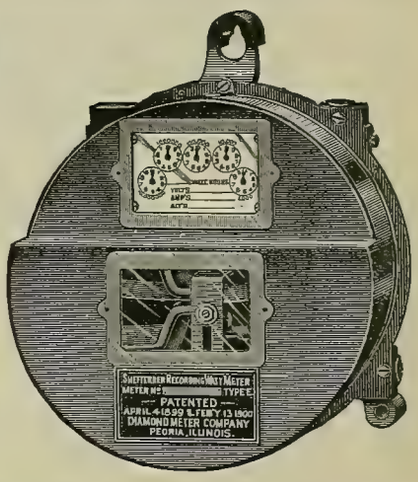

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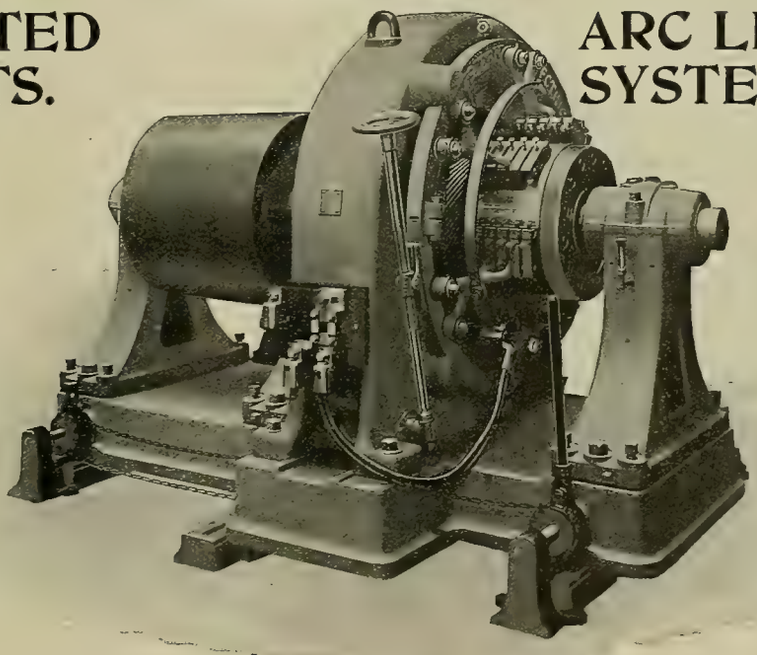

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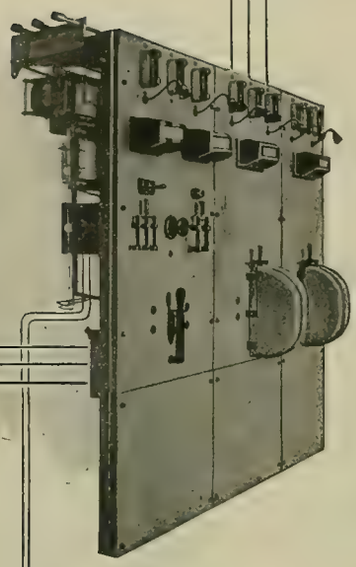

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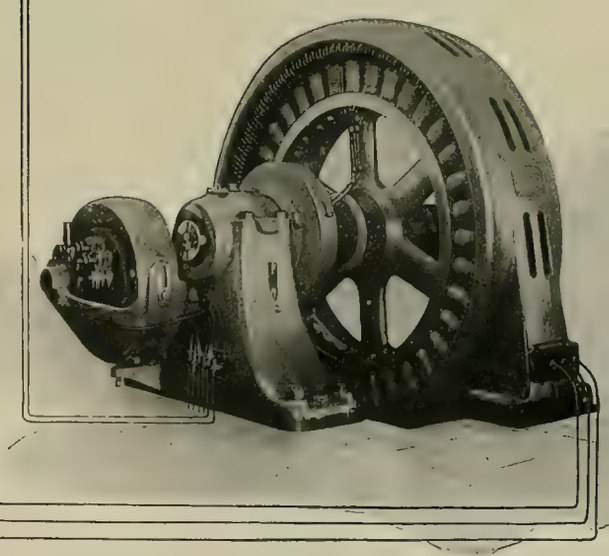

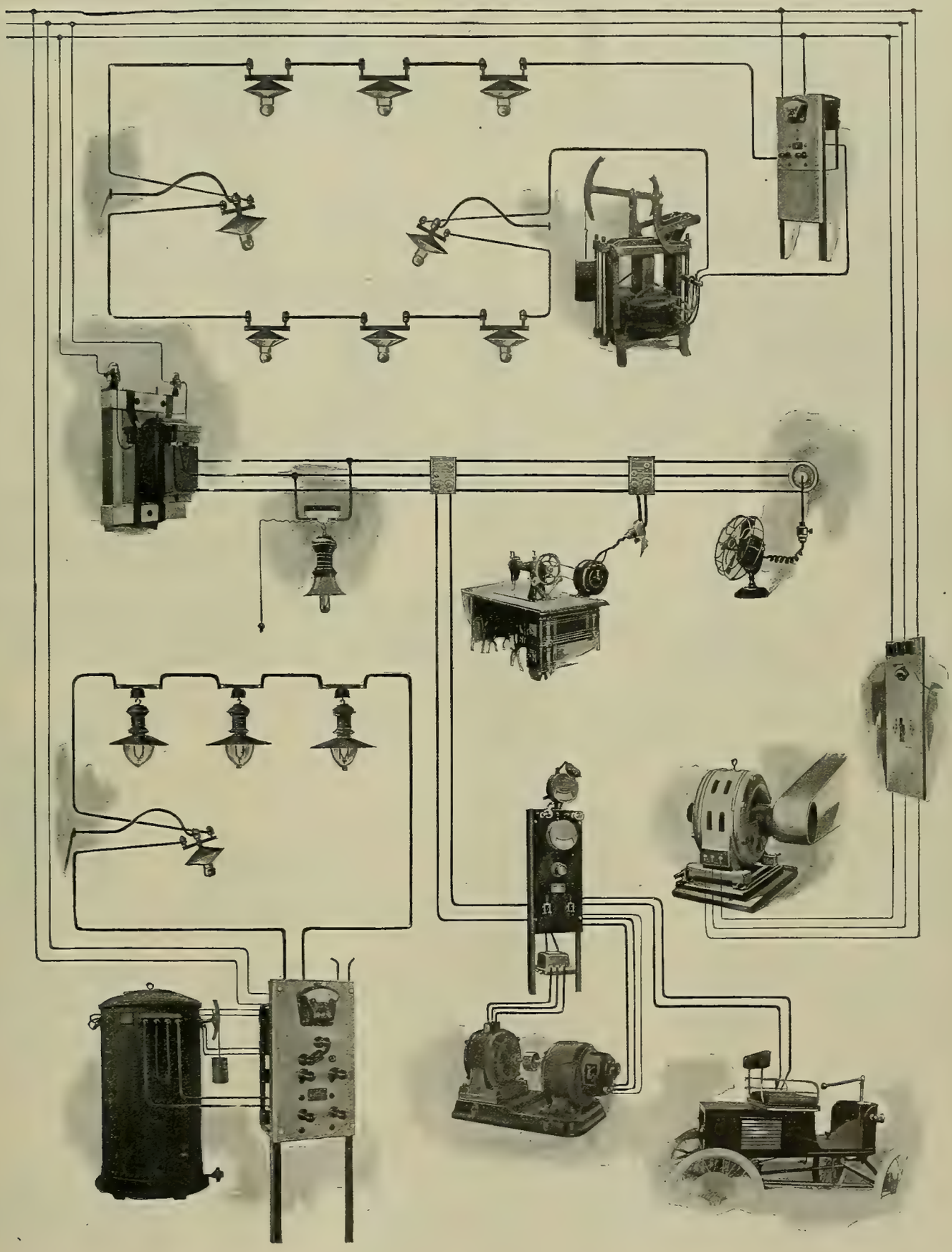

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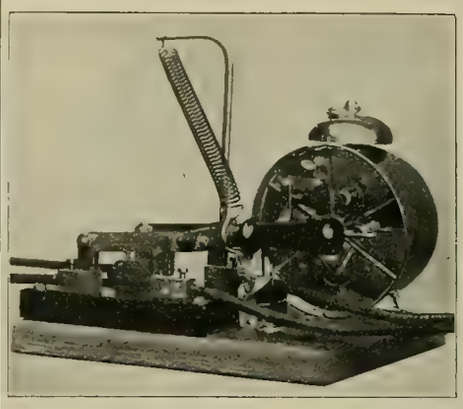

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Clock Switch

Turns out show window lights any time desired after store is closed. You only need to wind the clock. Switch is automatic. Perfectly reliab'e. Sent on ten days' trial.

Retail Prices { 15 Amp., D. P., $4.50 / 25 Amp., D. P., 5.00 / 50 Amp., D. P., 6.00

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Northall Swinging Cover Enclosed Arc Lamp, which opens like this, simply by pressing a spring, and closes with a snap.

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HOW'S THIS FOR A BABY?

If you want one I know where you can get it.

Just write

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We furnish complete sets of Castings, Materials and Blue-prints for this one-half H. P. Gas Engine and the 50 W att Dynamo.

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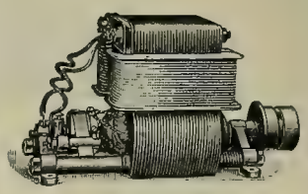

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IT'S A PICTURE OF A MAN WE MET AT THE CONVENTION WHO SAID WE DIDN'T KNOW HOW TO ADVERTISE OUR BUSINESS. HE SAID HE DIDN'T LIKE OUR STYLE BECAUSE EVERYBODY TALKED ABOUT US. HE BELIEVED IN "DIGNIFIED" ADVERTISING (BECAUSE NOBODY TALKED ABOUT IT!)—"QUIET AND DIGNIFIED" THAT'S WHAT HE WANTED.

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THE MISSOURI ELECTRICAL MANUFACTURING CO.,

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P. S. GIVE US A WHIRL ON AN ORDER. YOU DON'T KNOW WHAT THE NEW HOUSE CAN DO UNTIL YOU TRY IT. THEN TRY IT.

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Direct Current.

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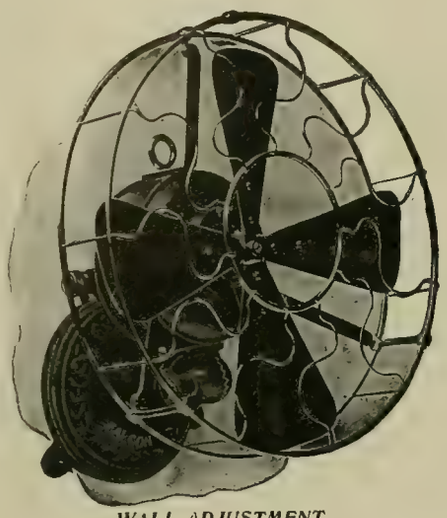
115, 220 and 250 volts.

Made with Universal Joint so that it can be used as either Desk or Bracket Fan.



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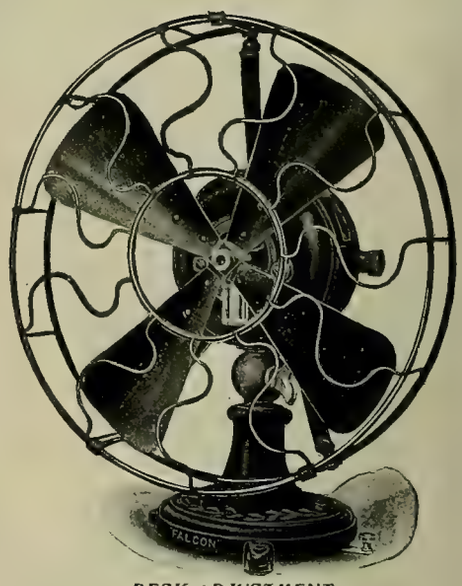

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Any Finish. *Any Voltage.*

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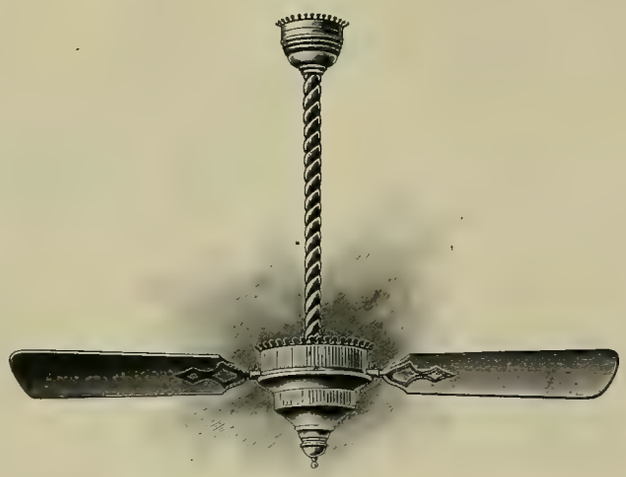

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All Styles.
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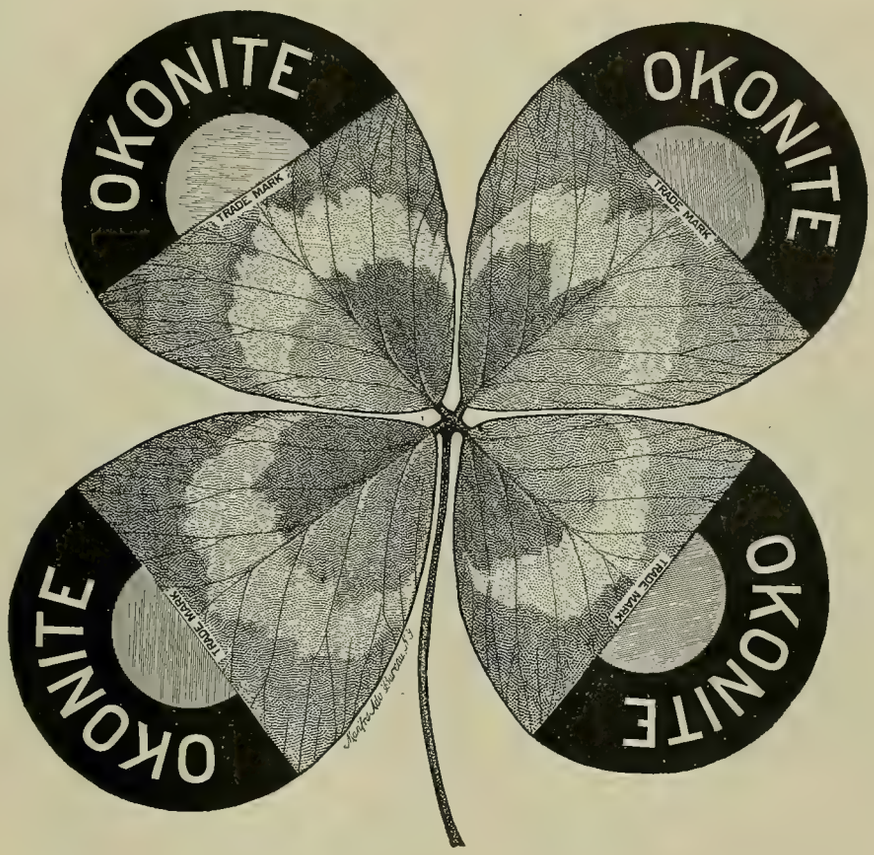

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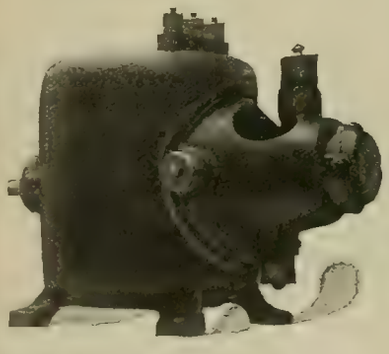

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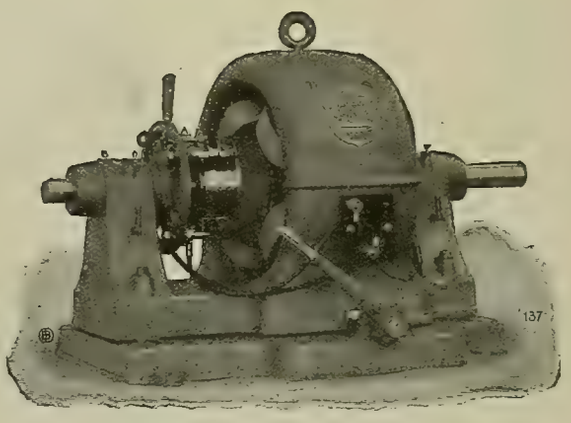

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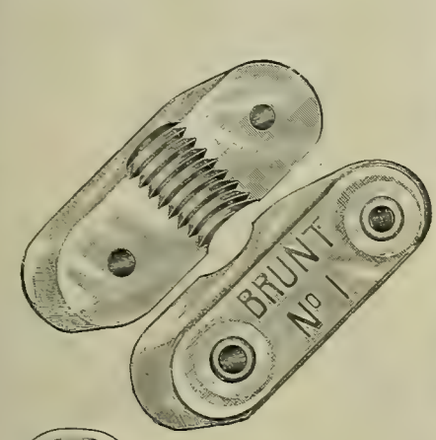

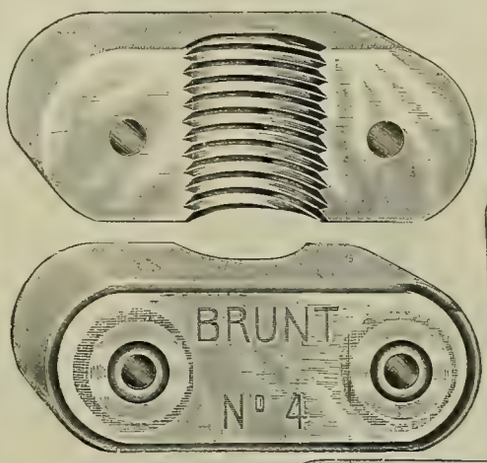

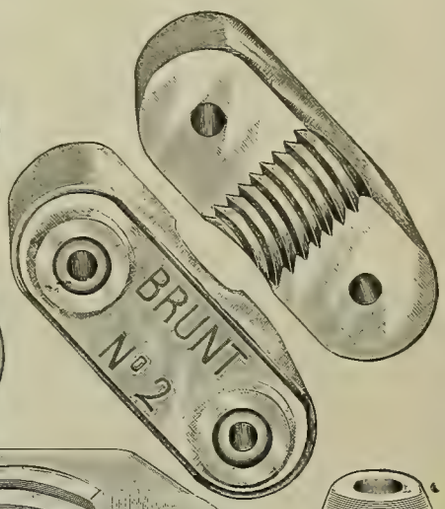

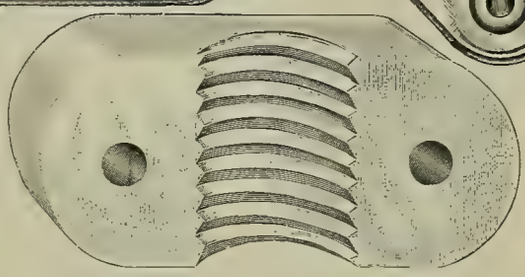

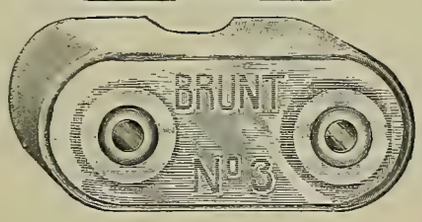

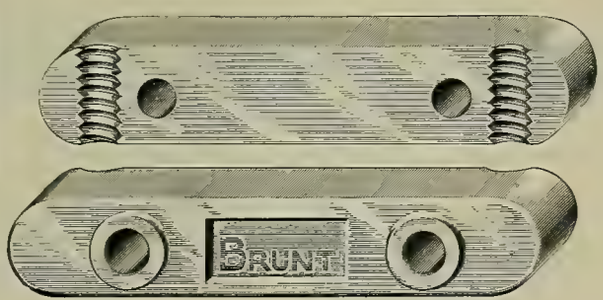

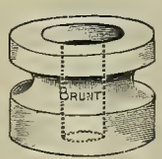

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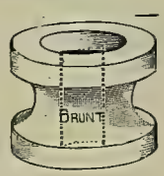

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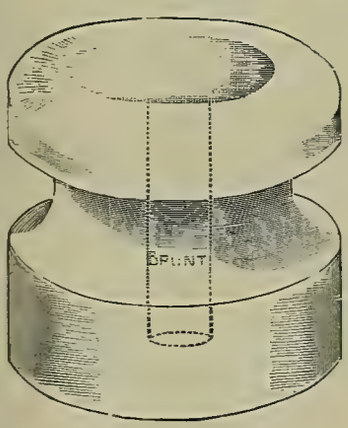

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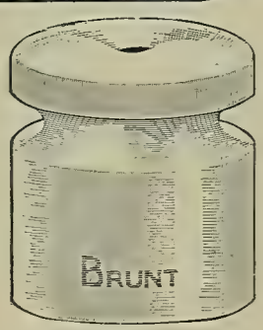

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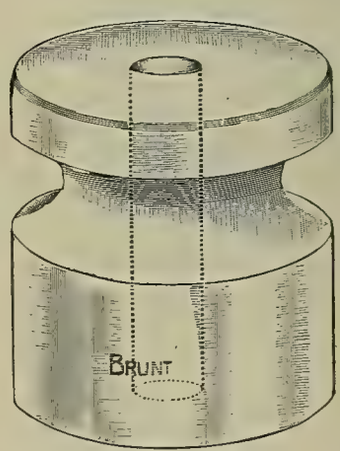

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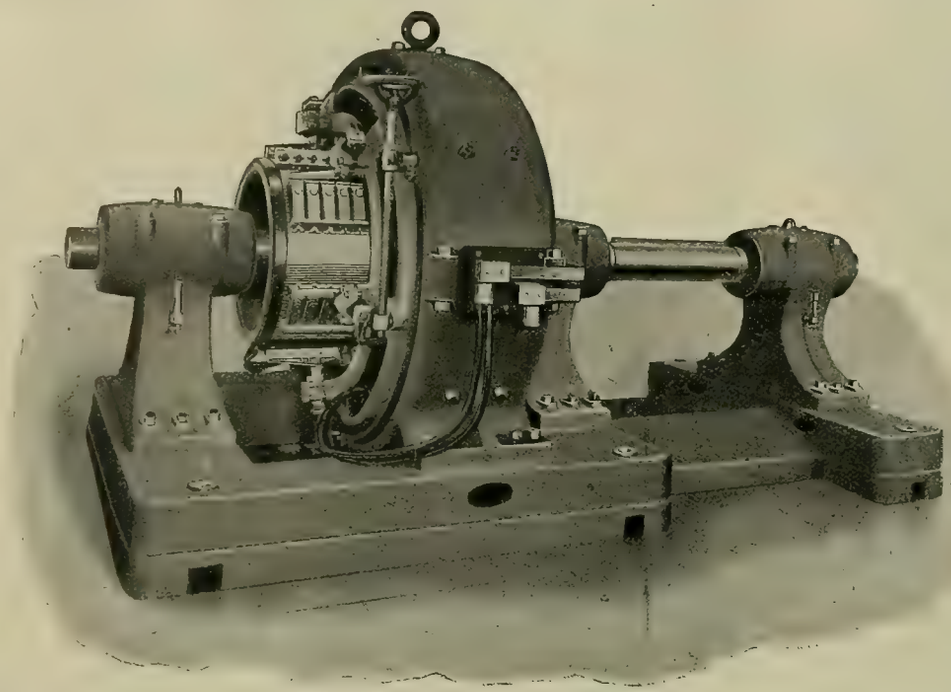

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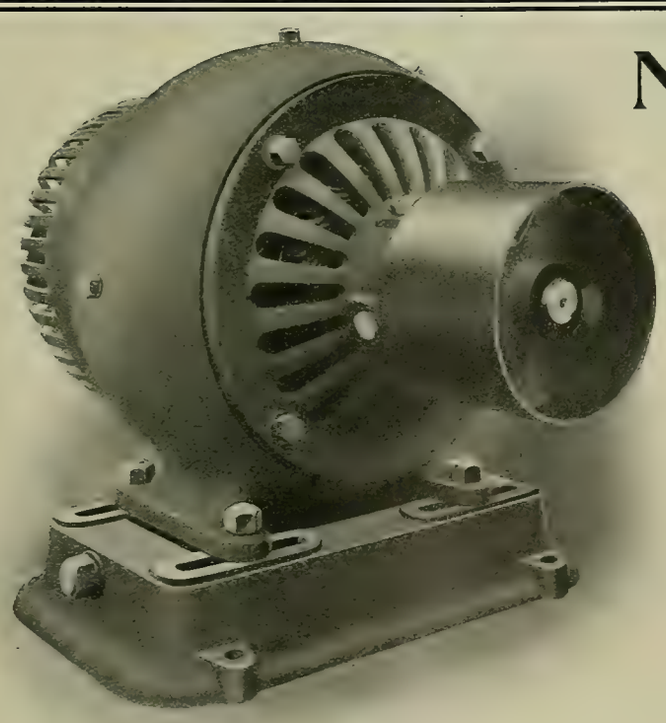

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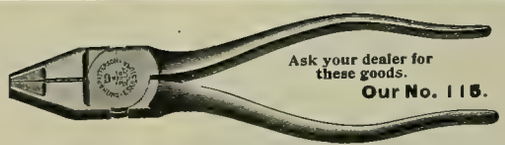

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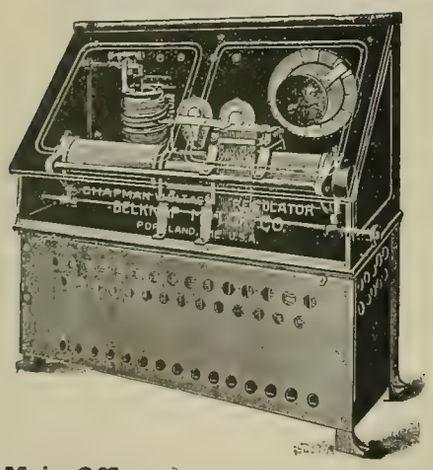

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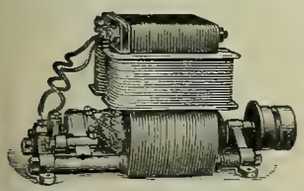

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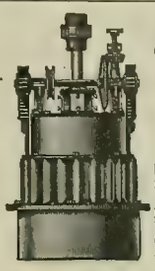

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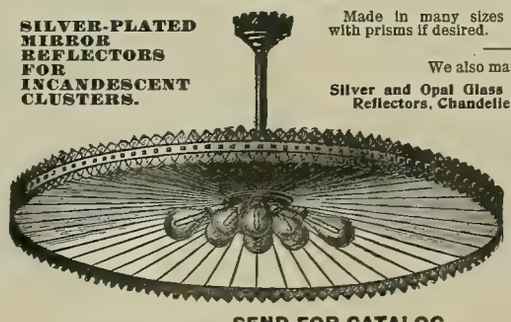

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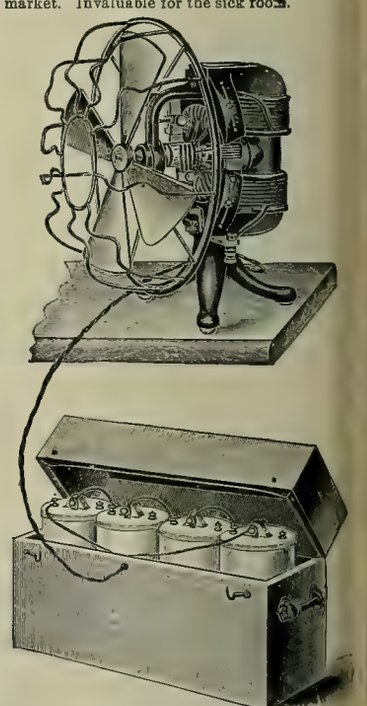

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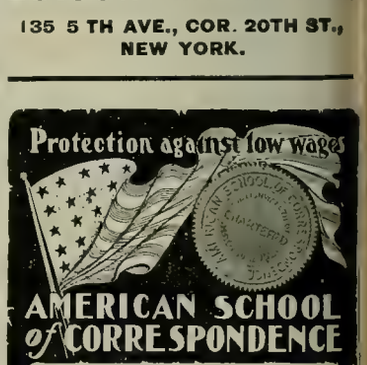

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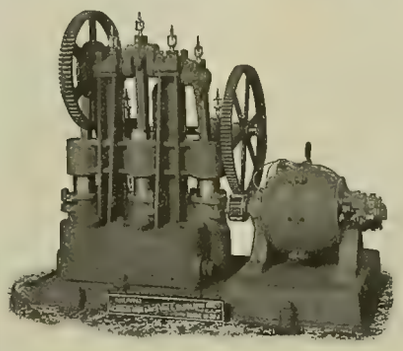

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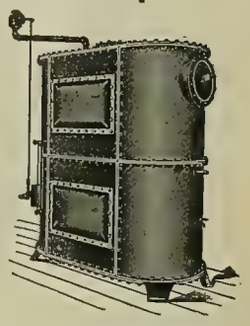

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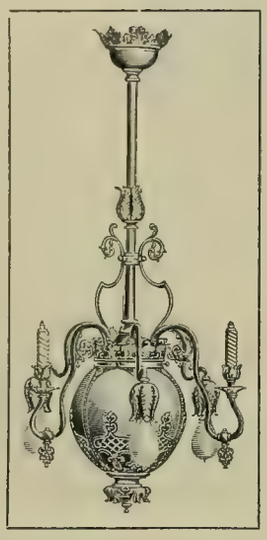

Designers and Manufacturers of

Gas and Electric Fixtures

269 to 281 State St.,

BROOKLYN, NEW YORK.

Samples of our goods can be seen in Collective Exhibit, Section S, Electricity Building, Pan-American Exposition.

Better goods than ours are not made.

"ALBERENE"

A STONE MUCH BETTER THAN SLATE OR MARBLE FOR HIGH-TENSION Switch-boards ETC.

ONE GREAT VIRTUE

Under the heat of an arc, it does not crumble.- like slate or marble. It has others-too.

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ELECTRICIAN PUBLISHING CO.

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These, our little "SHOW WINDOWS," coming out even as they do every week, can't give you an adequate idea of ALL the goods we manufacture—

BUT OUR CATALOGUE CAN.

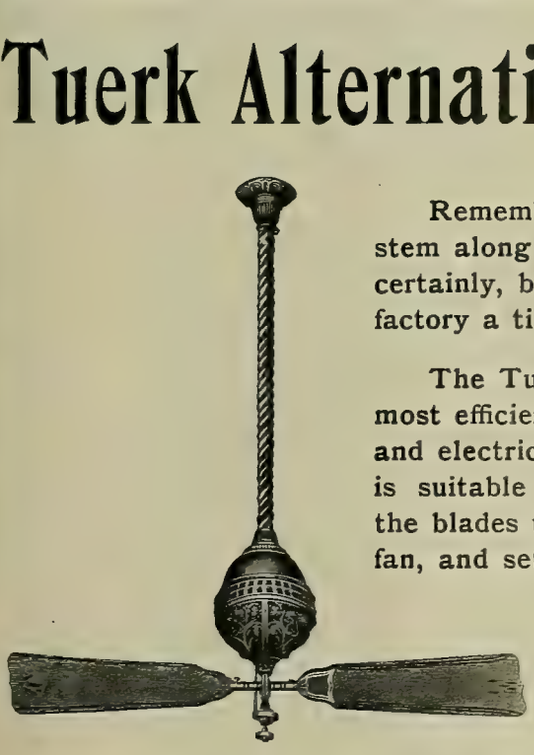
SEND FOR IT.

EDWARDS & CO., New York.

WESTERN ELECTRIC CO., New York,

Eastern Selling Agents.

Tuerk Alternating Current Ceiling Fan.



Remember the watch that you had to wind up by running the stem along a board? Had fewer working parts than a Waltham, certainly, but took lots of spring to make it go. Hardly so satisfactory a timepiece, was it?

The Tuerk Fan is comparable to the high-grade watch. It is most efficient in operation, and gives no trouble. It is mechanically and electrically perfect, light in weight, and exceedingly durable. It is suitable for circuits of all frequencies and voltages, and while the blades used are of greater width and sweep than on any other fan, and set at a sharper pitch, the consumption of current is but 100 watts at full speed—175 r. p. m. on 40, 50 and 60 cycle circuits, 152 r. p. m. on other frequencies up to 140 cycles.

HUNTER FAN AND MOTOR CO.,

FULTON, N. Y.

General and Export Agents,
E. B. LATHAM & CO.,
39 Vesey St., New York.

Western Agents,
WESTERN ELECTRIC CO,
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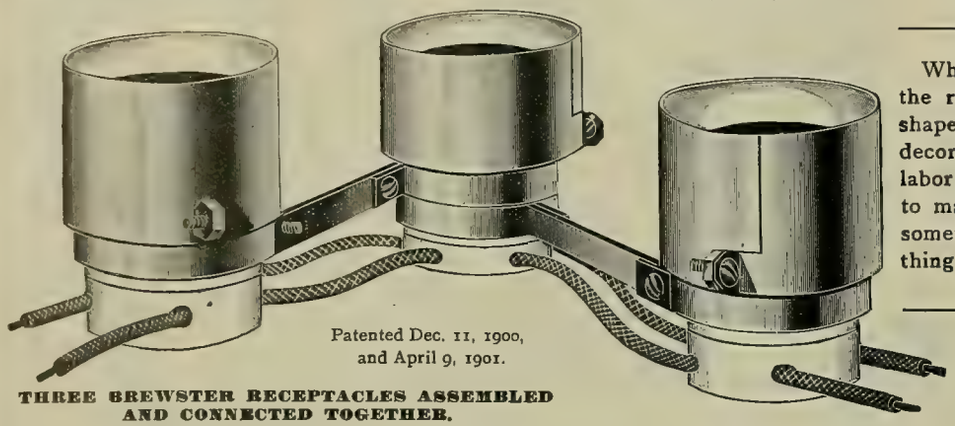
BREWSTER UNIVERSAL SIGN RECEPTACLES.

A SYSTEM OF UNITS

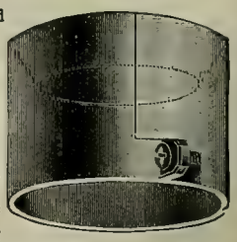
From which may quickly be formed, wired and installed anything in the shape of thoroughly weatherproof

ELECTRIC SIGNS or ELECTRICAL DECORATIONS of any style or variety.

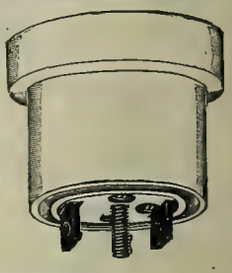


Patented Dec. 11, 1900, and April 9, 1901.

THREE BREWSTER RECEPTACLES ASSEMBLED AND CONNECTED TOGETHER.



When through using the receptacles in the shape of one sign or decoration, a very little labor only is necessary to make them up into something else—something entirely different.



Illustrating method of use and simplicity of means by which a perfectly rigid, yet readily adjustable, construction in any form or design desired is provided.

Just the thing for theaters, or for merchants who want to keep abreast of the times by electrical advertising and yet require variety.

PARTS OF THE UNIT READY TO ASSEMBLE.

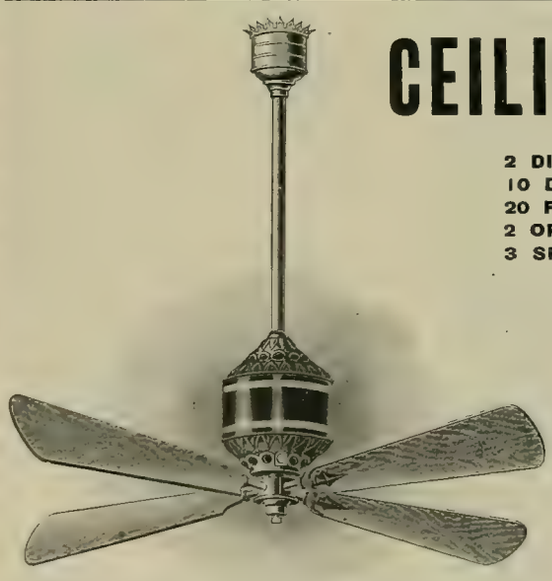
"THE CONNECTING LINK."

THE ELECTRIC MOTOR AND EQUIPMENT CO.,

SOLE MANUFACTURERS AND SALES AGENTS. 12-14 Beaver Street, NEWARK, N. J.

DIEHL ELECTRIC FANS

STANDARD OF THE WORLD FOR EFFICIENCY AND DURABILITY



No. 28. CEILING.
4 Blades with Switch. High Efficiency, Low Price.

CEILING FANS

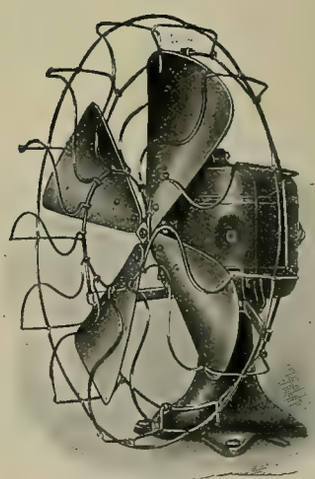
2 DIFFERENT TYPES,
10 DESIGNS,
20 FINISHES,
2 OR 4 BLADES,
3 SPEEDS.

To suit all conditions and any voltage on direct current circuits.

DESK AND BRACKET FANS,

9, 12 AND 16-INCH,
110, 220, 250, 500 VOLTS,
THREE SPEEDS.

SEND FOR DESCRIPTIVE CATALOGUE.



DESK FAN MOTOR.
9-12-16 inches.

DIEHL MANUFACTURING CO.,

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CHICAGO, 192-194 Van Buren St.
BOSTON, 128-132 Essex St.
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MAIN OFFICE AND WORKS:
ELIZABETHPORT, N. J.

SCRAP COPPER
WANTED

We pay highest market prices for old copper wire. Electric light and electric railway managers who desire to realize on material of this kind will find it to their advantage to communicate with us.

CHICAGO'S LEADING METAL HOUSE. ESTABLISHED 1885.

SWARTS METAL REFINING CO.,

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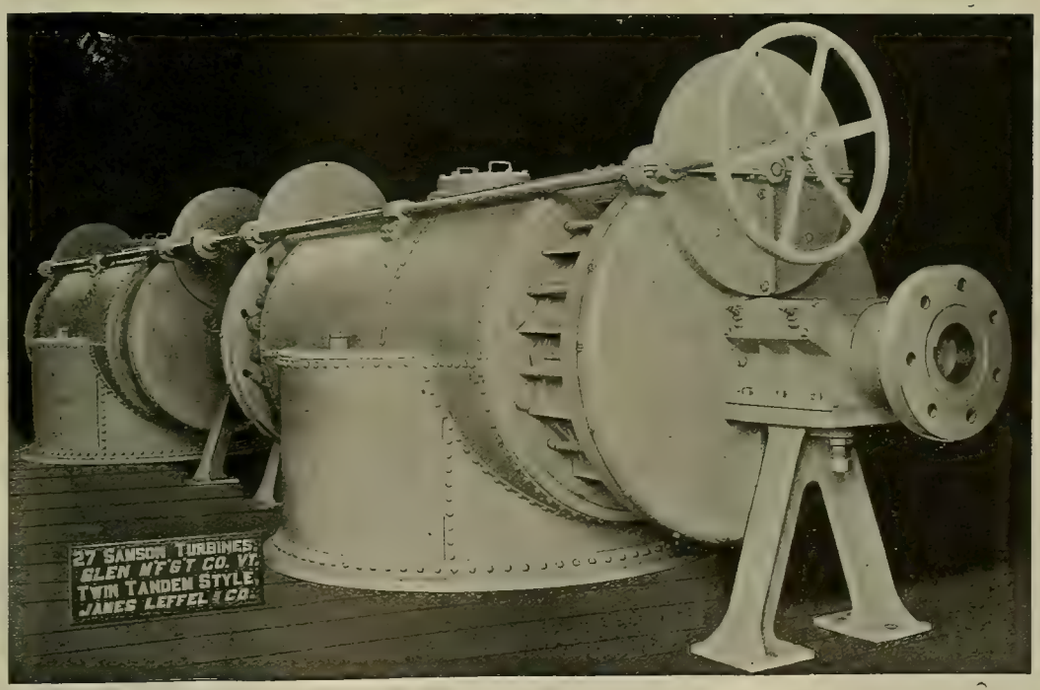
SAMSON TURBINES

AND CASCADE WATER WHEELS FOR HEADS FROM 3 FEET TO 2000 FEET.

ADAPTED TO ALL KINDS OF . . . . **Electric Lighting and Power Plants.**

SPECIAL FEATURES:

High Speed.
High Efficiency.
Great Strength.
FineRegulation.
Steady Motion.
Balanced Gate.
Great Concentration of Power in Limited Penstock Room.



These Wheels Built in Great Variety of Sizes and Styles, to Suit Any Conditions or Requirements. Special Attention Given to Designing and Building Wheels for Difficult Situations.

PAMPHLETS ON REQUEST. PLEASE ADVISE POWER REQUIRED AND HEAD OF WATER.

JAMES LEFFEL & CO., Springfield, Ohio, U. S. A.

Something New.

STERLING RENEWABLE FUSE

Copper Tipped Soldered Fuse.

¼ to 2 Amperes.

CAN BE RE-FUSED.
IS INDESTRUCTIBLE.

Will admit of rough handling.

100 Good Fuses in Each 100.

COST 1 CENT EACH.
RE-FUSED FOR ⅓ OF A CENT.

Try 100. You will use none other.

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No. 3.
Intercommunicating Central Energy Wall 'Phone.

INSIDE OR OUTSIDE,

LONG DISTANCE,
LOCAL or
INTERCOMMUNICATING.

No. 9 B.
Fire, Police and Burglar Alarm.

CENTRAL ENERGY SYSTEMS

FOR ALL PURPOSES.

Send for Catalogue and Prices.

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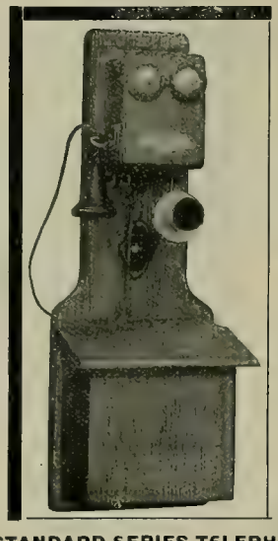
Manufacturers and Exporters of

THE HIGHEST GRADE SWITCHBOARDS AND TELEPHOHES.

250 CAPACITY MAGNETO SWITCHBOARD.

This Switchboard has mechanically self-restoring drops of the most compact and efficient design. Combined ringing and listening keys with ring back. Springs of German silver. Genuine platinum contacts. All line apparatus mounted upon a steel frame, insuring rigidity. Drops and jacks are mounted upon steel strips, faced with polished hard rubber, and are easily and quickly removable. Cabinets of quarter-sawed oak with an attractive brass foot rail.



STANDARD SERIES TELEPHONE.

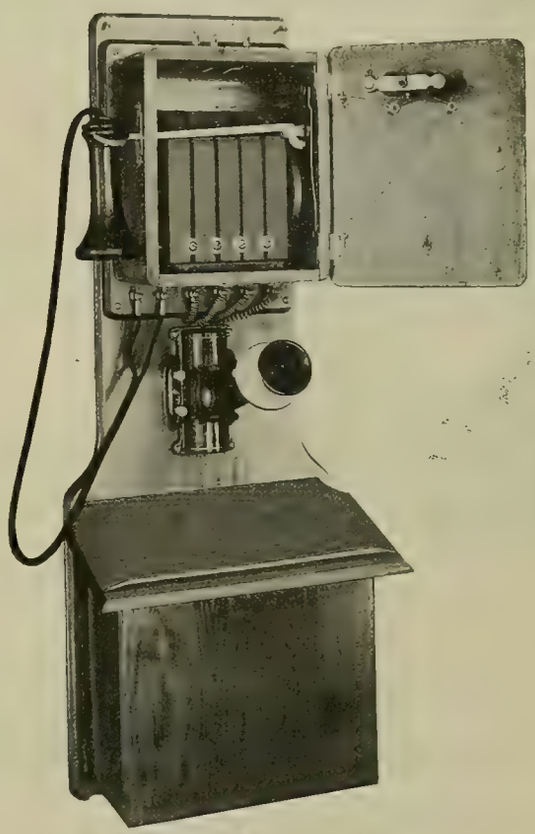
Quartered oak cabinet. Sensitive receiver; transmitter that carries up to the end of the line. Powerful generator. This is the instrument you want. Also made in the compact type for use with dry batteries.

Telephones = Switch Boards

Complete Equipment for Telephone Lines and Exchanges.

Notice Some of the Good Points.

The Heaviest Telephone Generator made.
Wide Cut Gear.
Heavy Cast Bearings.
Silk Wound Armature.
Platinum Contact Hook Switch-Perfect Contacts.
Absolutely Impossible for Dust or Dirt to Accumulate.
Receiver has no Exposed Metal Parts.
The Finest Finished Adjustable Arm in use.
Transmitter has a Heavy Cast Brass Front not Stamping; Cannot Buckle.
The Woodwork (Oak or Walnut) has a High Piano Finish.
Ringers 1200 or 1600 Ohms Resistance.
Two Cells (Wet or Dry) Batteries.
The Magneto Boxes can be Removed from Backboards without Cutting Wires.
This is not true with many other makes.
All Connections are Soldered.
Absolutely Guaranteed.



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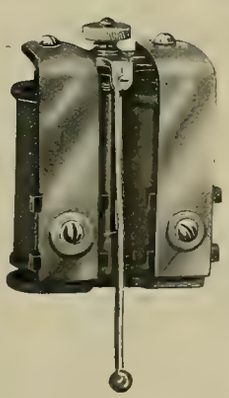
MOST PERFECT TELEPHONE RECEIVER EVER PLACED ON THE MARKET.

Type X Receiver.

Write us for our new telephone catalogue just out. It embodies everything new and up-to-date in the telephone line.



This is not a "Dead Ringer"

Either in Action or Imitation.

It can be adjusted while the operator is ringing.

The Adjustment is made by simply turning the Thumb-screw.

The Armature is carried on the frame and by means of the Thumb-screw its distance can be varied the slightest fraction of an inch.

WESTERN ELECTRICAL SUPPLY CO.,

NEW YORK OFFICE:
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Warehouse: 91 Liberty St.

ST. LOUIS, U. S. A.

GALV. IRON WIRE NO. 14.

Ton lots per 100 lbs	$ 3.70
No. 12, ton lots per 100 lbs	3.50
Brackets, oak, per 1,000	12.00
Pins, oak, per 1,000	6.50
Cross-arms, per foot, 2 to 8 Pin	.03
Porcelain Knob, No. 4, per 1,000	7.50
Glass Insulators, bbl. lots per 100	2.11

Headquarters for all Supplies.

Shipments made promptly. Send for our Hand-book of Information, sent free.

Exchange Telephones. Bridging Telephones.

118 & 120 W. Jackson Blvd., CHICAGO, ILL.

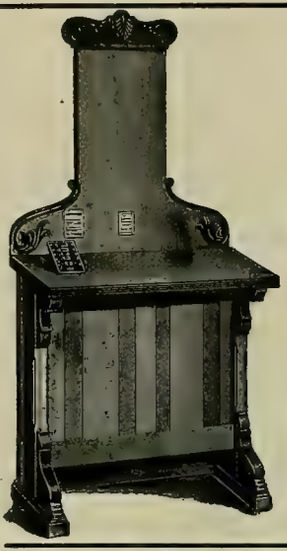
Farr Telephone & Construction Supply Co.

You cannot operate this machine with a penny on a string or by working wires through slots.

TRY THE OTHERS.

We have machines for all kinds of service.
Sent on 30 days' trial.

THE AMERICAN TOLL TELEPHONE CO.,
50 Sheriff St., Cleveland, O.



SLOT MACHINES FOR TELEPHONE PAY STATIONS.

Years of efficient service have proven the reliability of our apparatus.

THERE ARE OTHERS, BUT NONE AS GOOD.

Our Machines are strictly automatic, because when the coin is deposited the machine does the rest.

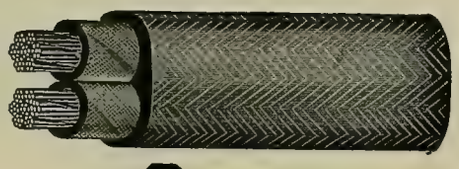
THERE IS NO CRANK TO TURN, LEVER TO PULL, NOR BUTTON TO PUSH.

A service equal to that furnished by Bell companies, and nothing less will satisfy the public. Catalogue for the asking.

SATISFACTION GUARANTEED.

MASON TELEPHONE PAY STATION CO.,
LUDINGTON, MICH.

INSULATED RUBBER WIRES AND CABLES.



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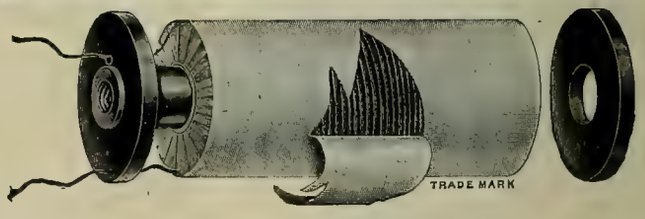
WORKS AT TRENTON, N. J.



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MAGNETS, SOLENOIDS AND INDUCTION COILS MADE ANY SIZE AND TO ANY RESISTANCE FOR TELEPHONE AND SWITCH-BOARD WORK.

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VARLEY DUPLEX MAGNET CO.,
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There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

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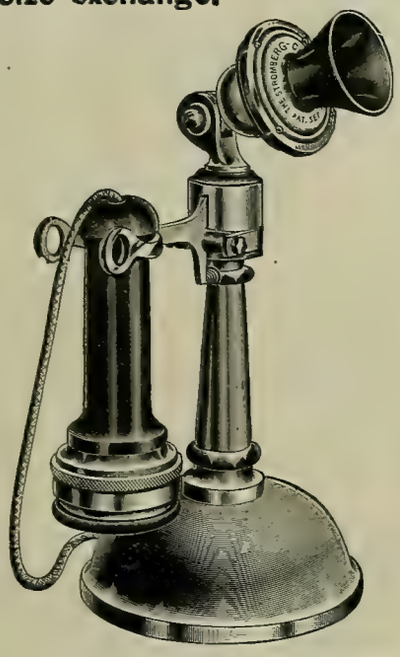
TELEPHONES AND SWITCHBOARDS

for any size exchange.

"CENTRAL ENERGY" SYSTEM.



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CORRESPONDENCE SOLICITED.

THE STROMBERG-CARLSON TEL. MFG. CO.

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Metallic Circuit Multiple Switchboards.

Positive Double Supervisory Signals. Central Energy.
Simple and Mechanically Perfect.
All Circuits Perfectly Balanced Electrically.
Cost of Operation and Maintenance Reduced to a Minimum.

The Method of Operating that we have adopted has been determined upon, by long years of experience and practical operation by the very best telephone engineers, to be unexcelled.

Send Us Your Specifications.

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MADISON, WIS.

Manufacturers and Importers

HIGH GRADE TELEPHONE APPARATUS

EXCLUSIVELY.

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INDEPENDENT TELEPHONE CONVENTION

BUFFALO,
June 11-13, 1901.

THE WESTERN ELECTRICIAN

Of June 8th and 15th will cover this important annual event in telephone circles, which promises to be the most interesting and instructive meeting in the history of the association. To increase your business among the telephone exchanges of the world you should be largely represented in the advertising columns of the above numbers. . . . . .

NOW IS THE TIME TO ORDER YOUR SPACE.

Western Electrician

510 Marquette Bldg., CHICAGO.

ESTABLISHED 1866.

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The old original

D. A. KUSEL TELEPHONE AND ELECTRIC MFG. COMPANY,

1119 Pine St., ST. LOUIS, MO.

The oldest and most reliable manufacturer of telephones and switchboards in the west. Write for catalogue and price list.

D. A. KUSEL, Proprietor.

DEALERS AND CONTRACTORS

For Satisfactory Intercommunicating

TELEPHONES

At bottom prices, write to

THOMAS, WILCOX & DIETZ, • • Cleveland, Ohio.

SPECIAL BRIDGING PHONE

Equipped with our new five-bar nickeled Bridging Generator, 1,600-ohm adjustable Ringer, Carbon Lightning Arresters, special Long Distance Adjustable Transmitter mounted on Concealed Cord Arm, and hard rubber Bell style Bi-polar Receiver.

This instrument guaranteed to ring 50 well-adjusted bells on a 100-mile line of No. 12 iron wire and is the strongest bridging phone ever manufactured.

PRICE $12.50

SEND FOR SAMPLE AND BE CONVINCED. PARTICULARS ON APPLICATION.

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INDEPENDENT TELEPHONE SUPPLY CO.,

Construction Material and General Supplies.

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ANNOUNCEMENT.

We are prepared to furnish you an estimate, with plans and specifications, for any size telephone plant. We are agents for the Kellogg Switchboard & Supply Co. Write us for information.

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American Vitrified Conduit Company,

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Contractors for Complete Installation of Conduit Systems.

General Offices: 39 Cortlandt St., N. Y.

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MANUFACTURE EVERYTHING TELEPHONIC.

KOKOMO TELEPHONES

Will Satisfy YOU.

NOTHING IN FRONT OF THEM.

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EUREKA DEPOLARIZING SOLUTION FOR BATTERY CELLS.

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Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

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For use in Electric Plants and Power Stations.

BINK'S DRY NON-FLAME PAINT.

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Send for circulars and prices.

CABLE TERMINALS.

CHEAPEST AND BEST ON THE MARKET.

NEAT, COMPACT, CONVENIENT,

SUBSTANTIAL, MOISTURE PROOF, WILL NOT ARC.

HARD RUBBER INSULATION.
ALL CONTACTS SOLDERED.

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Century Telephone Construction Co., CLEVELAND, OHIO.

A Direct Reading Ohmmeter.

Ohmmeters, Ammeters, Voltmeters.

Special Electrical Machinery.

F. B. SAGE & BRO.,

Successors to American Electric Specialty Co., 128 Liberty St., New York City.

New York Agents Wirt Electric Co. Rheostats and Brushes.

THE TELEPHONE HAND-BOOK

BY HERBERT LAWS WEBB.

Price $1.00.

The only complete and practical work of its kind on the market.

PUBLISHED BY THE ELECTRICIAN PUBLISHING CO., Suite 510 Marquette Building, Chicago

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No. 1. Desk Telephone.

Success

Comes only to those telephone exchanges which use the BEST material. If you use our goods success is assured.

We can supply EVERYTHING USED WITH TELEPHONES.

No order too small for attention or too large for our capacity. Rapid deliveries our rule and each order filled with care. Large stocks always on hand.

Telephones, every style and grade. Long and short backboards. Elegant finish and design. Prices that will suit. Hard rubber receivers. Oak or walnut woodwork. New ideas in magneto bells. Each instrument guaranteed.

All kinds of telephone supplies. New parts for old telephones. Double-pole receivers.

Electricians' tools. Lightning arresters, carbon and fuse. Extension bells—standard and bridging. Circuit-closers. Transmitters of various styles. Repeating coils, induction coils, construction material of all kinds.

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THE GORDON PRIMARY CELL.

The most improved, efficient, long lived and economic primary cell of the new century.

Extensively used for telephone, telegraph, fire and police alarm service, railroad signal work, gas engine ignition and automobiles.

Manufactured in ten different styles.

Catalogue, price-list, etc., upon application.

THE GORDON BATTERY CO., 13 and 15 Laight Street, New York.

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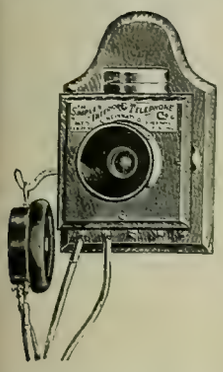
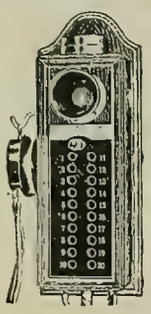


Why not increase your incomes by installing the

SIMPLEX INTERIOR TELEPHONE CO.'S

Apparatus in connection with your exchange subscribers' lines?



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431 Main St., Cincinnati, Ohio, U. S. A.

J. H. VAN VLISSINGEN, President. WM. C. HEINROTH, Treasurer.
L. G. WHEELER, Vice-President. L. G. BOWMAN, Sec'y and Gen'l Manager.

WESTERN TELEPHONE CONSTRUCTION CO.

CHICAGO, ILL.

NOTICE OF REMOVAL!

We desire to inform our friends and patrons of the removal of our FACTORY from Chicago to Winthrop Harbor, Ill. Also that after May first the Company's OFFICES and SALESROOMS will be located in the Fisher Building, Chicago, Ill.

Prompt attention given to all orders and shipments—no delay.

FACTORY: WINTHROP HARBOR, ILL.

OFFICES: FISHER BUILDING, CHICAGO, ILL.

TELEPHONE TROUBLES

ARE UNKNOWN WHEN OUR

CENTRAL ENERGY SYSTEM

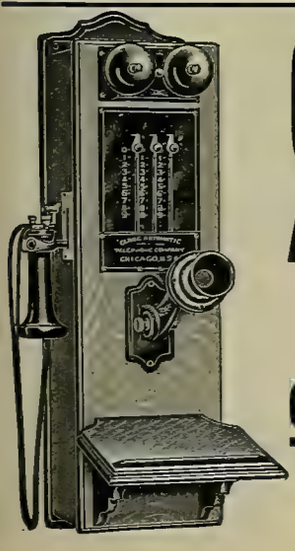
Is Installed in Your Exchange.

IT REPRESENTS THE HIGHEST TYPE OF MODERN TELEPHONE APPARATUS AND IS PERFECT IN EVERY DETAIL.

Our Line of TELEPHONES, SWITCH-BOARDS, PROTECTIVE DEVICES is Complete.

No. 35. CENTRAL ENERGY Telephone.

AMERICAN ELECTRIC TELEPHONE CO.,
36-50 W. Jackson Boulevard, CHICAGO, U. S. A.



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PRICES RIGHT.
TERMS RIGHT.
GUARANTEED.

GLOBE AUTOMATIC TELEPHONE CO.,

OFFICES, 59 DEARBORN STREET.
FACTORY, 31-45 WEST RANDOLPH STREET.

Telephone Manager!

Is your old Switchboard { WORN OUT / TOO SLOW / TOO SMALL / ALWAYS OUT OF REPAIR / GIVING BAD SERVICE } ?

THEN GET A

Union Switchboard.

THIS IS THE ONLY TELEPHONE SWITCHBOARD ON WHICH IT IS POSSIBLE TO GIVE IMMEDIATE ANSWERS TO ALL CALLS.

OUR AUTOMATIC CALL AND SUPERVISORY SIGNAL ARE THE LEAST COMPLICATED AND THE MOST POSITIVE.

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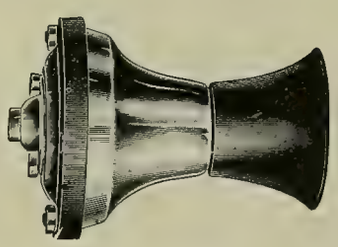

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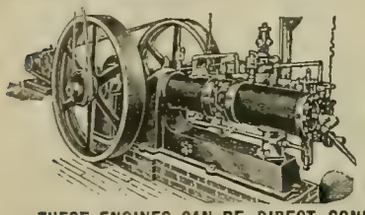

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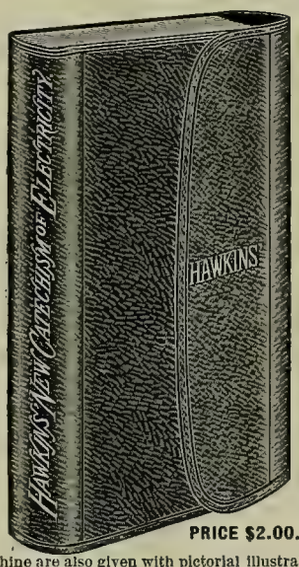

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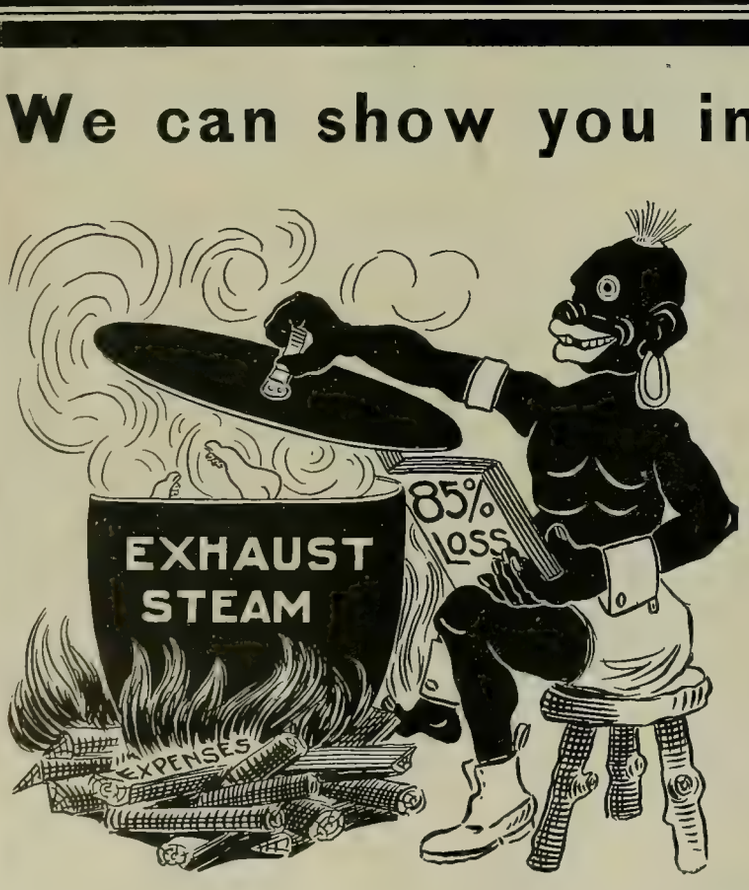

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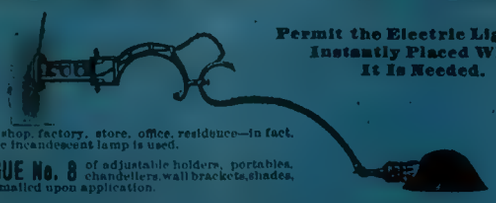

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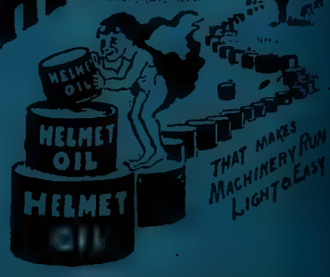

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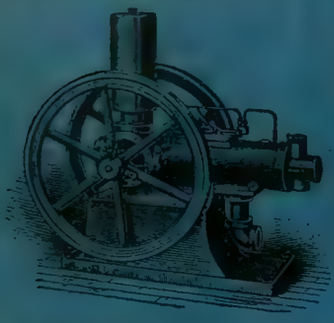

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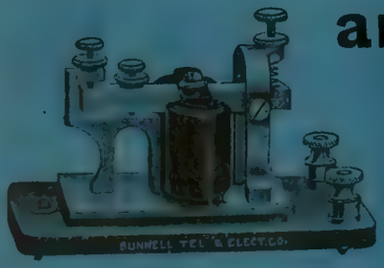

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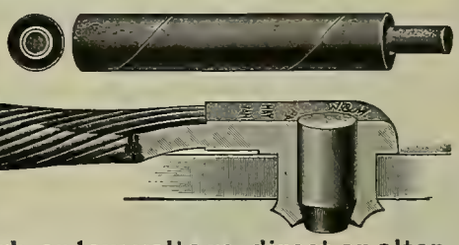

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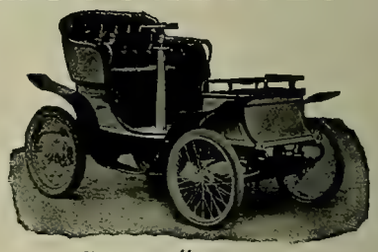

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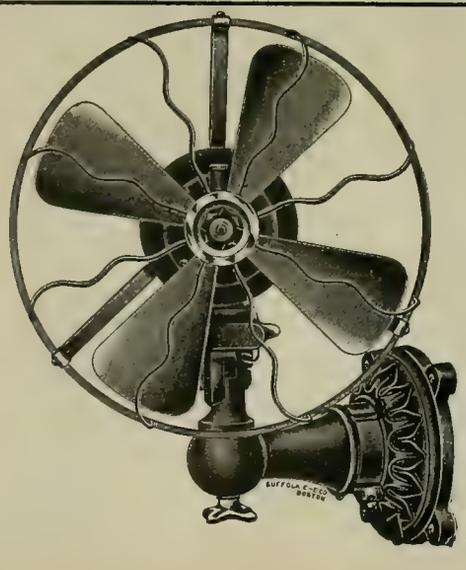

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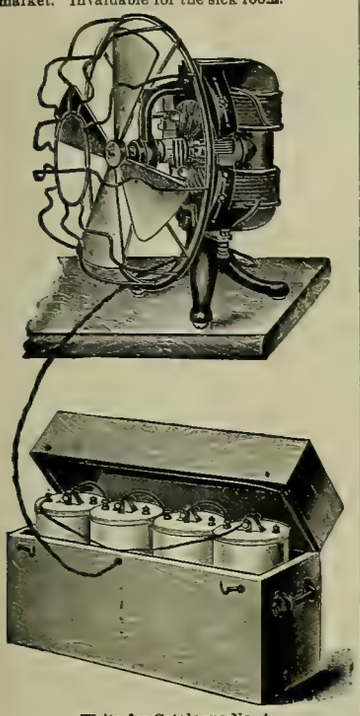

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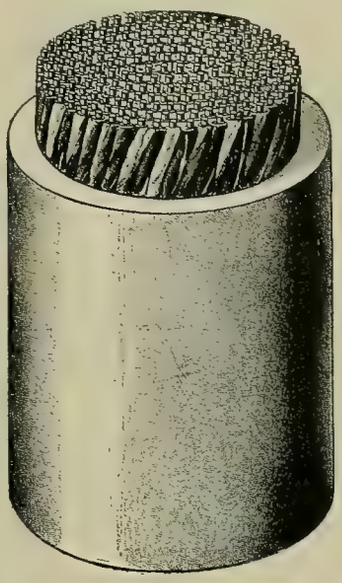

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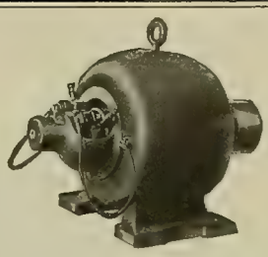

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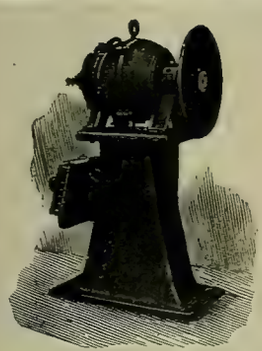

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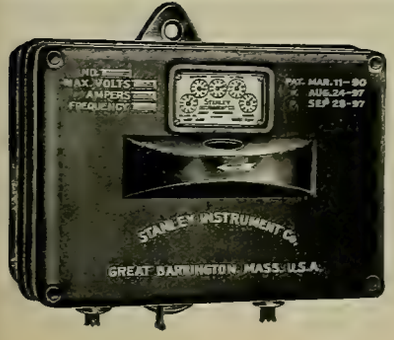

DON'T FORGET

YOU ARE LOSING MONEY BY USING OLD FASHIONED END BEARING METERS. STANLEY METERS SAVE YOU THIS LOSS.

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Stanley Instrument Company.

General Sales Department: 144 Broadway, NEW YORK, N. Y.

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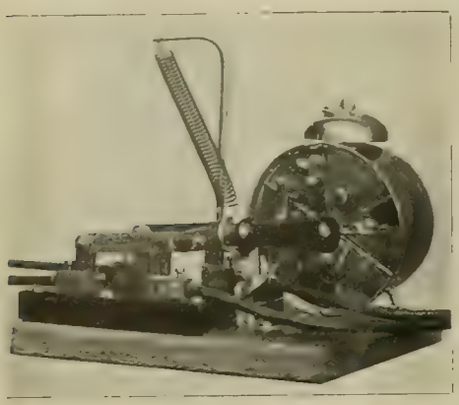


THE BEST WAY

Clock Switch

Turns out show window lights any time desired after store is closed. You only need to wind the clock. Switch is automatic. Perfectly reliable. Sent on ten days' trial.

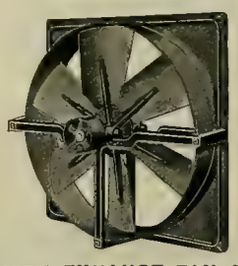
Retail Prices { 15 Amp., D. P., $4.50 / 25 Amp., D. P., 5.00 / 50 Amp., D. P., 6.00

GALESBURG, ILL., Dec. 27, 1900.

We, the undersigned merchants of Galesburg, Ill., have in use one of the Clock Switches made by the College City Electric Company, and find it satisfactory in every way. It is easily set and does not get out of order.

THE GALESBURG SHOE CO., Boots and Shoes. NELSON, MARKS & CO., Dry Goods.
W. A. ANDERSON & CO., Boots and Shoes. ANDERSON, DRAKE & CO., Wall Paper, Paints.

COLLEGE CITY ELECTRIC CO., Galesburg, Ill.

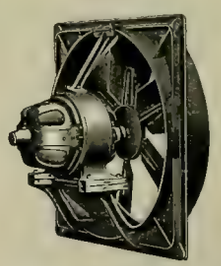


TRIUMPH EXHAUST FAN—Belted.

The only Fan made with flat, square back, adjustable self-oiling boxes, with Phosphor Bronze Bearings. Most easily installed. Simply lagged or bolted to opening. Sizes 14 to 96 in.

Catalogue and Discounts on Application.

Export quotations F. O. B., N. Y. We manufacture Desk Fans, Counter and Floor Column Fans, direct-connected, for waterpower; Belted Ceiling Fans.



TRIUMPH EXHAUST FAN

With Detachable Motor for all standard voltages of Direct Current, correct electrical and mechanical construction. Most efficient. Motor amply protected and convenient for inspection. Self-oiling boxes, carbon brushes and automatic feed rheostat with automatic release. Motor may be detached and utilized for other purposes.

Motor and Fan Frame shipped separately, making installation simple and easy. Sizes, 30 inches, 36 inches, 42 inches and 48 inches.

SPECIALTY MFG. CO., 400 and 402 S. Meridian Street, INDIANAPOLIS, IND., U. S. A.

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All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."

Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.

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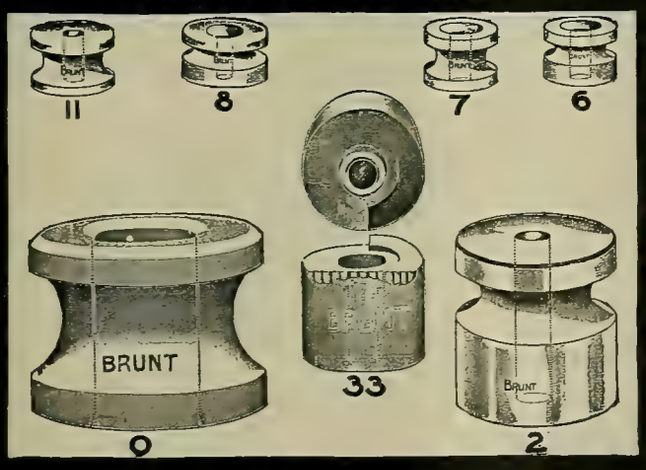
(10923)

HIGH GRADE Porcelain Insulators.

ALL STYLES AND SIZES.



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THEY COMPLY WITH ALL UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

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EAST LIVERPOOL, OHIO.

WESTERN ELECTRIC

Series Enclosed Alternating Arc System.

3 Lamps in Series on 220 to 240 Volts.

7 Lamps in Series on 500 to 550 Volts.

13 Lamps in Series on 1,000 Volts.

26 Lamps in Series on 2,000 Volts.

Any number of lamps in series by using step-up or step-down transformer.

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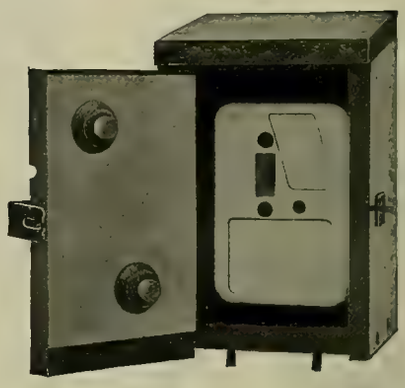
Lightning Arresters

For Alternating Current—Short Gap,
1,000 Volts to 15,000 Volts,
Single and Double Pole for Station and Lines.

For Direct Current—Magnetic Blowout,
6,000 Volts and Less,
Single Pole for Stations, Lines and Cars.



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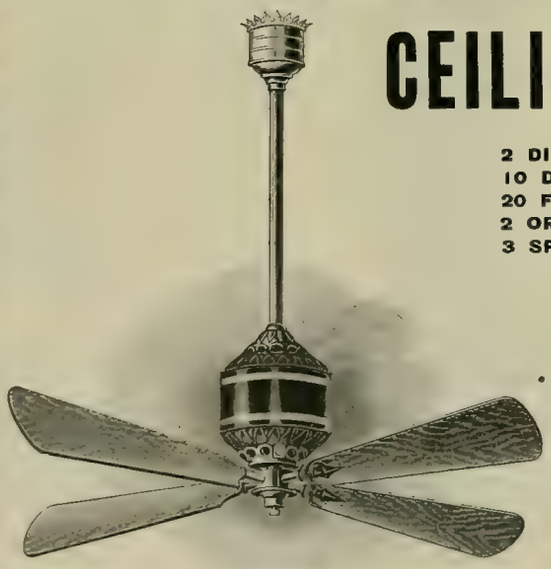

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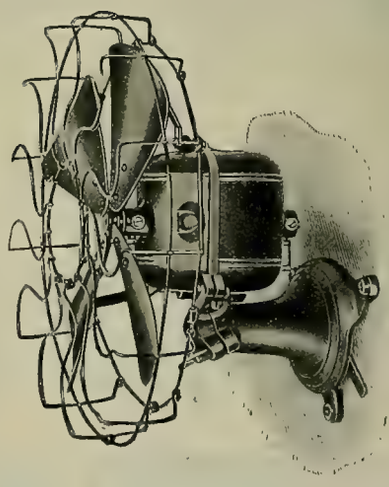

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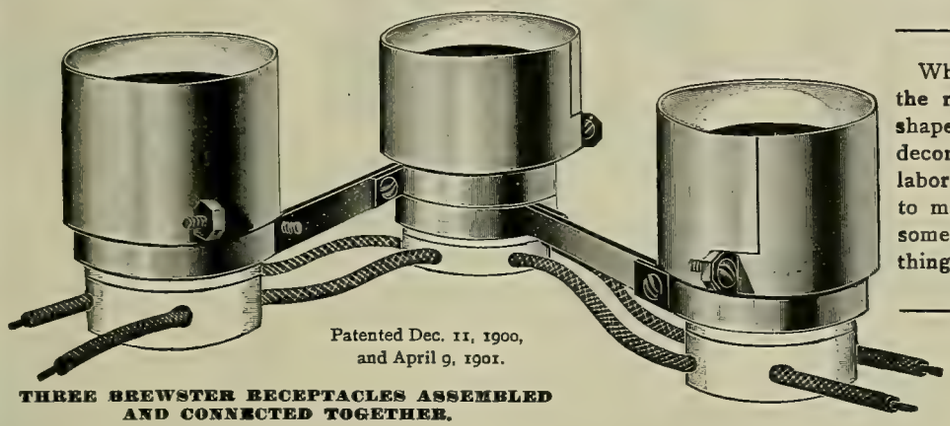

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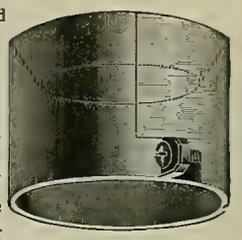

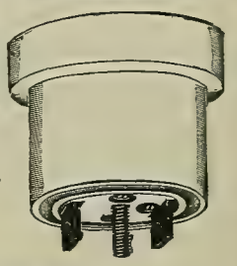

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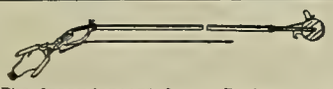

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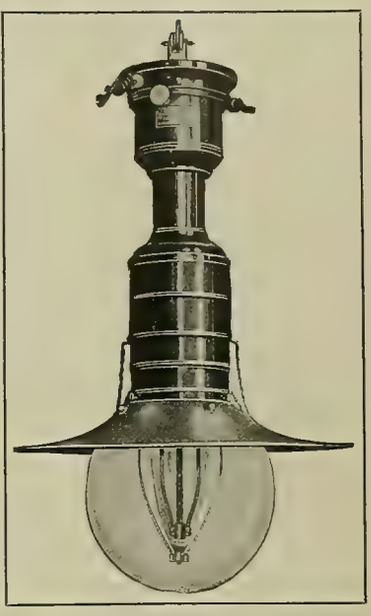

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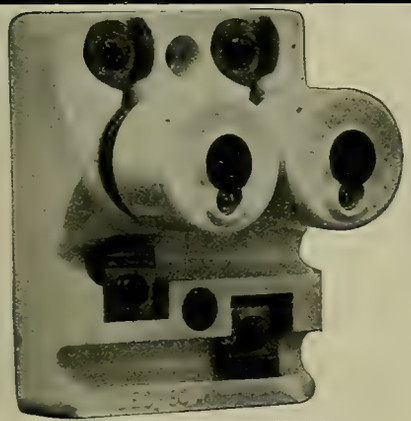

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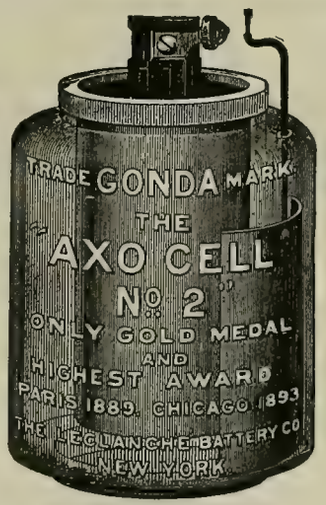

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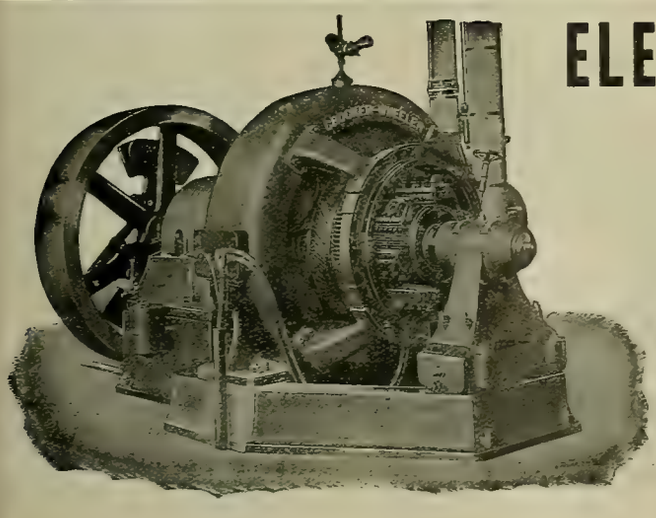

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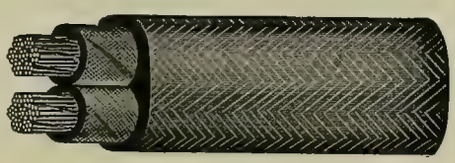

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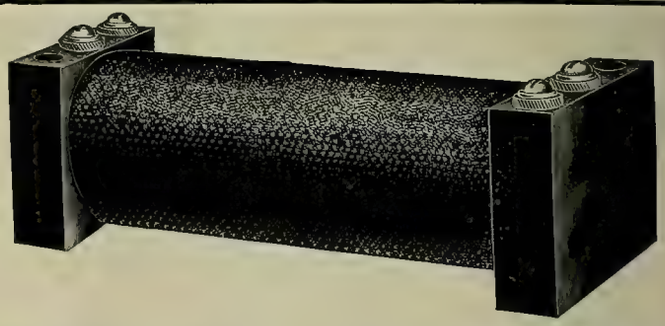

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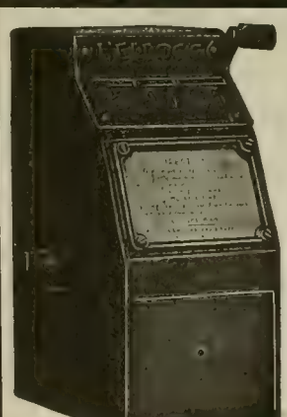

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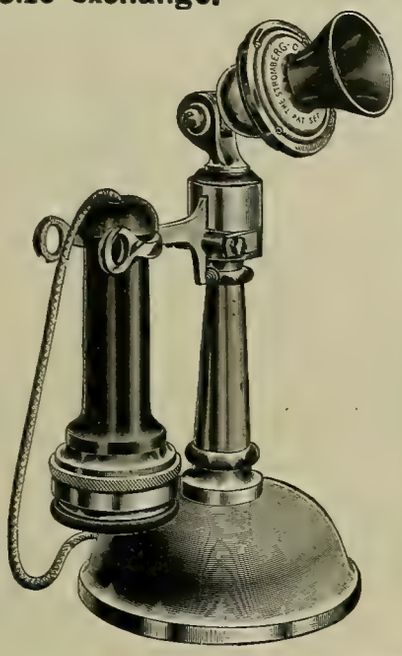

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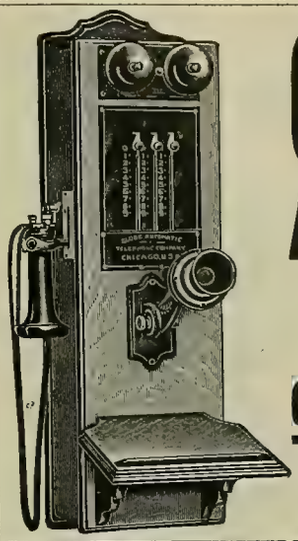

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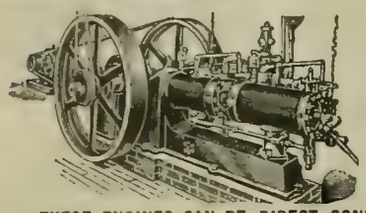

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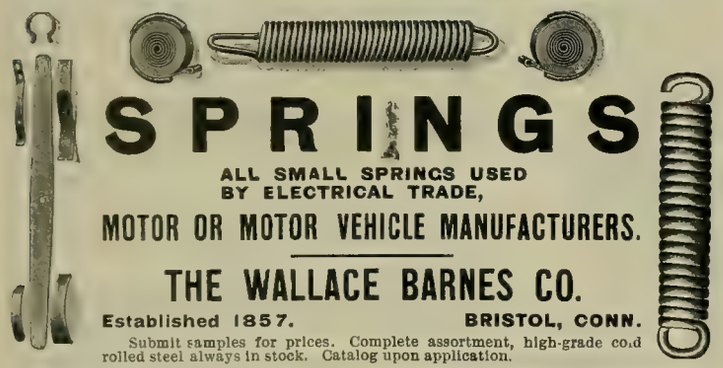

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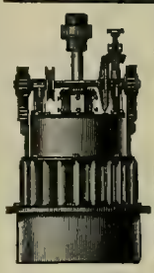

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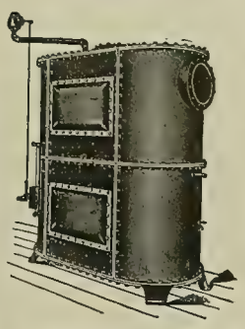

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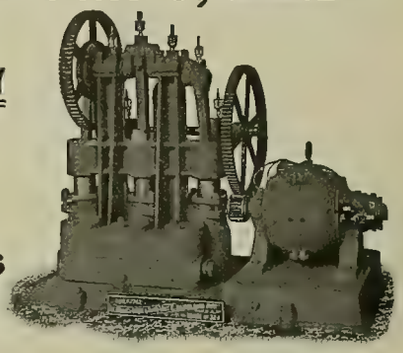

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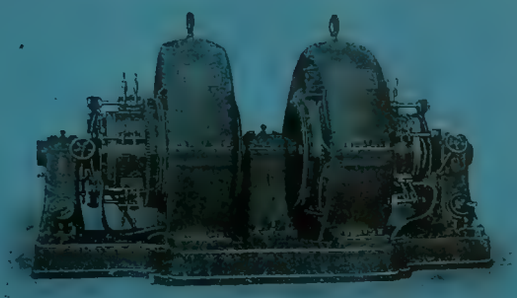

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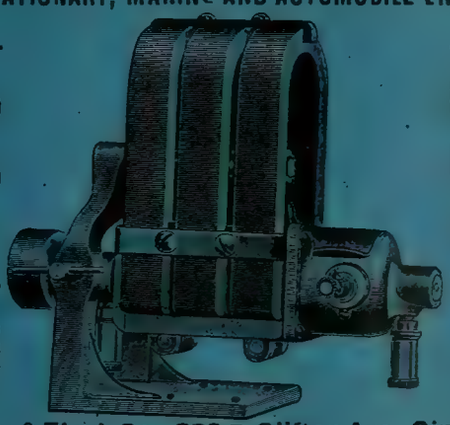

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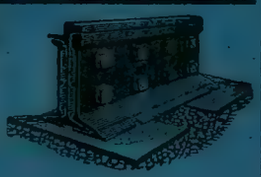

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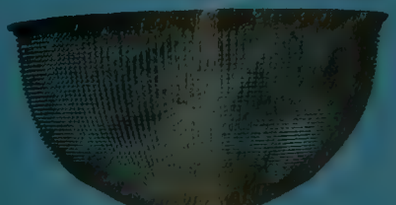
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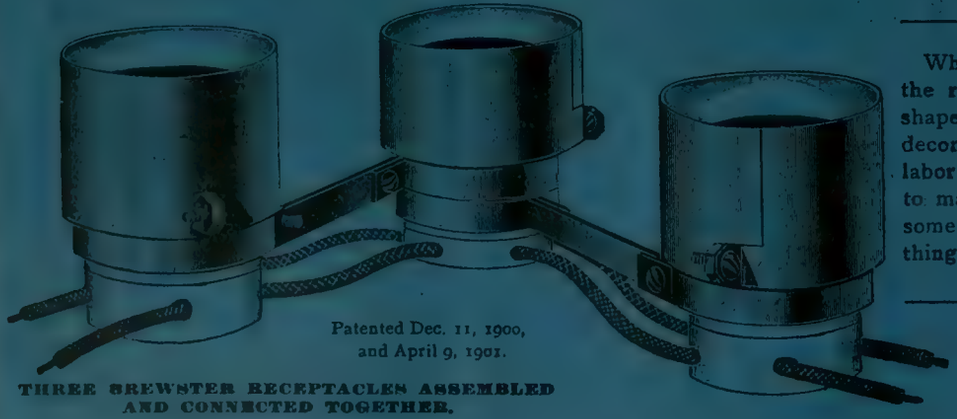

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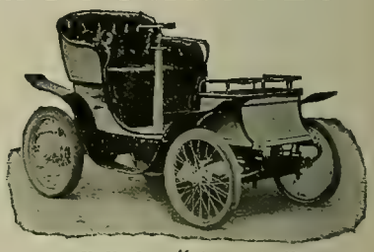

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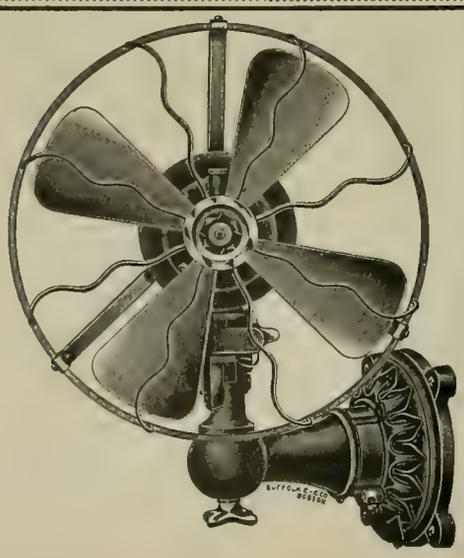

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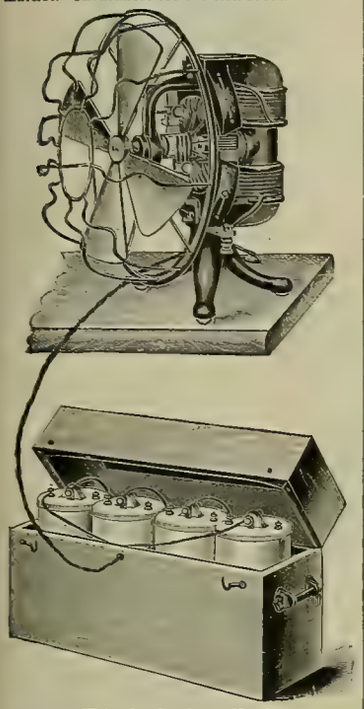

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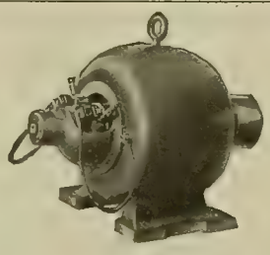

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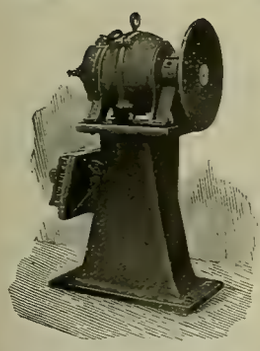

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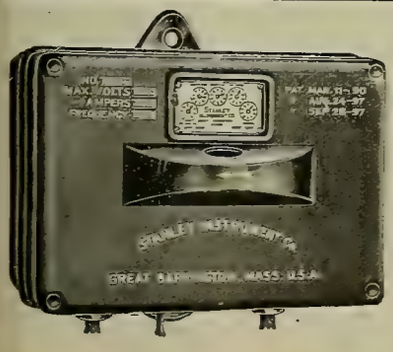

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Stanley Electric Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co
Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co
Turbine Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Varnishes.
Sterling Varnish Co.
Vulcanized Fibre.
Vulcanized Fibre Co.
White-Washing M'ch's.
Star Brass Works.
Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.
Woodwork.
Huey Company, The M. S.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 8.

Central Electric Company,

Telephone Construction Material.

BRACKETS, LAG BOLTS, PINS, POLE STEPS, CROSS-ARMS, CROSS-ARM BRACES, LAG SCREWS, INSULATORS.

CONSTRUCTION TOOLS OF EVERY DESCRIPTION.

Telephone Supplies.

Okonite Wire, The best for telephone construction. Will outlive any other wire.

National Telephone Cables, Single and double wrapped, aerial and underground, low static capacity.

264=266=268-270 FIFTH AVENUE, = CHICAGO.

HIGH-GRADE PORCELAIN TUBES

300 DIFFERENT LENGTHS AND SIZES

SHOW HIGHEST TESTS YET MADE ON TUBES.

BATTERY BUSHINGS IN ALL SIZES.

ASK YOUR DEALER FOR "BRUNT" TUBES, INSULATORS AND CLEATS.

THEY COMPLY WITH THE UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

THE G. F. BRUNT PORCELAIN WORKS,

EAST LIVERPOOL, OHIO.

FAN MOTORS

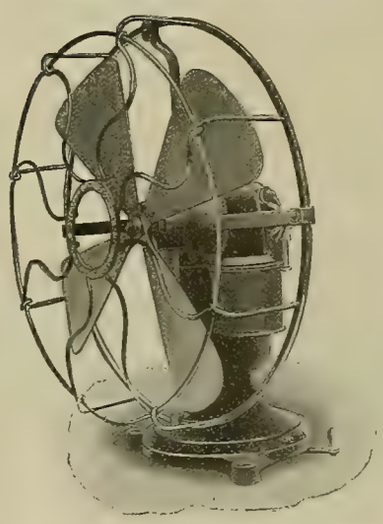
1901.

DIRECT CURRENT CIRCUITS.

Ceiling Fan Motors

PROVIDED WITH SWITCH GIVING THREE SPEEDS.

Wired for Chandelier Attachment.



Desk

Bracket

Ceiling

Styles.

MADE FOR 110, 220 AND 500 VOLT CIRCUITS.

WESTERN ELECTRIC COMPANY

CHICAGO. NEW YORK.

AMERICAN ELECTRIC COMPANY, Northwestern Agents, St. Paul, Minn.
MERCANTILE ELECTRIC CO., 810 Spruce St., St. Louis, Mo.
THE KILBOURNE & CLARK COMPANY, 815-817 Second Ave., Seattle, Washington.
PHILADELPHIA, 933 Market St.
STANDARD ELECTRIC CO., Cincinnati, Ohio.
CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

ANTWERP, 32 Rue Boudewyns.
LONDON, Bridge Chambers, 171 Queen Victoria St., E. C., and North Woolwich, E.
PARIS, 46 Avenue de Breteuil.

EDISON TELEPHONE LAMPS

Are the Standard for Visual Signals.

Their value has been verified by more than three years of extended service.

They are preferred because of

Certainty of service of each individual lamp—every lamp being perfect.
Extreme length of life.
Strong and durable mechanical construction.
Thorough uniformity of all lamps, insuring certainty of contact in sockets and freedom from misfit.
Maximum of maintained light for a minimum of power consumption.

Orders for any quantity promptly filled.
All lamps supplied closely rated and carefully selected.

EDISON DECORATIVE AND MINIATURE LAMP DEPT.

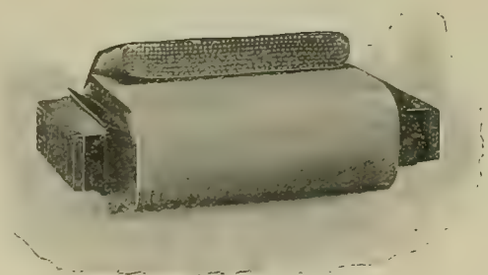
General Electric Company,

Harrison, N. J.

THE GENERAL ELECTRIC COMPANY'S

TYPE H

Oil Transformers



Coils of Type H Transformer.

Have compact form of winding which prevents vibration and presents large radiating surface to the oil. Therefore the insulation is permanent and the temperature rise small.

A careful test will reveal many other excellent qualities.

General Office: Schenectady, N. Y.

Sales Offices in All Large Cities.

Chicago Office, Monadnock Building.

Delegates

—TO THE—

CONVENTION OF THE INDEPENDENT TELEPHONE ASSOCIATION

Take Notice!

We hereby take exception to the statement of wise old King Sol, who said: "There is nothing new under the sun."

We desire to affirm that we have a telephone switchboard that is not only novel in its design and general arrangement, but comprises many features that enable it to be operated more easily and quickly than was ever known in telephone switchboard practice before its introduction.

Be sure to see our representatives and have the system explained to you before you leave Buffalo.

THE UNION SWITCHBOARD COMPANY,

ERIE, PA.

MR. SEYMOUR SWARTS

HEREBY ANNOUNCES THAT HE WILL BE AT THE INDEPENDENT TELEPHONE CONVENTION AT BUFFALO, JUNE 11TH AND 13TH, WITH RESIDENCE AT THE IROQUOIS HOTEL AND IN CONSTANT ATTENDANCE AT THE CONVENTION HALL FOR THE PURPOSE OF

BUYING SCRAP COPPER

MR. SWARTS WILL PAY THE HIGHEST MARKET PRICES FOR OLD COPPER WIRE AND OTHER "ELECTRICAL METAL SCRAP." TELEPHONE MEN WILL FIND IT TO THEIR ADVANTAGE ALWAYS TO KEEP US IN MIND AND COMMUNICATE WITH US WHENEVER THEY HAVE ANY SCRAP "GOING BEGGING."

CHICAGO'S LEADING METAL HOUSE. ESTABLISHED 1885.

SWARTS METAL REFINING CO.,

REFERENCES: { Foreman Bros. Banking Co., Dun's Agency, Bradstreet's Agency.

OFFICE AND WORKS: 20 & 22 N. DES PLAINES ST., CHICAGO.

IT BRINGS GOOD LUCK.

A WELL KNOWN PLANT
IN THE ELECTRICAL FIELD.

THE STANDARD FOR RUBBER INSULATION.

THE OKONITE CO., Ltd.,

253 BROADWAY,
NEW YORK.

WILLARD L CANDEE, } Managers.
H. DURANT CHEEVER, }
GEO T MANSON, General Supt.
W. H. HODGINS, Secretary.

AMERICAN ELECTRIC TELEPHONE CO.

AUTHORIZED CAPITAL THREE MILLION DOLLARS.

MANUFACTURER OF

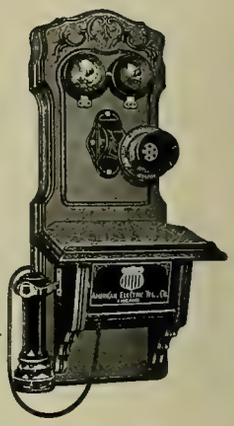
Modern Telephone Apparatus

FOR THE COMPLETE EQUIPMENT OF

CENTRAL ENERGY TELEPHONE PLANTS

FROM THE SWITCHBOARD — TO THE SUBSCRIBER.

No. 36.
Paris "Expo."
Telephone.



No. 34.
Central Energy
Telephone.

FACTORIES—AMERICAN ELECTRIC TELEPHONE CO.—1901.

INCLUDING

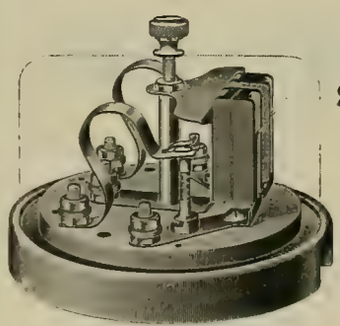
SWITCHBOARDS

Multiple for the Express—Central Energy and Magneto Systems.

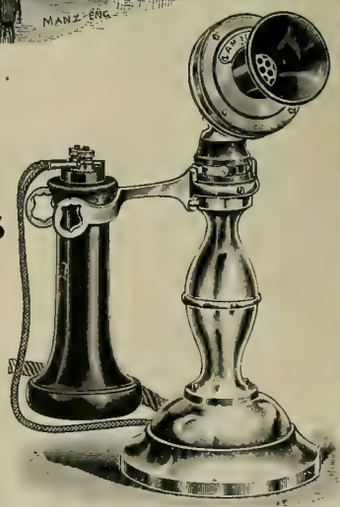
TOLL LINE BOARDS, DISTRIBUTING BOARDS, CABLE TERMINALS, LIGHTNING ARRESTERS,

AND

CONSTRUCTION SUPPLIES OF ALL KINDS.



Burns' Individual Station
Metallic Circuit
Protector.



No. 41. Paris Expo. Desk Set.

AMERICAN ELECTRIC TELEPHONE CO.

JACKSON BLVD. AND CANAL STREET, CHICAGO, U. S. A.

AD STUDIO—

WE SOLICIT TELEPHONE SWITCHBOARD PROPOSITIONS—

AND

FAN ORDERS.

Hurricane Direct Current Desk Fans—Direct Current Ceiling Fans—Alternating Fans.

The Missouri Electrical Manufacturing Co.,

P. D. CABLE, President. F. B. LITTLE, Vice-Pres't. R. W. MOORE, Secretary. W. F. LITTLE, Treasurer.

ST. LOUIS, MO.

ALSO AGENTS FOR

Vindex Transformers,
Bernard Dynamos and Motors,
Milwaukee Multipolar Apparatus
(Motors, Etc.)
General Incandescent Lamps,
Standard Insulating Varnishes,
Electro Insulating Tapes, Etc.

Ah There, Telephoniques !

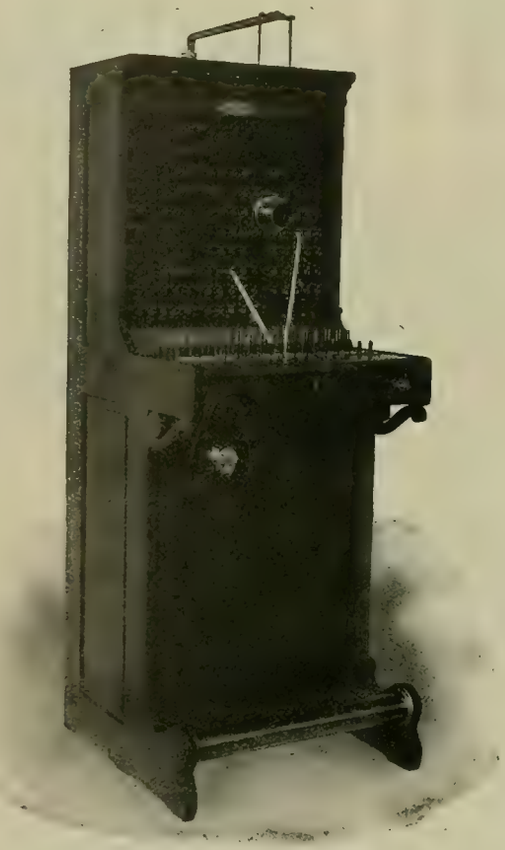
P. S. GIVE US A WHIRL ON AN ORDER. YOU DON'T KNOW WHAT THE NEW HOUSE CAN DO UNTIL YOU TRY IT—THEN TRY IT.

KELLOGG SWITCHBOARD & SUPPLY CO.,

MAKERS OF

Telephones, Switchboards and Complete Equipments

FOR SMALL OR LARGE EXCHANGES.

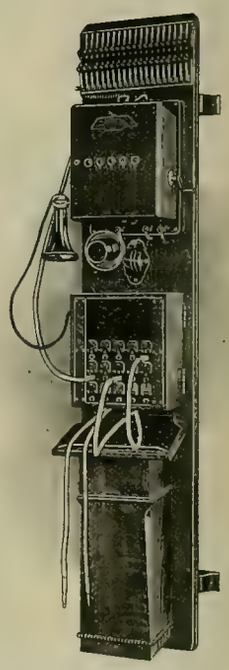


150 Line Magneto Switchboard.

The reader of this advertisement in particular, and the telephone public in general, are cordially invited to visit the Kellogg Pavilion in Section R of the Electricity Building, at the Pan-American Exposition at Buffalo. This is without question the finest pavilion devoted to any electrical exhibit, a fitting housing for what we know to be the most complete and best line of telephone apparatus ever displayed to the public.

Our exhibit adjoins that of the Bell and Western Electric Companies. We invite comparison.

Gentlemen will be in charge to explain the apparatus, to give technical advice and to talk business.



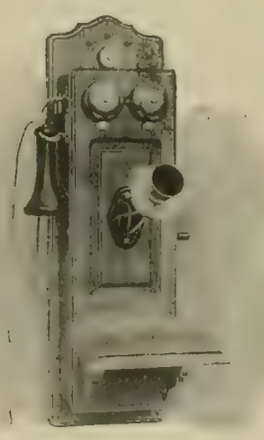
Combination Telephone and Switchboard for Selective Signaling.

Write for Descriptive Matter Concerning our Apparatus.

FACTORY AND GEN. OFFICES:
229 SO. GREEN ST., CHICAGO.

NEW YORK OFFICE:
346 BROADWAY.

CLEVELAND OFFICE:
ELECTRIC BLDG.

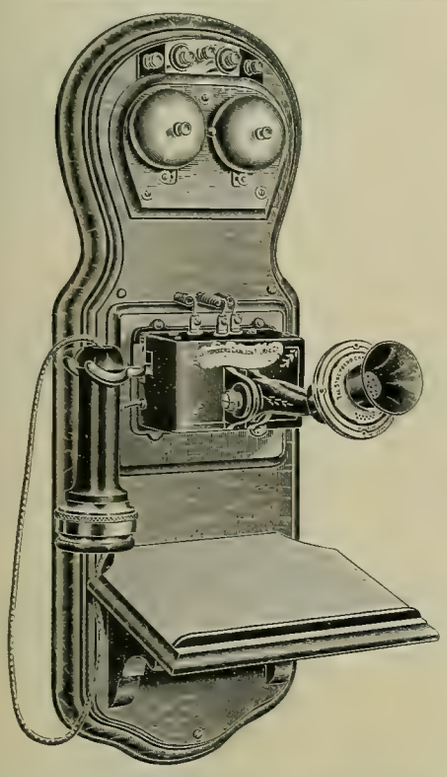


Dry Cell Type Compact Wall Telephone.

Bridging Wall Telephone with Pay Station.

Kellogg Single Slot Pay Station.

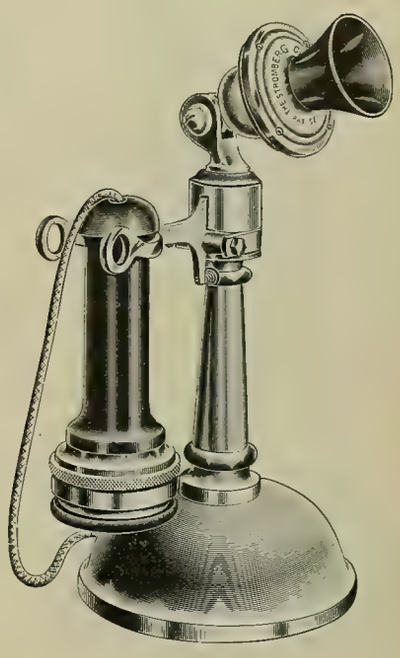
Central Energy Telephones



Central Energy Wall Telephone.

That talk any distance.

That never fall down.



Desk Telephone.

Delegates to the National Telephone Convention.

YOU are cordially invited to visit and make your headquarters in Section "G," Electricity Building, Pan-American Exposition, and inspect our exhibit of a full line of telephone equipment and working exchange. . . . . The Central Energy System is in service throughout the grounds and buildings for official use, and is the ONLY Independent exchange giving telephone service at the Exposition. . .

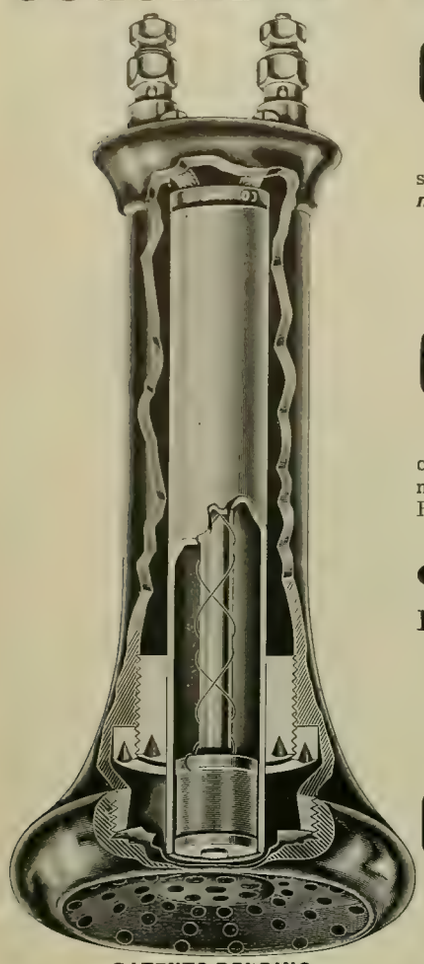
YOU SHOULD NOT FAIL TO VISIT SECTION "G."

Visitors to the Pan-American Exposition.

The Stromberg-Carlson Telephone Mfg. Co.

70-82 West Jackson Boulevard, CHICAGO, U. S. A.

COLUMBIA TELEPHONES AND SWITCHBOARDS.

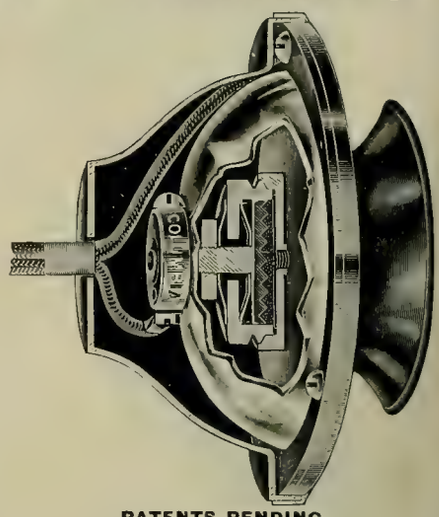


PATENTS PENDING.

Columbia Transmitters.

Elements of Unreliability and Expense, such as felt, silk, plush, paper, and kindred materials, are *eliminated* in the construction of this transmitter.

ABSOLUTELY { NON-PACKING. NO SIDE TONES. INDESTRUCTIBLE.



PATENTS PENDING.

Columbia Receivers.

A Double Pole Receiver of Superior Construction. The coil is protected from injury, being enclosed in a tubular magnet. Not affected by heat and impervious to moisture. Reproduces natural tones in clear, resonant sound.

COLUMBIA TELEPHONES IMPROVE SERVICE AND REDUCE COST OF REPAIRS AND RENEWALS TO A MINIMUM.

Prospective Purchasers of Telephones and Switchboards are Respectfully Invited to Correspond with Us.

Columbia Telephone Manufacturing Co.,

194-204 SOUTH CLINTON STREET,
CHICAGO, ILL.

Telephone and Electric Station Managers and Supply Men:

Increase your revenues by installing interior and private line telephones that can be connected with the Exchange.

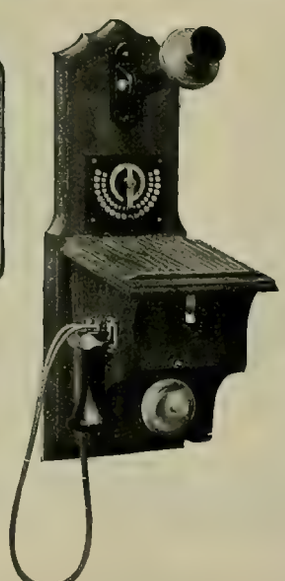
Circular full metallic switch.
Complete secrecy.
Pointer does not have to be returned to the home number.

CENTURY
TELEPHONE CONSTRUCTION CO.
CLEVELAND, O.

Private Line Instrument No. 35.

Hotel Telephone No. 50.

Intercommunicating Wall Phone No. 40.



No. 50.

Intercommunicating Desk Telephone No. 45.

An all-wool cloth costs more than cotton mixture; it wears longer and looks better and is cheapest in the end. You know this, and the same thing is true of good leather in belts, shoes, etc.

ALL OIL is the same story. Get **ALL OIL,** then use it on the machinery only, and not on the floor. This means less needed and more safety in the cylinders as well.

LUBRICATING DEPARTMENT

DEARBORN DRUG AND CHEMICAL WORKS,

27, 28, 29, 30, 31, 32, 33 and 34 RIALTO BUILDING,

WM. H. EDGAR, President. CHICAGO, ILL. **Telephone, Harrison 1358 and 1373.**

218 CENTRAL BATTERY TELEPHONE EXCHANGES EQUIPPED WITH

"AMERICAN"

STORAGE CELLS.

SEND FOR DESCRIPTIVE CIRCULAR AND PRICE LIST.

AMERICAN BATTERY COMPANY,
172-174 S. CLINTON ST.,
CHICAGO, ILL.
Established 1889.

D. L. BENSON,
CONSULTING, CONSTRUCTING, ELECTRICAL AND MECHANICAL ENGINEER.
520 MONADNOCK BLOCK,
Telephone Main 3244. CHICAGO.

Kilfyre
DRY POWDER COMPOUND

IDEAL FIRE PROTECTION
FOR ELECTRICAL APPARATUS.
SEE IT AT INDEPENDENT TELEPHONE CONVENTION AT BUFFALO, N. Y., JUNE 11-13, 1901.

SARGENT & LUNDY,
Engineers,
1000, 46 E. VAN BUREN ST., CHICAGO.
FREDERICK SARGENT. A. D. LUNDY.

Mister Manufacturer!

HERE IS YOUR SPRING MEDICINE. ℞

Take One Northern Motor—hitch it to any old machine in the shop—mix in a very little good electric juice and we warrant the dose will effect such an immediate and astonishing cure that you will want more of the remedy. *A permanent, profitable cure.*

Write for details of the prescription. Bulletin No. 240.

POWER PLANTS FOR LONG DISTANCE TRANSMISSION. TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co.,
PITTSFIELD, MASS.

Northern Electrical Mfg. Co.,
MADISON, WIS.

YES, THOUSANDS!

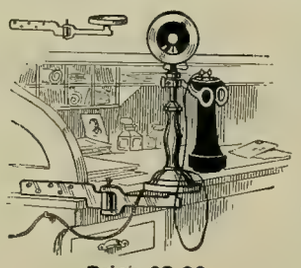
Thousands of the largest lamp consumers in the United States have tested, tried and adopted Packard Incandescent Lamps.

They will meet your requirements as no other lamp will.

Electric Appliance Company,

ELECTRICAL SUPPLIES,
92 and 94 West Van Buren St., CHICAGO.

SWINGING TELEPHONE BRACKETS



FOR USE ON
ROLL TOP, RAIL TOP and FLAT DESKS.

Price, $3.00.

Telephone Users, Write Us.
Liberal Discount to the Trade.

THE GRIGGS MFG. CO,
79-81 Fifth Avenue,
Patentees and Manufacturers. CHICAGO.

SOFT GREEN MICA

A VERY SOFT MICA FOR **COMMUTATOR INSULATION.**

We are the original and largest importers of this quality and have direct connection for our supply. If you have not used this quality let us send you a sample order. Prices lowest in the market.

ALL OTHER QUALITIES.

EUGENE MUNSELL & COMPANY, CHICAGO—NEW YORK.

ENGINEERING.

HERBERT A. WAGNER,
Consulting Engineer,
RAILWAY LIGHTING AND POWER PLANTS,
TIMES BLDG. NEW YORK CITY.
415 LOCUST ST., ST. LOUIS.

VOLT-AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET.
78-80 Cortlandt St., NEW YORK, N. Y.

Largest Manufacturers of Hair Springs in the United States.

Non-Magnetic Hair Springs of Phosphor Bronze and other non-magnetic metals. Hair springs of any description manufactured to order.

F. N. MANROSS, Forestville, Conn.

YOU NEED IT!

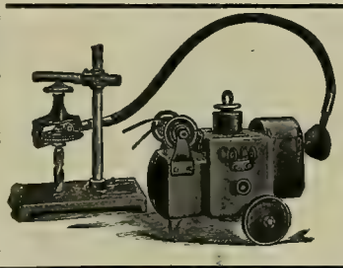
Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.

Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., 909, 100 Sole Manufacturers, Washington Street, - CHICAGO.

BONITA

A MINERAL PRODUCT FOR HIGH-GRADE INSULATION

RAVEN MINING CO., Marquette Bldg., Chicago, Ill.



ESTABLISHED 1875.
COMBINATION OF
Stow Flexible Shaft
AND
MULTI-SPEED MOTOR.

Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

STOW MFG. CO., Binghamton, N. Y.
Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England.

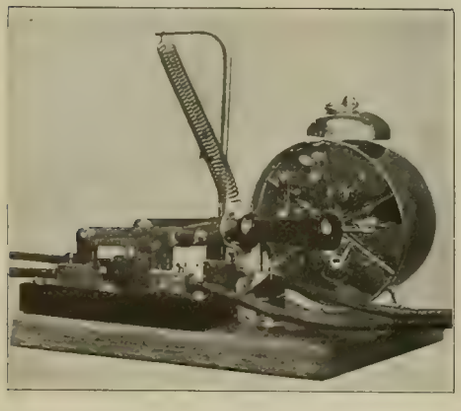
It requires more than some holes to make McRoy Conduits — There's skill, born of experience.

McROY CLAY WORKS
BRAZIL, INDIANA
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of **BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES,** FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.

CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.



THE BEST WAY

Clock Switch

Turns out show window lights any time desired after store is closed. You only need to wind the clock. Switch is automatic. Perfectly reliable. Sent on ten days' trial.

Prices { 15 Amp., D. P., $4.50 / 25 Amp., D. P., 5.00 / 50 amp., D. P., 6.00

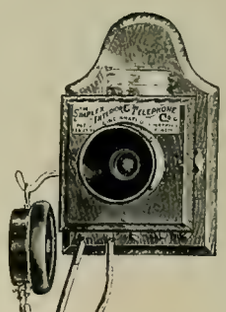
GALESBURG, ILL., Dec. 27, 1900.

We, the undersigned merchants of Galesburg, Ill., have in use one of the Clock Switches made by the College City Electric Company, and find it satisfactory in every way. It is easily set and does not get out of order.

THE GALESBURG SHOE CO., Boots and Shoes. NELSON, MARKS & CO., Dry Goods.
W. A. ANDERSON & CO., Boots and Shoes. ANDERSON, DRAKE & CO., Wall Paper, Paints.

COLLEGE CITY ELECTRIC CO., Galesburg, Ill.

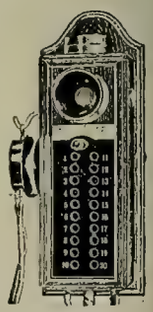
EXCHANGE OWNERS!



Why not increase your incomes by installing the

SIMPLEX INTERIOR TELEPHONE CO.'S

Apparatus in connection with your exchange subscribers' lines?



THERE'S MONEY IN IT.

431 Main St., Cincinnati, Ohio, U. S. A.

FRANK N. PHILLPIS, President. C. H. WAGENSEIL, Treasurer. EUGENE F. PHILLIPS, General Manager. E. ROWLAND PHILLIPS, Vice-Pres C. R. REMINGTON, Jr, Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

New York Store, W. J. Watson, 26 Cortlandt St.
Chicago Store, F. E. Donohoe, 82 Lake St.
Montreal Branch, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

IDEAL AUTOMATIC ANNUNCIATORS.
The Best on the Market. Write for Prices.
Manufactured by
THE HEATH ELECTRIC CO.,
DETROIT, MICH.

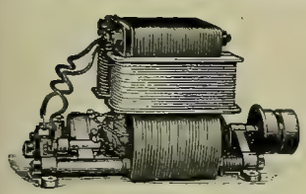
Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

Expansion Bolts

For fastening all kinds of structure to brick and stone work
Patentee and M'f'r. ISAAC CHURCH,
Send for catalogue C. TOLEDO, OHIO.

CHAILLET, ADOLPHE A.
Consulting Electrical Engineer.
Plans and specifications for Electric Lighting and Power Plants. Designer of Electrical Machinery.
476 ELLICOTT SQUARE, BUFFALO, N.Y.

THE FRANKLIN MODEL DYNAMO



10 Volts, 5 Amperes.
Shunt or Series Winding.

We furnish all Castings, Punchings and Materials in sets with Blue-prints and Directions.

To the electrical student, amateur or ingenious per on these machines are of the greatest interest, as they furnish practical experience in construction and winding.

WRITE FOR DYNAMO CIRCULAR NO. 16.

PARSELL & WEED, 129-131 West 31st St., New York City.

Always ready night and day,
Never sleeping or at play.

Remember this refers to the

NATIONAL AUTOMATIC TELEPHONES.

Ask these people below if it is not true:
I. T. Mc Cue, Auxvasse, Mo.
The Steinauer Tel. Co., Steinauer, Neb.
Sterling Tel. Co., Sterling, Kas.
P. G. Walton, Anthony, Kas.
Hundreds of others.

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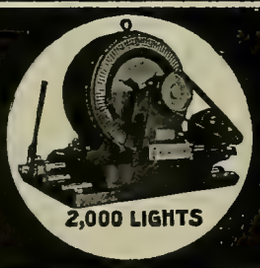

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Position, by young man with four years' experience in telephone work. Can do all-around work. Am member of International Correspondence School, Scranton, Pa. Best of references. Address "WORKER," care Western Electrician 510 Marquette Bldg., Chicago.

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The Electric Light plant at Virginia, Ill., a town of 2,000 population; plant in good condition; present owners unable to take care of the concern on account of other business. No city contract; think proper parties could procure one. Best residences, stores, churches, hotels, courthouse, opera house use electric lights; have two boilers, two engines, one Wood incandescent dynamo, one Ball arc dynamo. Correspondence solicited.

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One 50 k. w. multipolar Excelsior, 125-volt Generator, direct-connected to a New York Safety Engine, 12 x 13, practically new.
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Two 100 k. w. 6-pole, Triumph, 110 volt Generators.
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One 250 h. p. Worthington Water-tube Boiler, good for 135 pounds Hartford.
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Two	120-k. w.	"	"
One	30-k. w.	Westinghouse	"
One	45-k. w.	"	"
Two	60-k. w.	"	"
One	60-k. w.	"	" 60 cycle.
One	75-k. w.	"	" 60 "
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Send for our **Monthly Bargain Sheet**, with net prices on machines in stock at our works. All apparatus fully guaranteed.

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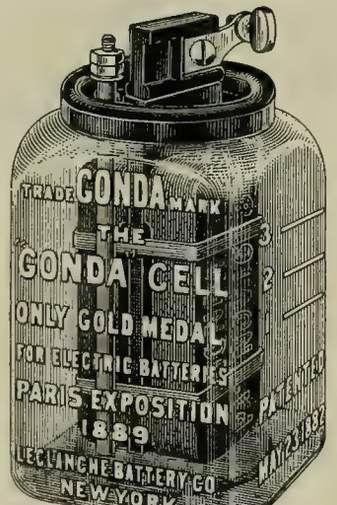

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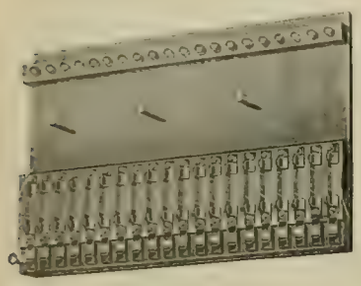

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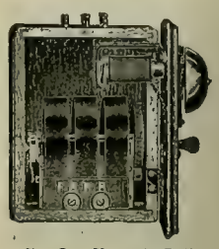

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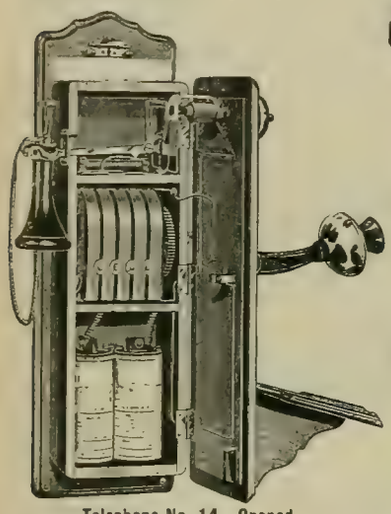

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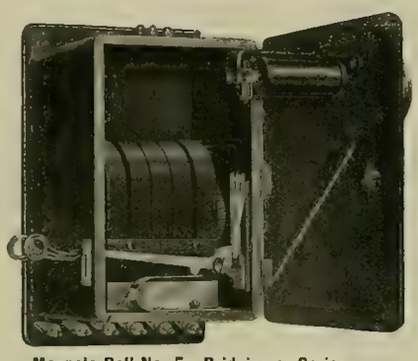

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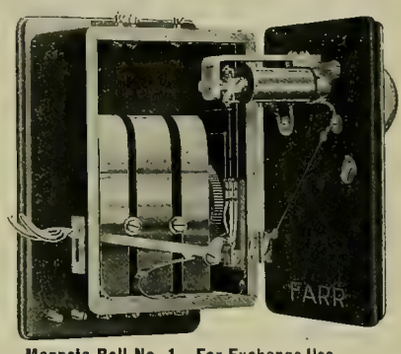

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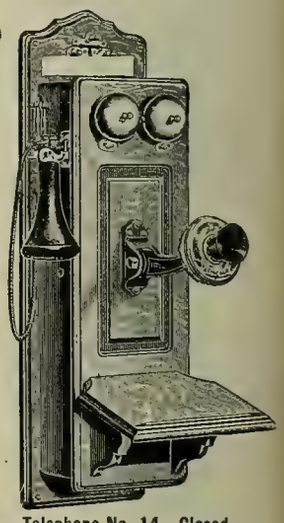

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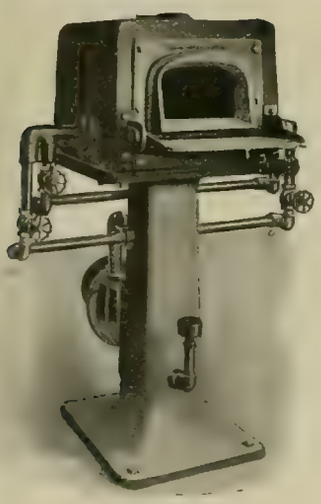

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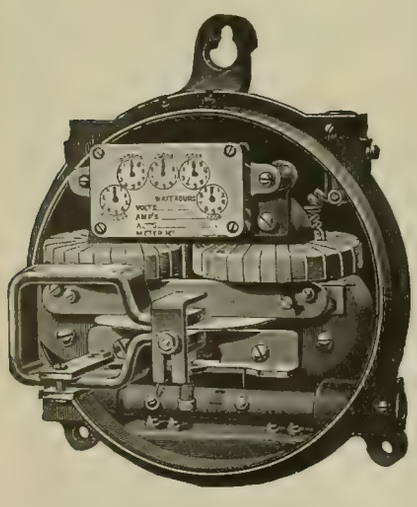

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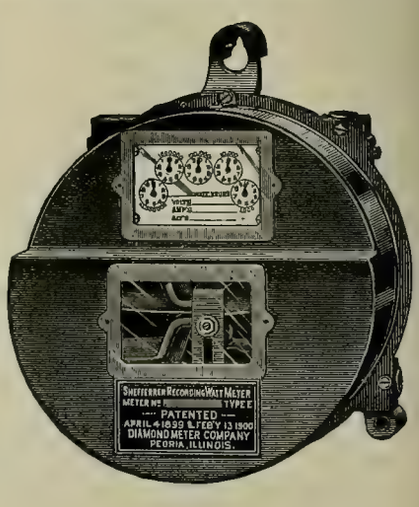

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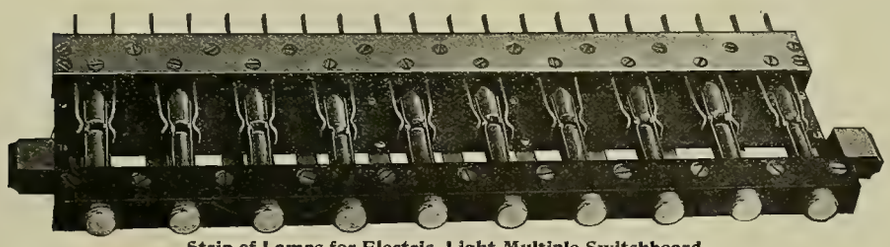

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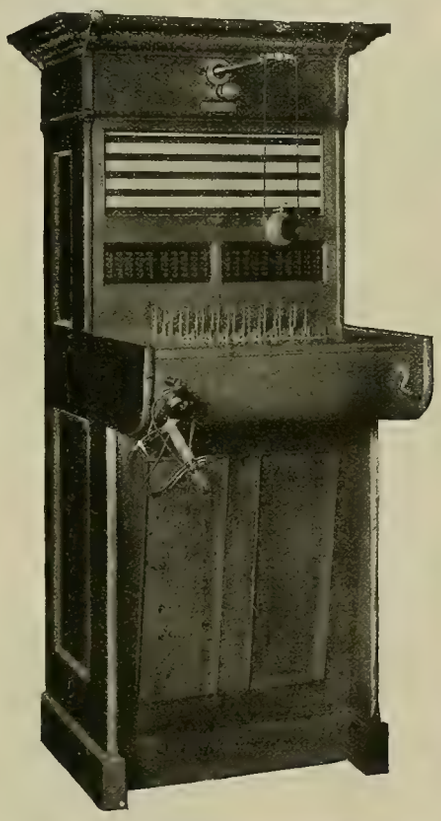

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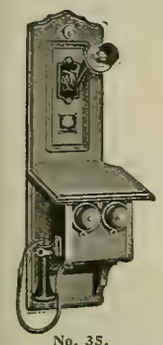

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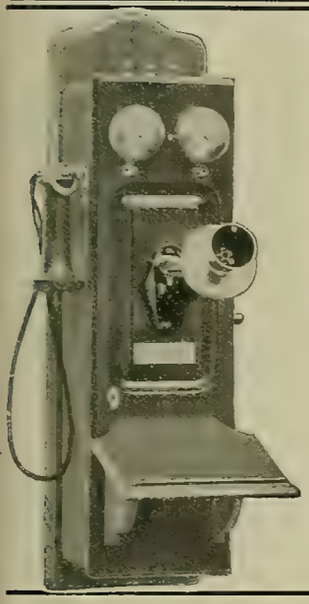

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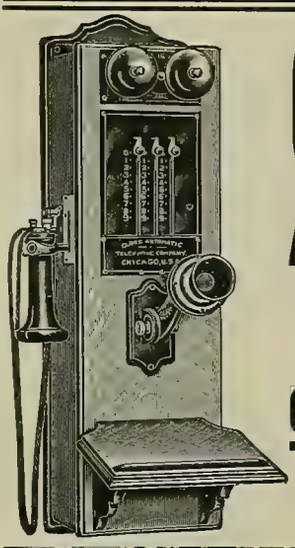

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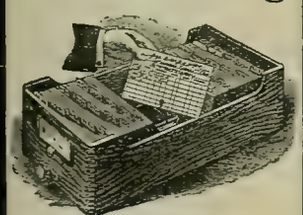

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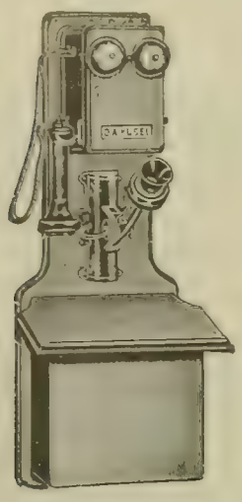

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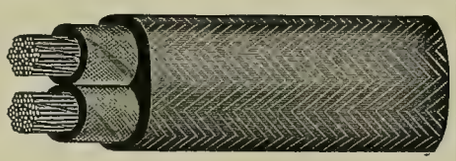

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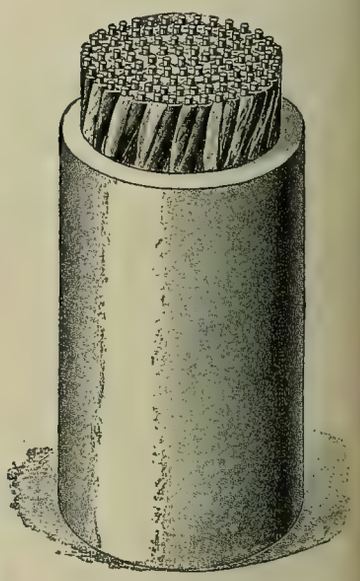

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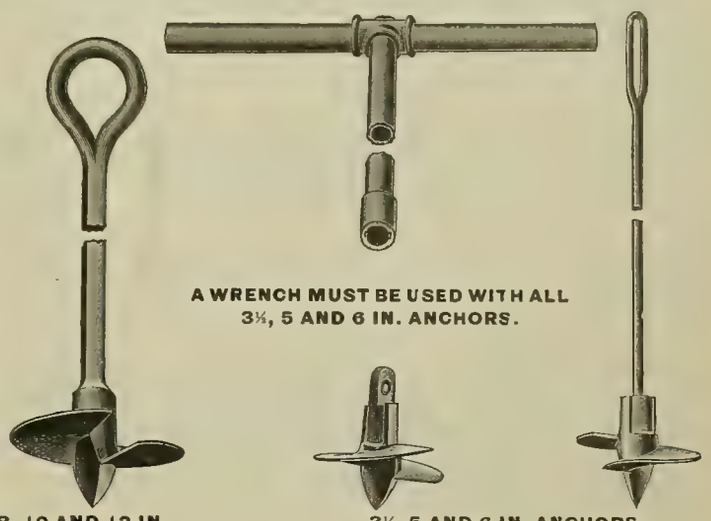

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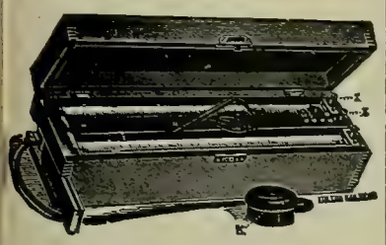

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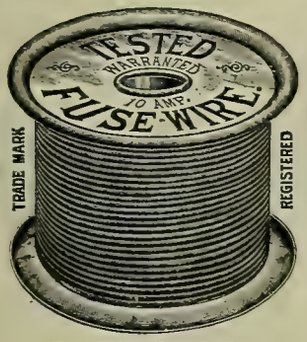

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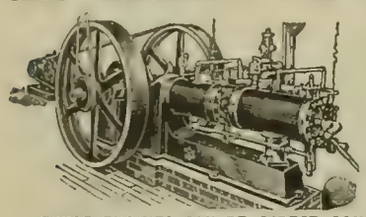

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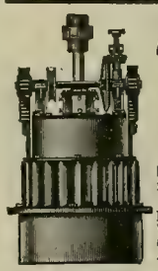

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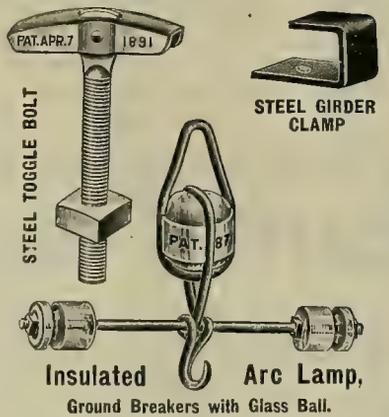

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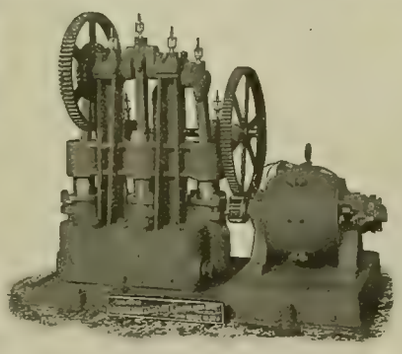

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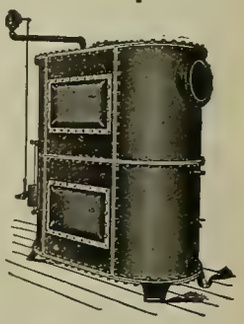

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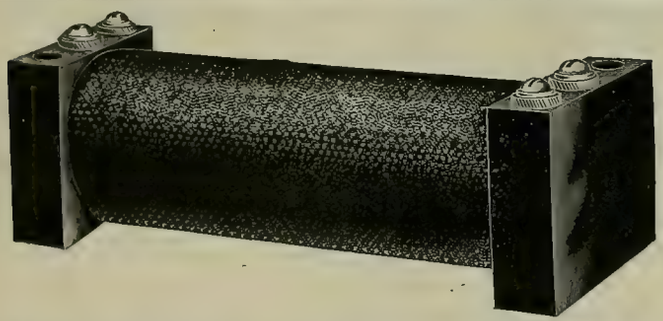

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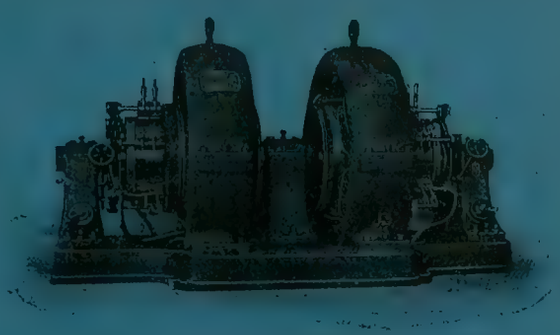

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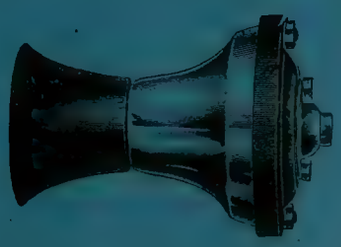

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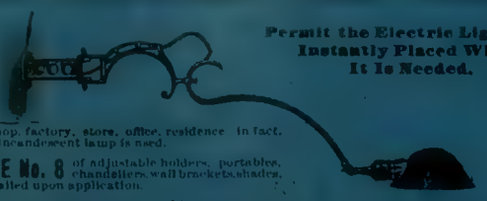

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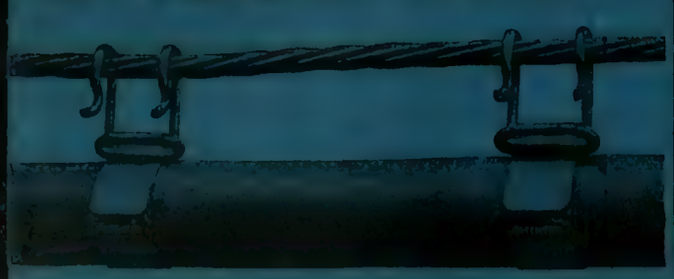

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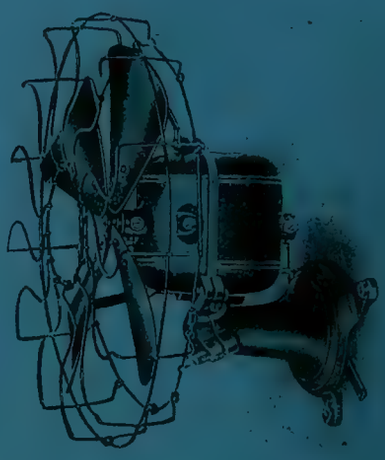

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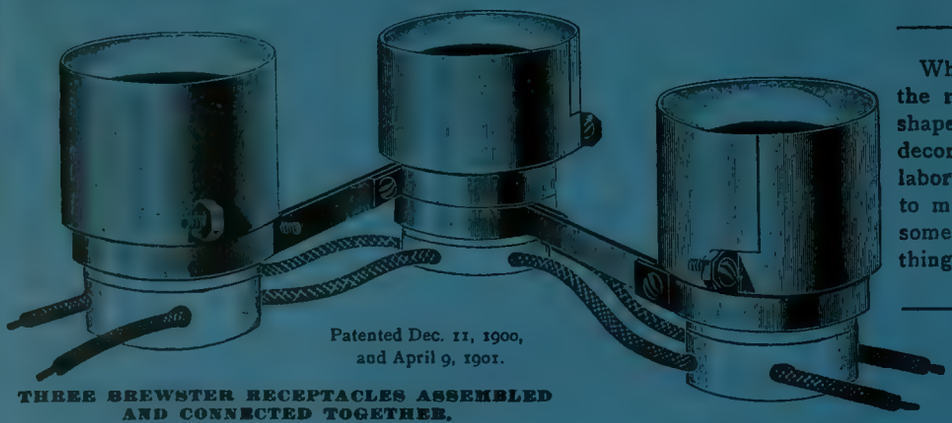

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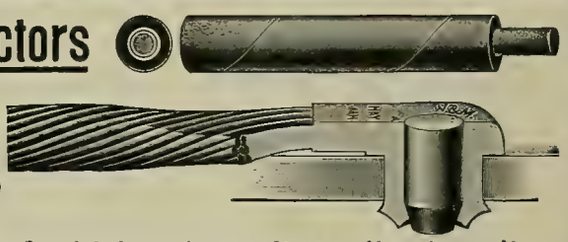

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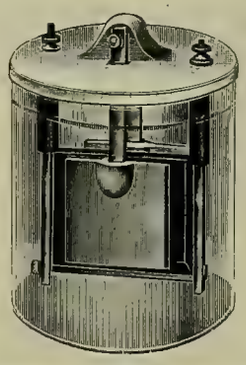

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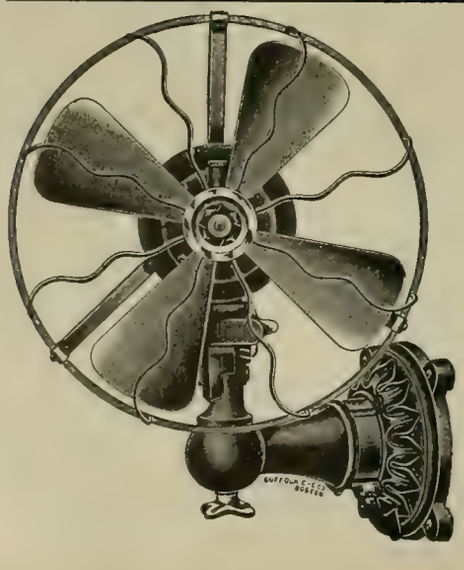

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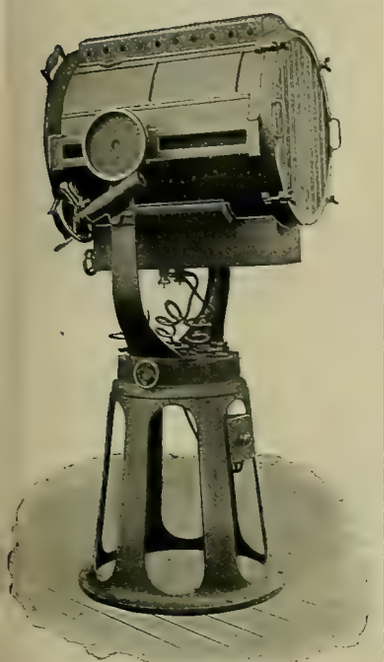

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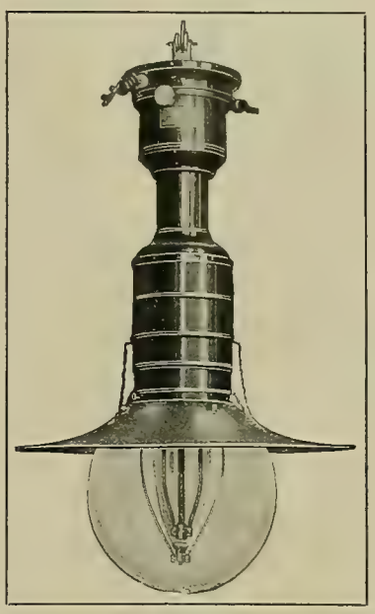

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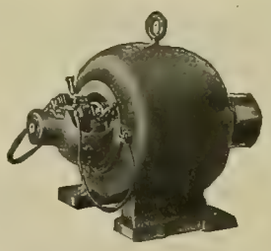

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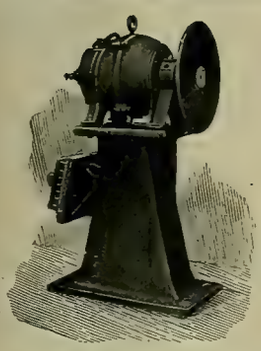

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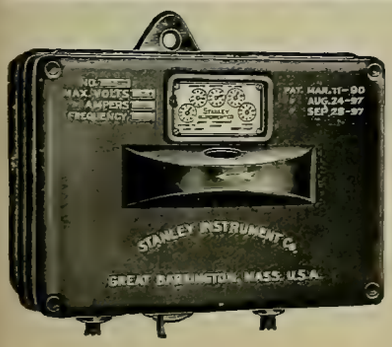

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India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Missouri Electrical Mfg. Co.
National India Rubber Co.
New York Insulated Wire Co.
Ohio Electric Works.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Simplex Electrical Co.
Standard Underground C. Co.
Western Elec. Supply Co.
Western Electric Company.
Junction Boxes.
Bossert Elect. Const. Co.
D. & W. Fuse Company.
General Inc. Arc Light Co.
Lamps, Incandescent.
Central Electric Co.
Chicago Edison Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
General Electric Co.
General Inc. Arc Light Co.
General Inc. Lamp Co.
Missouri Electrical Mfg. Co.
Ohio Electric Works.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co.
Lamps, Inc., Adjusters.
Crescent Manufacturing Co.
Inc. El. Lt. Manipulator Co.
Lamps, Incandescent—Replacers & Cleaners.
Inc. El. Lt. Manipulator Co.
Lightning Arresters.
American Elec. Fuse Co
Auto. Lightning Arrester Co.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks., Inc.
General Electric Co.
Westinghouse El. & Mfg. Co.
Linemen's Climbers.
Anderson & Sons, W. H;
Klein & Son, Mathias.
Smith & Hemenway Co.
Magnet Wires.
(See Insulated Wires.)
Meters.
Diamond Meter Co.
Ft. Wayne Elec. Wks., Inc.
General Inc. Arc Light Co.
Mica.
Munsell & Co., Eugene.
Mining Apparatus, Elec.
Crocker-Wheeler Company.
Jeffrey Mfg. Co.
General Electric Co.
Northern Elec. Mfg. Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.
Motors—See Dynamos and Motors.
Packing.
Besly & Co., Chas. H.
Patent Attorneys.
Barnacio, F. W.
Johnston, Thomas J.
Phosphor Bronze.
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.
Platinum Bought and Sold.
Baker & Company.
Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Poles and Ties.
Benham, George W.
Berthold & Jennings.
Coolidge Fuel & Supply Co.
Fowler, John H.
Holcomb-Lobb Co., The.
Hopkins & Co., A. P.
Huebel & Co., C. J.
Lindsley Bros. Co.
Maltby Lumber Co.
Meredith Cedar Co., J. P.
Ozan Lumber Company.
Perrizo & Sons.
Pittsburg & L. S. Iron Co.
Porter-Morse Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Weatherproof Sect. Pole Co.
Wittenberg Cedar Co.
Worcester Co., C. H.
Porcelain.
Akron Smoking Pipe Co.
Bowers Manufacturing Co.
Brunt Porcelain Works, G. F.
Mogadore Insulator Co.
Peru Elec. Mfg. Co.
Power Transmission Machinery.
Jeffrey Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Pulleys.
Rockwood Mfg. Co.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Rail Bonds.
American Steel & Wire Co.
Rail Joints.
Continuous Rail Joint Company of America.
Refiners.
Gt. West. Sm. and Refining Co.
Swarts Metal Refining Co.
Reflectors.
Amer. Reflector & Ltg. Co.
Re-Winding—Repairs.
Becker Bros.
Chicago Edison Co.
Gregory Electric Co.
Schureman & Hayden.
Rheostats.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Sage & Bro., F. B.
Westinghouse El. & Mfg. Co.
Second-Hand Mach'y.
Alexander, Thomas.
Chicago House Wrecking Co.
Gregory Electric Co.
Illinois Maintenance Co.
Matthews & Bros., W. N.
Schureman & Hayden.
Walsh's Sons & Co.
Shades.
Amer. Reflector & Ltg. Co.
Pacific Electric Co.
Speaking Tubes.
Central Electric Co.
Edwards & Company.
Electric Appliance Co.
Western Electric Co.
Western Elec. Supply Co.
Speed Indicators.
Besly & Co., Chas. H.
Queen & Co.
Weston Electrical Inst. Co.
Springs.
American Steel & Wire Co.
Barnes Co., The Wallace.
Manross, F. N.
Steel Boxes.
Bossert Elec. Const. Co.
Storage Batteries.
American Battery Co.
Columbus Batt. & Spec. Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Helios-Upton Co.
Structural Iron Work.
American Bridge Co.
Tapes, Insulating.
American Electrical Works.
American Steel & Wire Co.
Central Electric Co.
Electric Appliance Co.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Western Electric Co.
Western Elec. Supply Co.
Telephones, Telephone Material and Switchboards.
American Elec. Fuse Co.
American El. Telephone Co.
American Toll Telephone Co.
Bissell Company, The F.
Central Electric Co.
Central Tele. & Elec. Co,
Century Telephone Const. Co.
Chicago Telephone Sup. Co.
Columbia Telephone Mfg Co.
Ericsson Telephone Co.
Farr Tel. & Cons. Supply Co.
Globe Automatic Tel. Co.
Griggs Mfg. Co., The.
Holtzer-Cabot Electric Co.
Independent Tel. Const. Co.
Independent Tel. Supply Co.
Kansas City Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Kokomo Tel. & El. Mfg. Co.
Kusel Tel. & El. Mfg. Co., D. A.
Mason Telep. Pay Station Co.
Missouri Electrical Mfg. Co.
Moon Mfg. Co., The.
National Automatic Tel. Co.
National Tel. Equipm. Co.
Palmer Bros.
R. I. Telephone & Elec. Co.
St. Louis Elec. Supply Co.
Simplex Interior Telep. Co.
Standard Construction Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Strowger Aut. Tel. Exchange.
Telephone Co. of Amer., The.
Thomas, Wilcox & Dietz.
Union Switchboard Co.
Warner Electric Company.
Western Electric Co.
Western Elec. Supply Co.
Yurgae Signalphone Mfg. Co.
Telephone Service.
Chicago Telephone Co.
Tools.
Anderson & Sons, W. H.
Klein & Son, Mathias.
Missouri Electrical Mfg. Co.
Smith & Hemenway Co.
Torches.
Turner Brass Works.
Transformers.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Stanley Electric Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co
Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co
Turbine Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.
Varnishes.
Sterling Varnish Co.
Vulcanized Fibre.
Vulcanized Fibre Co.
White-Washing M'ch's.
Star Brass Works.
Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.
Woodwork.
Huey Company, The M. S.
X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

For Alphabetical Index of Advertisements See Page 3.

CARBONS CARBONS CARBONS

The "Electra" Carbons are the recognized standard all the world over.

There are no Carbons better than the "Electra" and none "just as good."

There is No Higher-Class India-Rubber Insulation For Wires and Cables than

HABIRSHAW.

Authorized Manufacturers of the

ATTIX FLEXIBLE TUBE WIRE.

The India-Rubber and Gutta-Percha Insulating Co.,

MAIN OFFICE, Glenwood Works,

J. W. CODFREY, Manager Sales,
15 Cortlandt Street, NEW YORK.

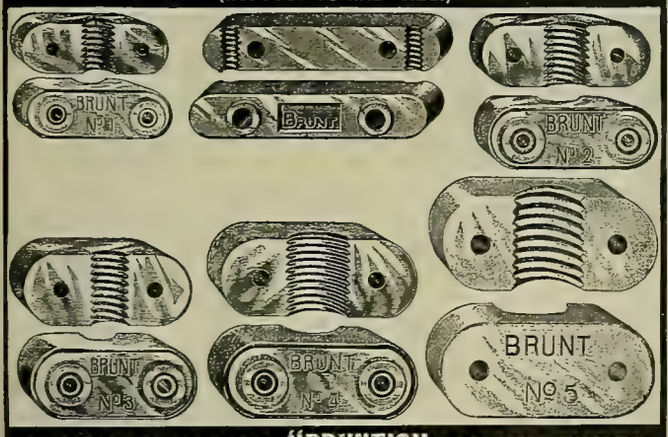
YONKERS, N. Y.

(10923)

A FEW OF BRUNT'S

High-Grade Porcelain Cleats.

(REDUCED TO HALF SIZE.)



INSIST ON HAVING "BRUNT'S" CLEATS, TUBES AND INSULATORS. YOU REQUIRE THEM IN DOING FIRST-CLASS WORK.

THEY COMPLY WITH ALL UNDERWRITERS' REQUIREMENTS.

EVERY PIECE MARKED "BRUNT."

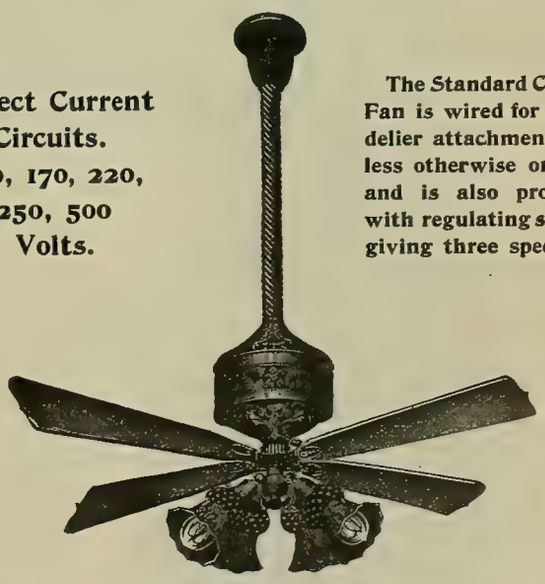
THE G. F. BRUNT PORCELAIN WORKS,

EAST LIVERPOOL, OHIO.

FAN MOTORS

Direct Current Circuits.
110, 170, 220, 250, 500 Volts.

The Standard Ceiling Fan is wired for chandelier attachment unless otherwise ordered and is also provided with regulating switch giving three speeds.



STANDARD CEILING FAN WITH CHANDELIER ATTACHMENT.

WESTERN ELECTRIC COMPANY

CHICAGO. ST. LOUIS. PHILADELPHIA. NEW YORK.

AMERICAN ELECTRIC COMPANY, St. Paul, Minn.

CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

STANDARD ELECTRIC COMPANY, Cincinnati, Ohio.

KILBOURNE & CLARK COMPANY, Seattle, Wash.

ANTWERP. LONDON. PARIS.

KELLOGG SWITCHBOARD

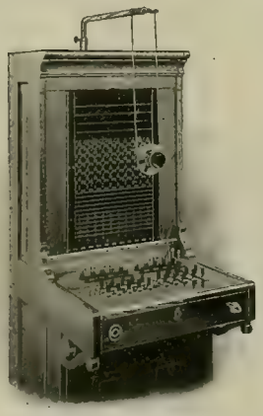
MANUFACT

Complete Equipments for

CHICAGO FACTORY.

Combination Central Energy and Magneto Switchboard.

Switchboard with Sensitive Ringers for Toll Line Use.



Bell Type Switchboard, Manually Restoring Drops.

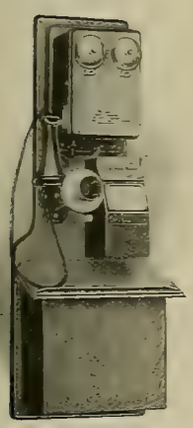
150 Line Magneto Switchboard, Self-restoring Drops.

AND SUPPLY COMPANY,

URERS OF

Exchanges of Any Size.

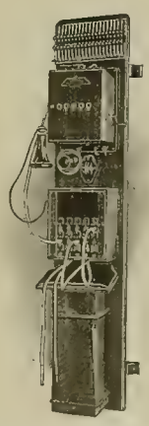
EXCHANGE OF THE PITTSBURG AND ALLEGHENY TELEPHONE CO., PITTSBURG, PA.



Bridging Wall Set, with Pay Station.

TO THE READER: The reader of this advertisement in particular and the telephone public in general are cordially invited to visit the Kellogg pavilion in Section R of the Electricity Building at the Pan-American Exposition at Buffalo. This is without question the finest pavilion devoted to any electrical exhibit, a fitting housing for what we know to be the most complete and best line of telephone apparatus ever displayed to the public. Our exhibit adjoins that of the Bell and Western Electric Companies. We invite comparison. Gentlemen will be in charge to explain the apparatus, to give technical advice and to talk business. Very truly,

KELLOGG SWITCHBOARD AND SUPPLY COMPANY.



Combination Telephone and Switchboard for Selective Signaling.

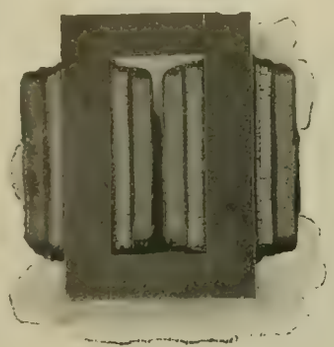
Portable Desk Set.

FACTORY AND GENERAL OFFICES: 229 SO. GREEN STREET, CHICAGO.

THE GENERAL ELECTRIC COMPANY'S

TYPE H

Oil Transformer Coils



Section of Coils and Core.

Have no sharp corners and but one surface between the coils which is practically cylindrical, making possible the most effective insulation between the high and low potential windings.

General Office: Schenectady, N. Y.

Sales Offices in All Large Cities. **Chicago Office, Monadnock Building.**

EDISON TELEPHONE LAMPS

Are the Standard for Visual Signals.

Their value has been verified by more than three years of extended service.

They are preferred because of

Certainty of service of each individual lamp—every lamp being perfect.
Extreme length of life.
Strong and durable mechanical construction.
Thorough uniformity of all lamps, insuring certainty of contact in sockets and freedom from misfit.
Maximum of maintained light for a minimum of power consumption.

Orders for any quantity promptly filled.
All lamps supplied closely rated and carefully selected.

EDISON DECORATIVE AND MINIATURE LAMP DEPT.

General Electric Company,

Harrison, N. J.

AT THE

CONVENTION

OF THE

INDEPENDENT TELEPHONE ASSOCIATION

You Had an Exceptional Opportunity to See and Compare the Various Makes of Telephone Apparatus.

DID YOU HAVE THE UNION MULTIPLE SWITCHBOARD EXPLAINED TO YOU?

THIS SYSTEM COMPRISES THE FOLLOWING NOVEL FEATURES:

An Auxiliary Board which assures instantaneous service.

Multiples that are all alike—no special wiring for answering sections.

An Automatic Subscriber's Call without battery standing on the line.

A Supervisory Signal that operates on an entirely new principle.

A Visual Busy Signal.

THE UNION SWITCHBOARD COMPANY,

ERIE, PA.

CENTRAL ENERGY MULTIPLE SWITCHBOARDS

FOR ANY SIZE EXCHANGE.

Lamp or Visual Line Signals.
Double Supervisory Clearing Out Signals.

THE MOST SIMPLE AND ECONOMICAL TELEPHONE SYSTEM NOW IN USE.

3,600 LINE "CENTRAL ENERGY" MULTIPLE SWITCHBOARD, ROCHESTER TELEPHONE CO., ROCHESTER, N. Y.

CENTRAL ENERGY MAGNETO CALL .. **TELEPHONES** THAT TALK ANY DISTANCE. THAT NEVER FALL DOWN.

Toll Line Apparatus a Specialty.

A FULL LINE OF CONSTRUCTION MATERIAL ALWAYS ON HAND.

TELEPHONE EXCHANGES CONSTRUCTED COMPLETE.

CORRESPONDENCE SOLICITED.

THE STROMBERG-CARLSON TEL. MFG. CO.,

70-82 W. Jackson Blvd., CHICAGO, U. S. A.

AD STUDIO.

ANY OLD GUY CAN PLANT A TREE, BUT IT TAKES "LITTLE WILLIE" AND THE "OLD MAN" TO MAKE IT GROW. WE FIRST SAW THAT THE GROUND WAS O. K. (ST. LOUIS IS GOOD "GROUND"), AND WE'RE MAKING THAT PLANT GROW.

WE SOLICIT TELEPHONE SWITCHBOARD PROPOSITIONS—

AND

FAN ORDERS.

Hurricane Direct Current Desk Fans—Direct Current Ceiling Fans—Alternating Fans.

The Missouri Electrical Manufacturing Co.

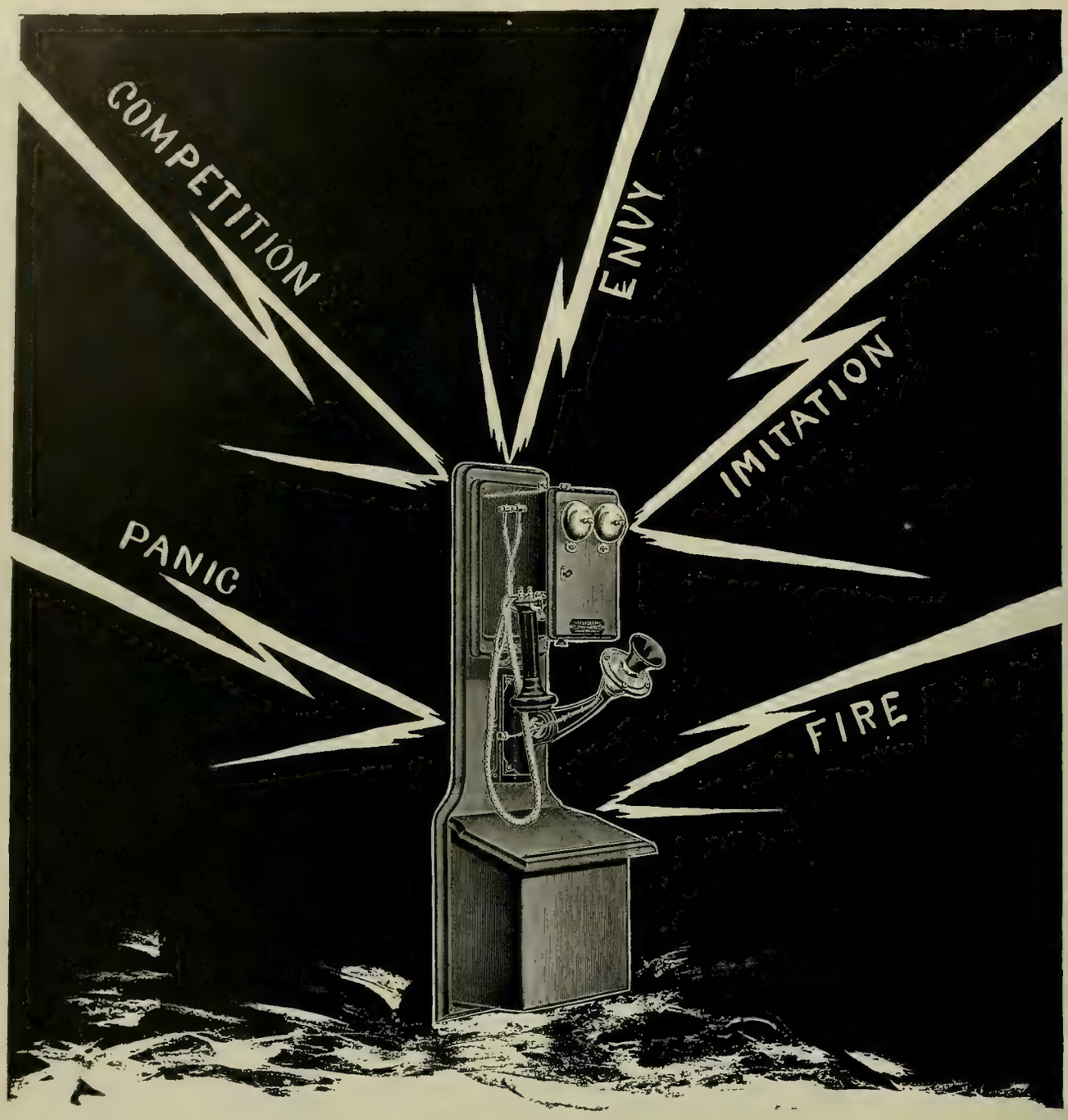
P. D. CABLE, President. F. B. LITTLE, Vice-Pres't. R. W. MOORE, Secretary. W. F. LITTLE, Treasurer.

ST. LOUIS, MO.

ALSO AGENTS FOR

- Vindex Transformers,
- Bernard Dynamos and Motors,
- Milwaukee Multipolar Apparatus (Motors, Etc.),
- General Incandescent Lamps,
- Standard Insulating Varnishes,
- Electro Insulating Tapes, Etc.

P. S. GIVE US A WHIRL ON AN ORDER. YOU DON'T KNOW WHAT THE NEW HOUSE CAN DO UNTIL YOU TRY IT—THEN TRY IT.



INVULNERABLE

TO ALL ATTACKS.

THE APPARATUS OF THE

STANDARD TELEPHONE & ELECTRIC CO.

MADISON, WIS., U. S. A.

NATIONAL

Lead=Covered, Paper=Insulated Telephone Cables.

Single and Double Wrapped. **Aerial and Underground.**

CONSTRUCTION MATERIAL.

Pins, Brackets, Cross=Arms, Lag Bolts, Lag Screws, Pole Steps, Insulators.

All in Chicago Stock. **Ready for Immediate Shipment.**

TOOLS.

We carry a complete line of telephone construction tools of the best grade at the best prices.

TELEPHONE SUPPLIES OF ALL KINDS.

Central Electric Company,

264=266=268=270 Fifth Avenue,
CHICAGO.

"BY THEIR WORKS

YE SHALL KNOW THEM."

OUR WORKS,--

	No. of Employees	Floor Space Occupied.
February, 1898	7	1,000 Sq. Ft.
" 1899	75	5,000 " "
" 1900	150	50,000 " "
" 1901	250	100,000 " "

WHAT DID IT?

THE EFFICIENCY AND RELIABILITY OF THE TELEPHONE APPARATUS

MANUFACTURED BY THE **Sterling Electric Company,**

LA FAYETTE, IND. BRANCH OFFICE, 1260 Monadnock, Chicago.

Don't Let it Get Away!

YOU CAN SAVE

85 per cent of your exhaust steam and sell it for three times the first cost by installing the Holly System of underground mains.

This will pay all your station expenses and give you free power.

Write for our new pamphlet, telling how it is done.

MENTION WESTERN ELECTRICIAN.

AMERICAN DISTRICT STEAM CO., LOCKPORT, N. Y.

CHEMISTRY.

ANALYTICAL AND ASSAY LABORATORIES.

GENERAL CHEMISTS.

Do You Need Such Work Done? Can We Help You? All Kinds of Analyses and Explanations.

DEARBORN DRUG AND CHEMICAL WORKS,

27, 28, 29, 30, 31, 32, 33 and 34 RIALTO BUILDING,

WM. H. EDGAR, President. —CHICAGO, ILL.— Telephone, Harrison 1358 and 1373.

Always ready night and day,

Never sleeping or at play.

Remember this refers to the

NATIONAL AUTOMATIC TELEPHONES.

Ask these people below if it is not true:

I. T. Mc Cue, Auxvasse, Mo.

The Steinauer Tel. Co., Steinauer, Neb.

Sterling Tel. Co., Sterling, Kas.

P. G. Walton, Anthony, Kas.

Hundreds of others.

Try our selective party line phones.

Positively secret, rings only party desired.

We also manufacture series, and bridging bells phones.

The National Automatic Telephone Co.

CHICAGO.

Columbia Carbons

FOR

Enclosed Long Burning Arc Lamps

USED EXCLUSIVELY BY THE

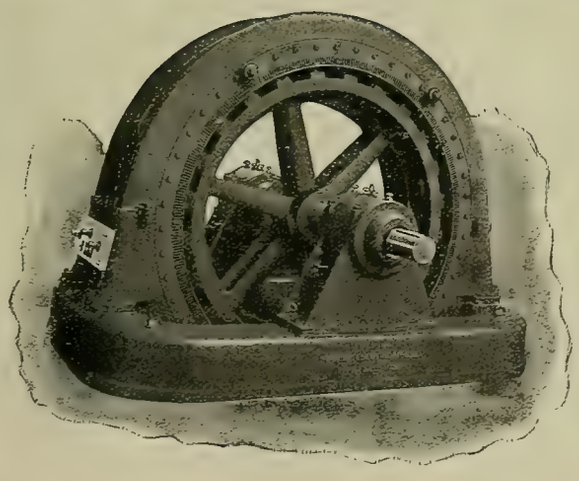
PAN-AMERICAN EXPOSITION.

RESULTS TALK.

Try them and be convinced. COST you NOTHING if not as represented.

National Carbon Co.,

CLEVELAND, OHIO.



Alternating or Direct Current

Generators and Motors.

Factory and Shop Equipments, Mining, Railway and Lighting Work.

Power Plants for Long Distance Transmission.

Catalogues and Circulars on request. Correspondence solicited from manufacturers, machine tool makers, mine operators, railways, etc.

TRANSFORMERS, INSTRUMENTS, SWITCHBOARDS.

Stanley Electric Mfg. Co.,
Pittsfield, Mass.

Northern Electrical Mfg. Co.,
Madison, Wis.

NEWGARD WATERPROOF RECEPTACLE

The only combined waterproof globe and receptacle absolutely moisture and weather proof. Will last for years where permanent wiring has hitherto been unknown.
Made for Edison and T.-H. base lamps—16 and 32 C. P. Three styles—for pendant work, flange or bracket style, and with pipe connection for use with ⅜-inch iron pipe.

SEND FOR CIRCULARS.

ELECTRIC APPLIANCE COMPANY,
92 and 94 West Van Buren Street, CHICAGO.

3/4 c. BUYS OUR NEW ENCLOSED FUSE.

ROUGH HANDLING WILL NOT BREAK IT.

FUSE WIRE PROTECTED.

ALL MICA INSULATION. SAMPLES FREE.

WE ALSO MAKE { Fuse Blocks, Lightning Arresters, Connectors, Paper Insulators, FUSE WIRE and Specialties.

THREE BIG STORES.

AMERICAN ELECTRIC FUSE CO.
New York. Chicago. San Francisco.

SOFT GREEN MICA

A VERY SOFT MICA FOR COMMUTATOR INSULATION.

We are the original and largest importers of this quality and have direct connection for our supply. If you have not used this quality let us send you a sample order. Prices lowest in the market.

ALL OTHER QUALITIES.

EUGENE MUNSELL & COMPANY, CHICAGO—NEW YORK.

ENGINEERING.

HERBERT A. WAGNER,
Consulting Engineer.
RAILWAY LIGHTING AND POWER PLANTS,
TIMES BLDG., NEW YORK CITY.
416 LOCUST ST., ST. LOUIS.

VOLT-AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET.
78-80 Cortlandt St., NEW YORK, N. Y.

American Vitrified Conduit Company,
MANUFACTURERS OF
VITRIFIED SALT GLAZED UNDERGROUND AND INTERIOR CONDUITS.
Contractors for Complete Installation of Conduit Systems.
General Offices: 39 Cortlandt St., N. Y.

Eldredge Battery Voltmeter,
For Testing Primary and Storage Batteries, 0 to 3 Volts.
DEAD BEAT.
The only low-price pocket instrument indicating in volts. Connecting posts have non-removable nuts. Light weight and neat in appearance.
Eldredge Electric Mfg. Co.,
Springfield, Mass., U. S. A.

YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., 908, 100 Washington Street, Sole Manufacturers, CHICAGO.

BONITA
A MINERAL PRODUCT FOR HIGH-GRADE INSULATION
RAVEN MINING CO., Marquette Bldg., Chicago, Ill.

GENERAL INCANDESCENT ARC LIGHT CO.,
Factory and General Offices: 572-578 FIRST AVENUE, NEW YORK.
TRADE G. I. MARK.
Manufacturers of HIGH-GRADE ELECTRICAL SUPPLIES.
WRITE FOR ATTRACTIVE BULLETINS.
Branch Offices:
Chicago, Philadelphia, Boston, Cleveland, St. Louis, Milwaukee, Cincinnati, Denver, St. Paul.

G. I. INCANDESCENT LAMPS.

A Seth Thomas Clock was never more reliable than are McRoy Conduits

McROY CLAY WORKS
BRAZIL, INDIANA
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.
CEMENT LINED PIPE FOR CONDUITS. Executive Offices, Times Building, NEW YORK, N. Y.

SWINGING TELEPHONE BRACKETS

FOR USE ON
ROLL TOP,
RAIL TOP
and FLAT DESKS.
Telephone Users, Write Us.
Liberal Discount to the Trade.
Price, $3.00.

THE GRIGGS MFG. CO.,
79-81 Fifth Avenue,
Patentees and Manufacturers. CHICAGO.

AUTOMATIC LIGHTNING ARRESTER.

The only device that is warranted to protect telephones and switchboards against lightning.

No fuse to burn out, line is never open, service is never interrupted; works automatically, requires no attention after being installed.

Mounted on porcelain and very ornamental in appearance.

We put them up singly for individual telephones, and mounted in sections of fifty for exchange protection.

Their use on farmer lines will save more than their cost the first season.

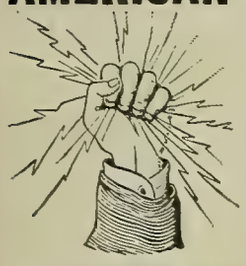
We invite investigation and correspondence.

AUTOMATIC LIGHTNING ARRESTER CO.,
RAVENNA, OHIO.

FRANK N. PHILLPIS, President. C. H. WAGENSEIL, Treasurer. EUGENE F. PHILLIPS, General Manager. E. ROWLAND PHILLIPS, Vice-Pres. G. R. REMINGTON, JR., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



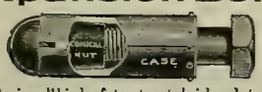
BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

New York Store, W. J. Watson, 26 Cortlandt St.
Chicago Store, F. E. Donohoe, 82 Lake St.
Montreal Branch, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

IDEAL AUTOMATIC ANNUNCIATORS.
The Best on the Market. Write for Prices.
Manufactured by
THE HEATH ELECTRIC CO.,
DETROIT, MICH.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

Expansion Bolts



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NEVER KNOWN TO FAIL OR LOSE A WIRE.
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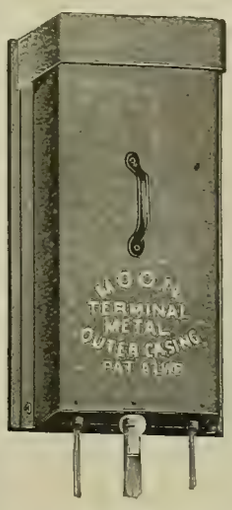

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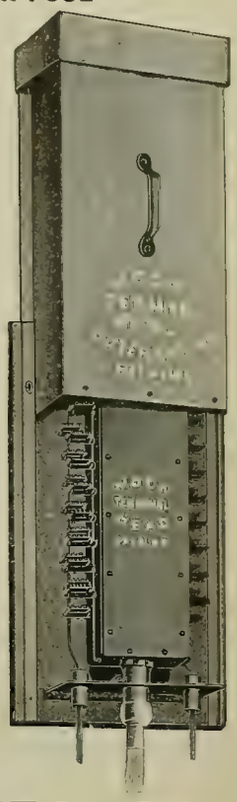

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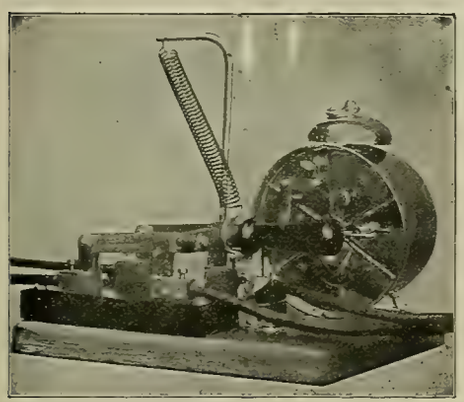

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Clock Switch
Turns out show window lights any time desired after store is closed. You only need to wind the clock. Switch is automatic. Perfectly reliable. Sent on ten days' trial.
Prices { 15 Amp., D. P., $4.50 / 25 Amp., D. P., 5.00 / 50 Amp., D. P., 6.00 .
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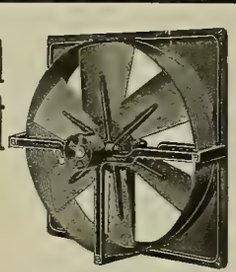
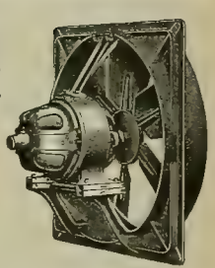


Triumph Exhaust Fan
With Detachable Motor



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Slow-Burning Weatherproof and Slow-Burning Wire.
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The Electric Light plant at Virginia, Ill., a town of 2,000 population; plant in good condition; present owners unable to take care of the concern on account of other business. No city contract; think proper parties could procure one. Best residences, stores, churches, hotels, courthouse, opera house use electric lights; have two boilers, two engines, one Wood incandescent dynamo, one Ball arc dynamo. Correspondence solicited.

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TO AVOID MOVING TWICE,

We will make especially low prices on the following apparatus for a few days:

One 50 k. w. multipolar, Excelsior, 125-volt Generator, direct-connected to a New York Safety Engine, 12 x 13, practically new.
One 75 k. w. 125-volt multipolar, American Ball Generator, direct-connected to an American Ball Engine, complete with sub-base, used three months.
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One 300 h. p. 14 x 24 x 16 New York Safety Tandem Compound Engine.
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Two 100 k. w. 6-pole, Triumph, 110 volt Generators.
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One 250 h. p. Worthington Water-tube Boiler, good for 135 pounds Hartford.
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One battery, seven boilers, horizontal tubular shell 72 inches diameter by 18 feet long, containing 72 tubes 4 inches diameter each. The shell is ⅜-inch steel with longitudinal seam, butt jointed, double riveted. The heads are $\frac{9}{16}$ inch steel, well stayed. The boiler has a manhole in front head and a manhole on top. The bottom at the back is reinforced on top with 2-inch blowout.

Murphy patented smokeless furnace; grate area 6 feet x 6½ feet, with front, and with automatic stoker and magazine 6 feet x 2½ x 1⅛ feet; grate bars, shaking pattern and ash-pit doors complete. Castings for setting and tie rods, and buck staves with boiler. Each boiler has a 6-inch pipe for connecting to a steam main equipped with a Pratt & Cady globe valve, also blowoff valves and Ashton pot safety valve and Reliance water column.

With battery is a 4-inch main with branches for cooling grates with exhaust steam, with all fittings complete; also blow-off and feed-water mains on back of boilers. The valves of the branches of the feed-water mains may be operated on front of boilers by means of rods. Battery has two double duplicate stoker engines, one at each end, with all connections complete for operating stokers.

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One	30-k. w.	General Electric	alternator.
One	60-k. w.	"	"
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Two	120-k. w.	"	"
One	30-k. w.	Westinghouse	"
One	45-k. w.	"	"
Two	60-k. w.	"	"
One	60-k. w.	"	" 60 cycle.
One	75-k. w.	"	" 60 "
One	120-k. w.	"	" 60 "
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Send for our **Monthly Bargain Sheet**, with net prices on machines in stock at our works. All apparatus fully guaranteed.

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One Armington & Sims Engine, 14 in. diameter, 13 in. stroke, with pulleys 66 in. diameter by 15½ in. face.
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One A 12 T. H. alternating current generator, 125 cycles — 1000 volts — 60 amperes. Wooden base in operative condition.

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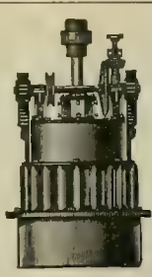

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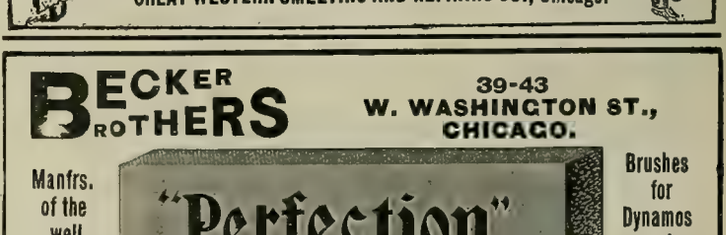

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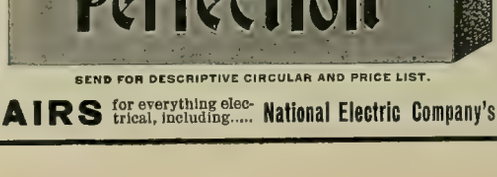

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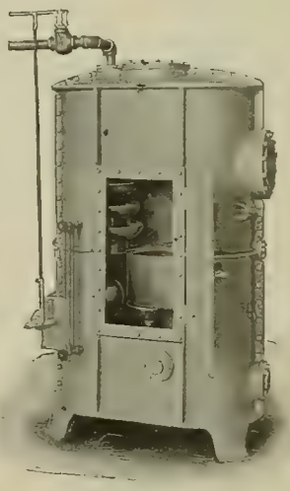

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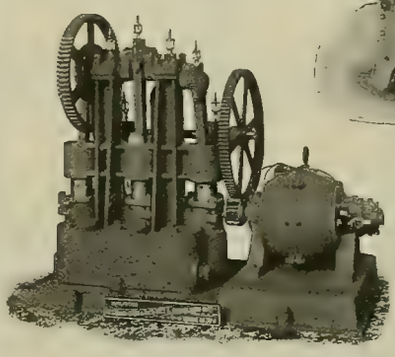

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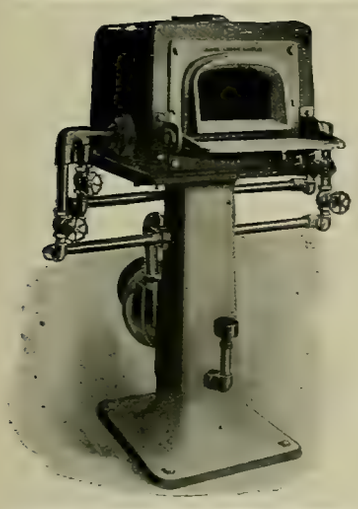

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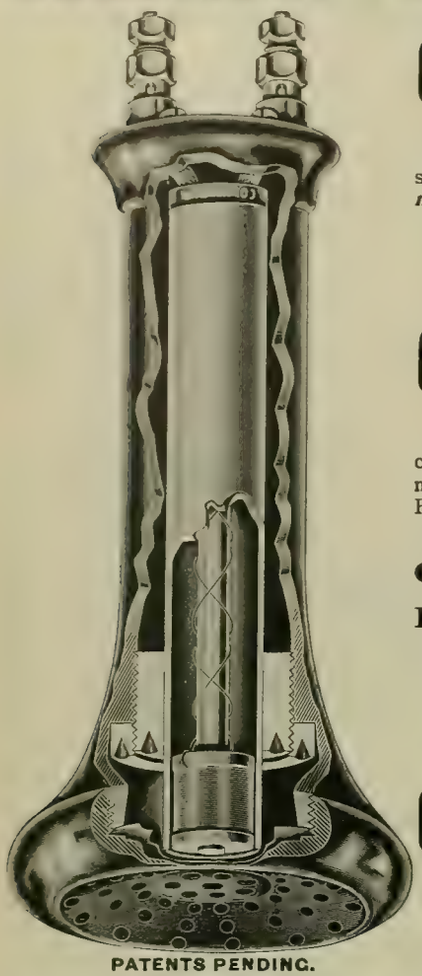

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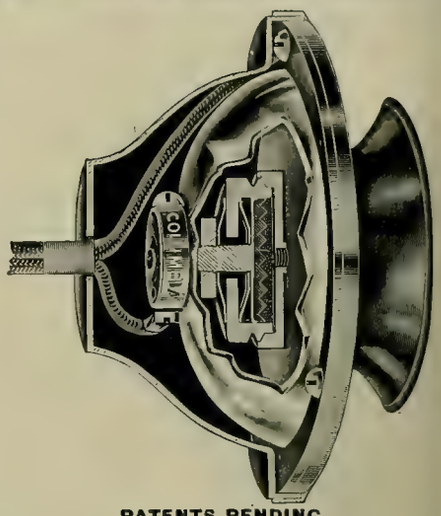

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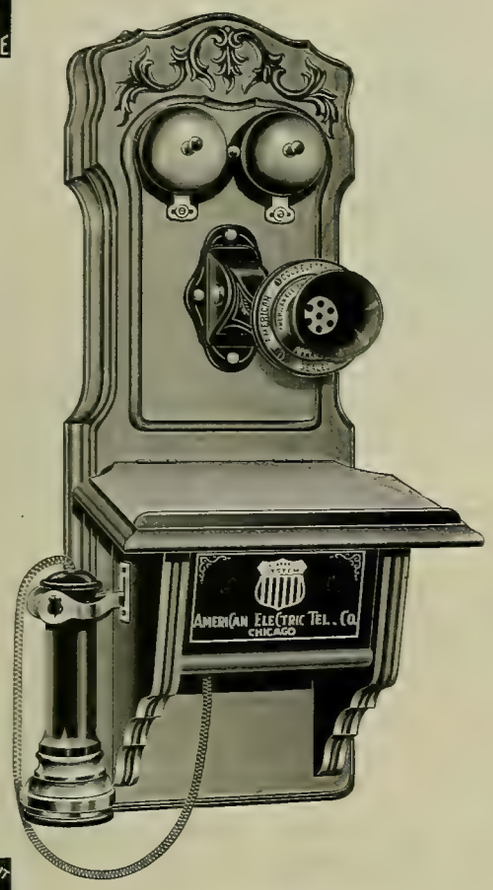

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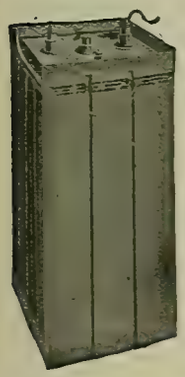

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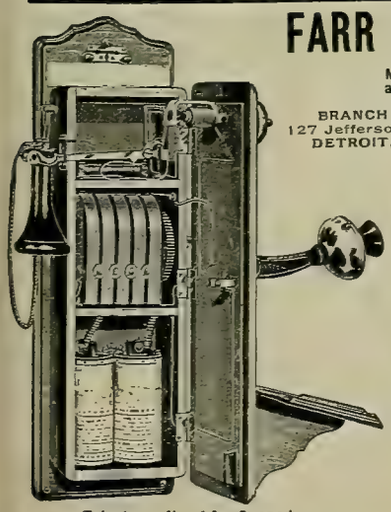

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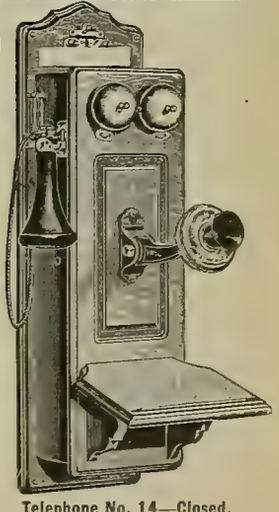

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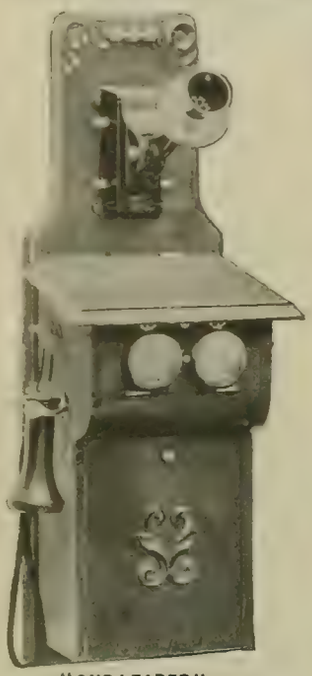

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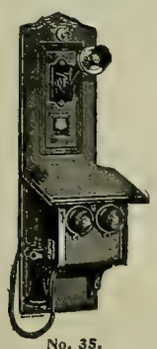

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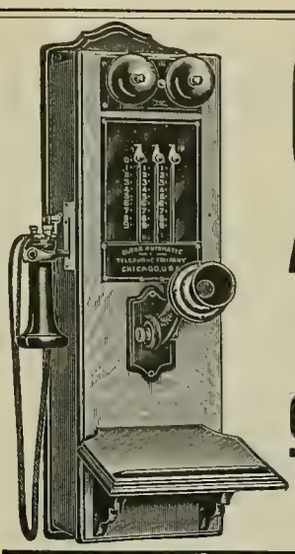

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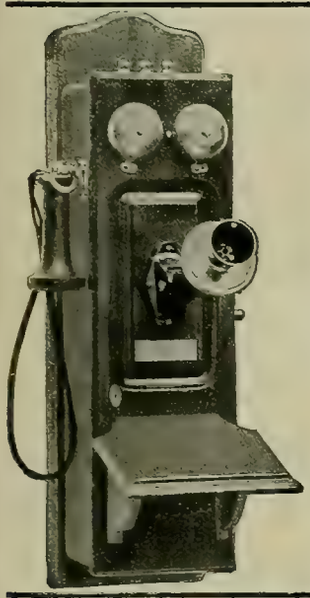

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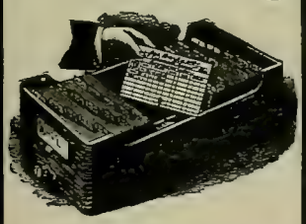

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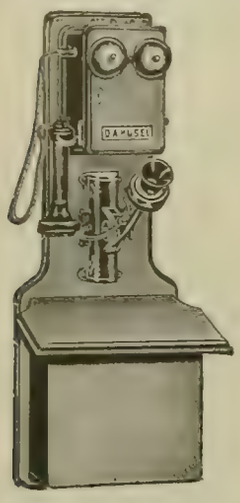

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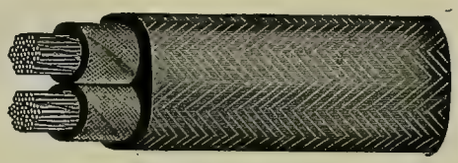

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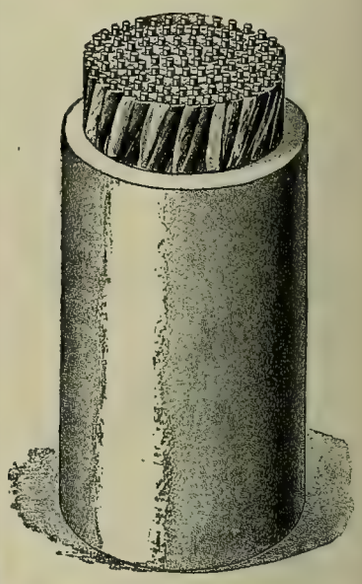

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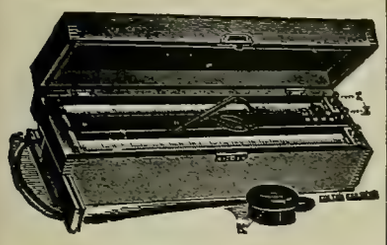

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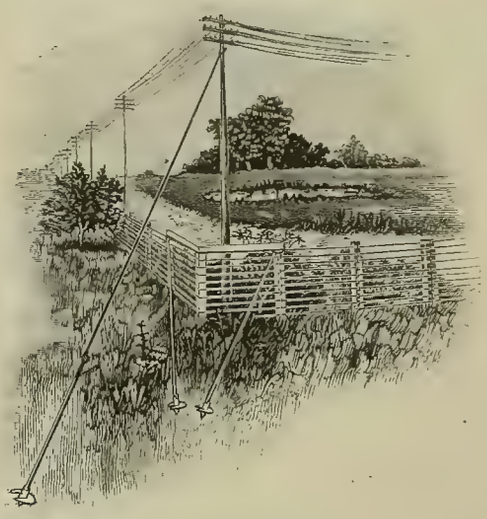

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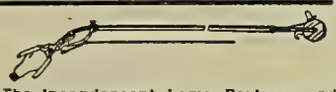

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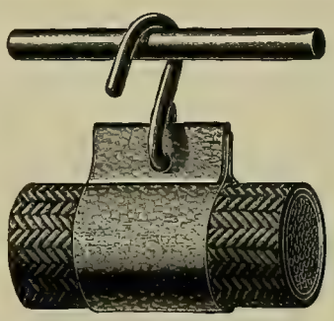

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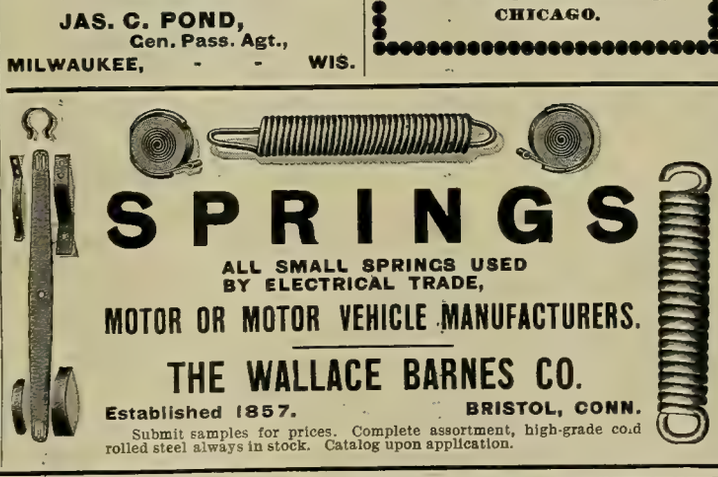

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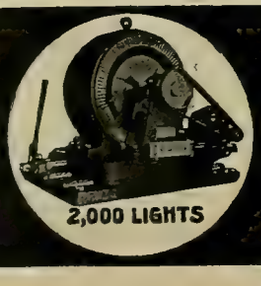

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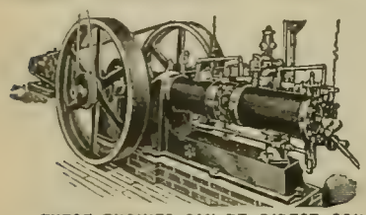

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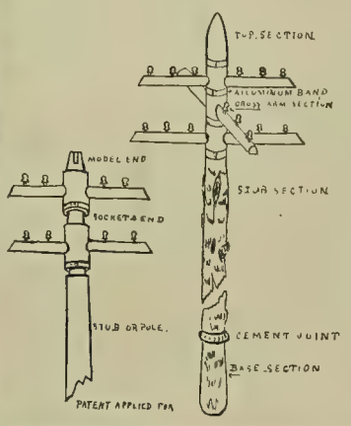

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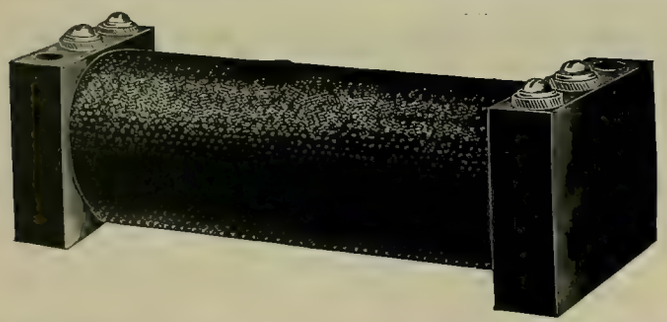

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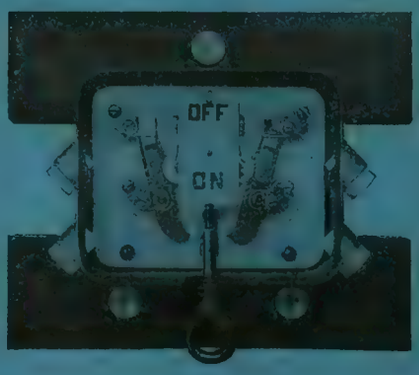

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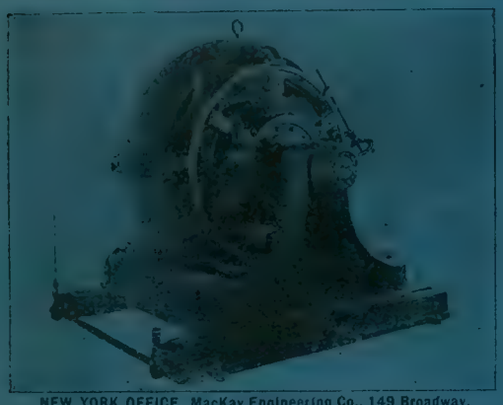

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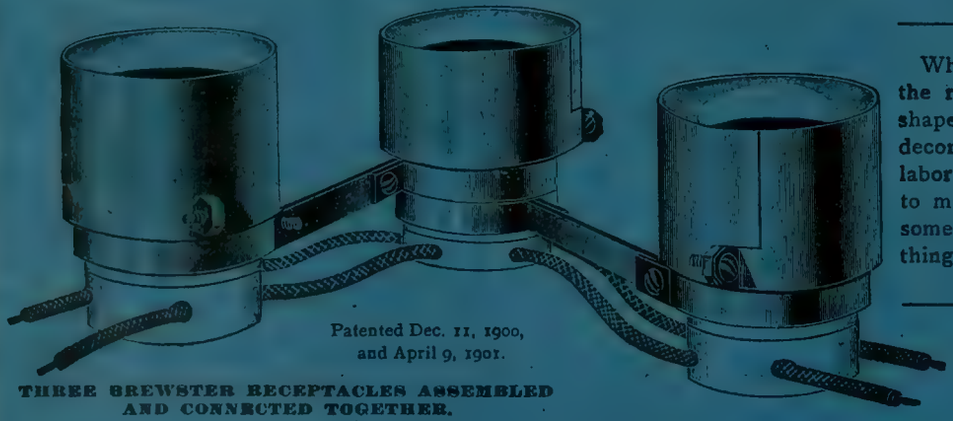

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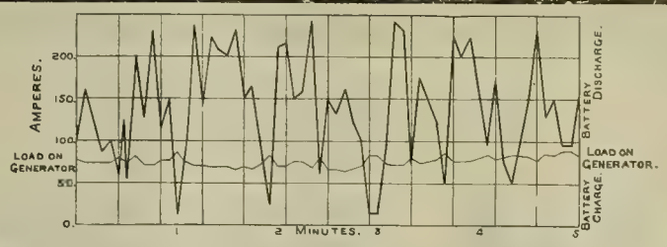

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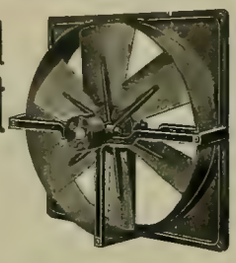

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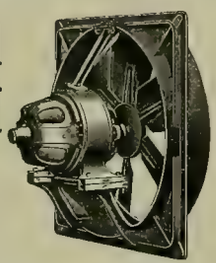

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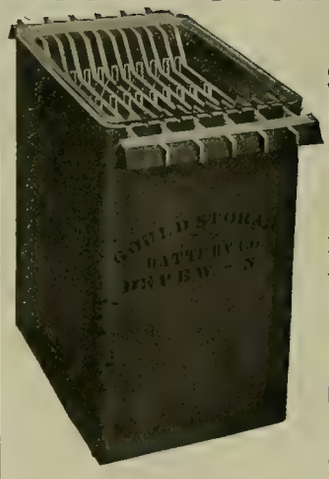

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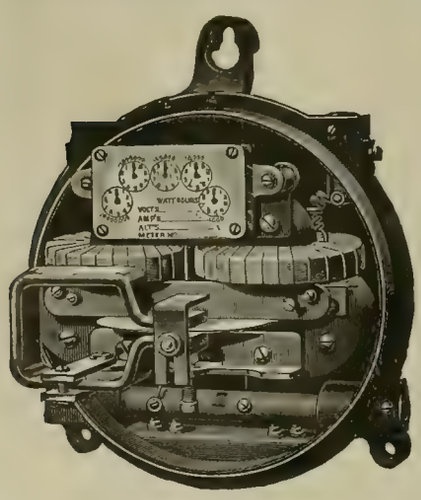

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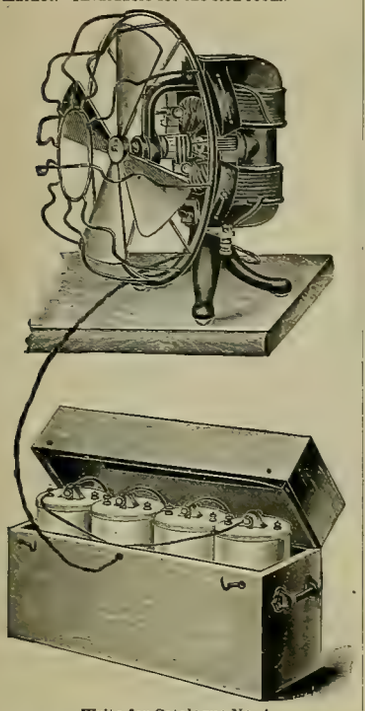

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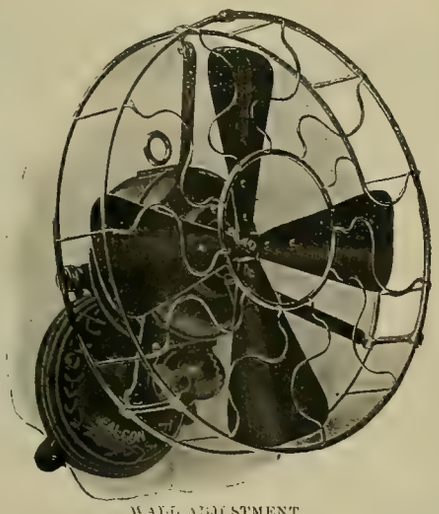

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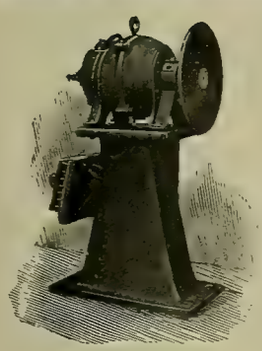

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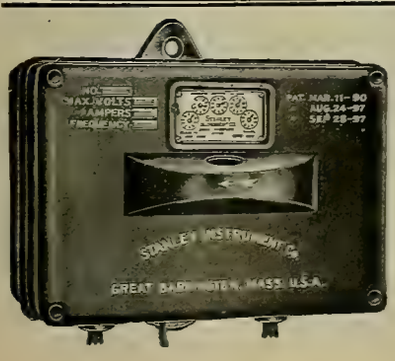

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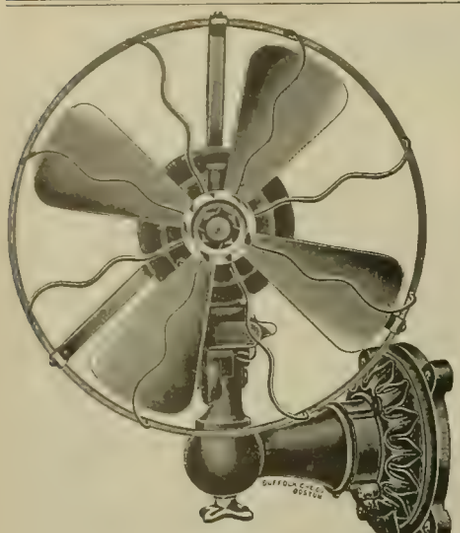

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Made for Alternating or Direct Currents, all voltages.

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THE GENERAL ELECTRIC COMPANY

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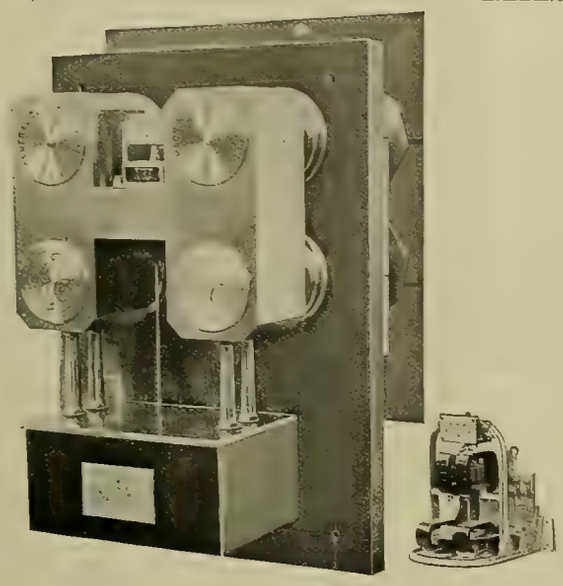

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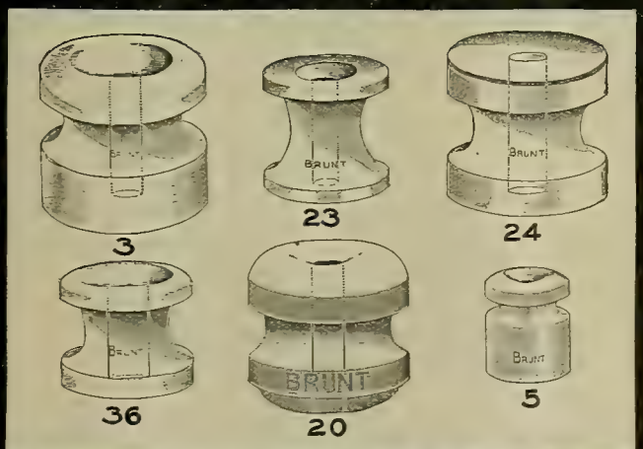

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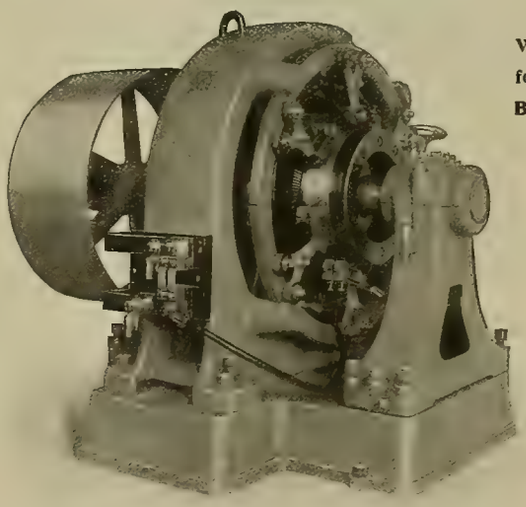

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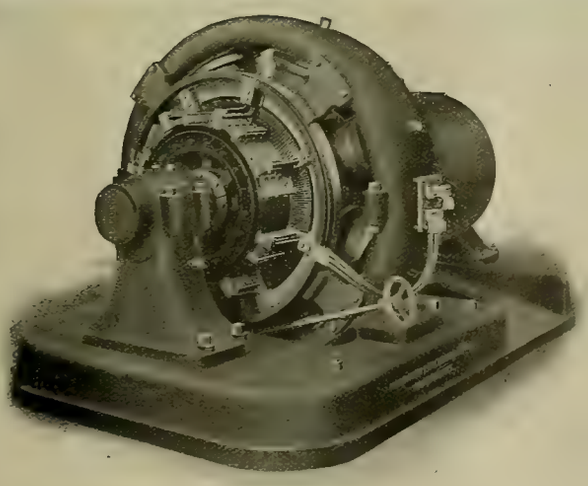

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For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
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Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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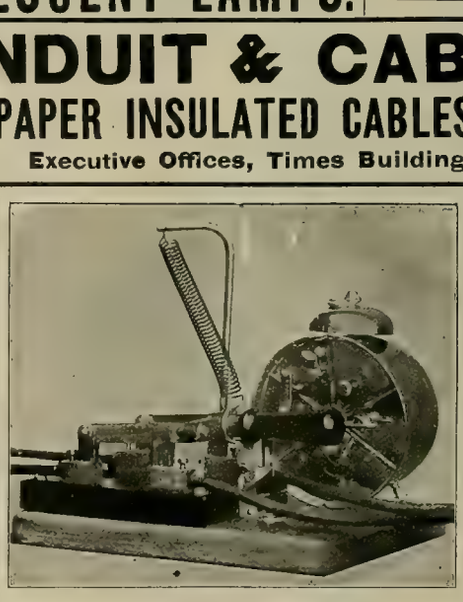

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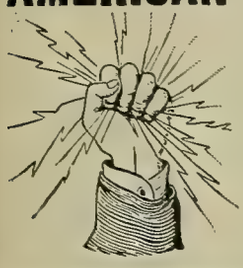

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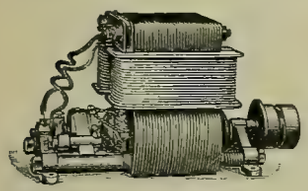

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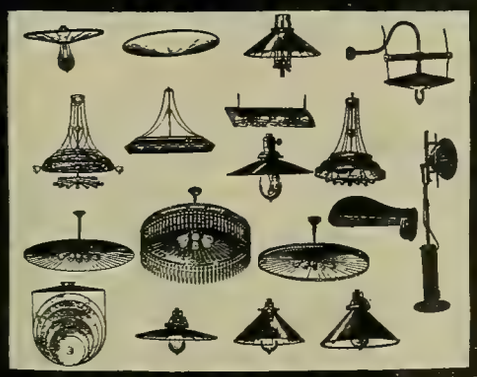

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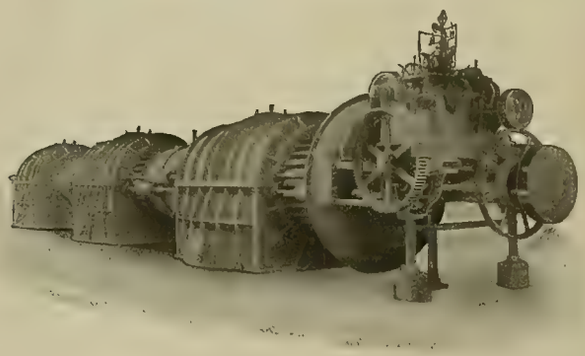

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One 250 h. p. Worthington Water-tube Boiler, good for 135 pounds Hartford.
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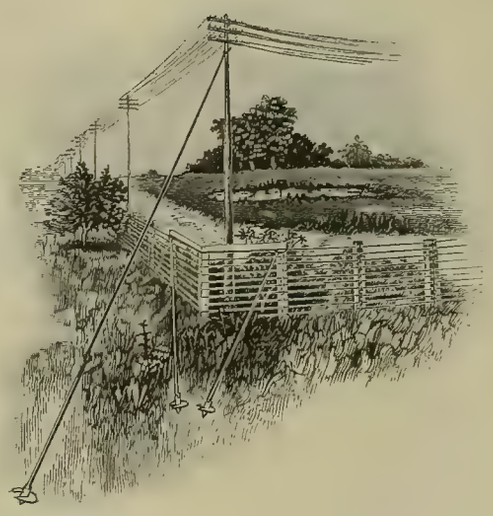

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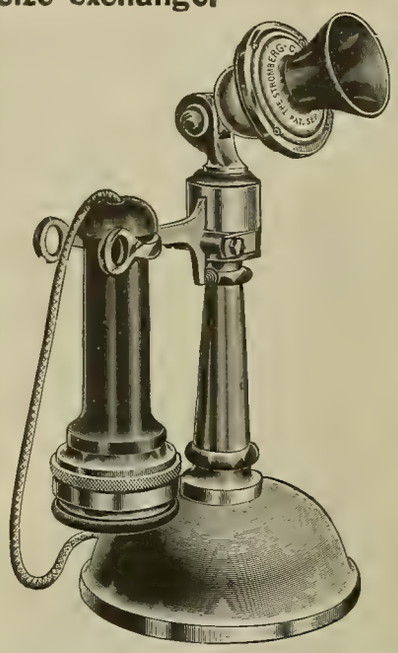

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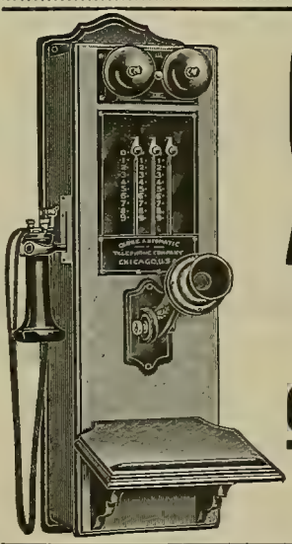

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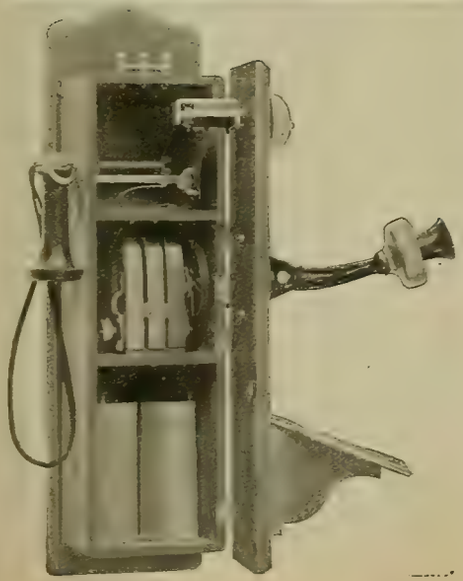

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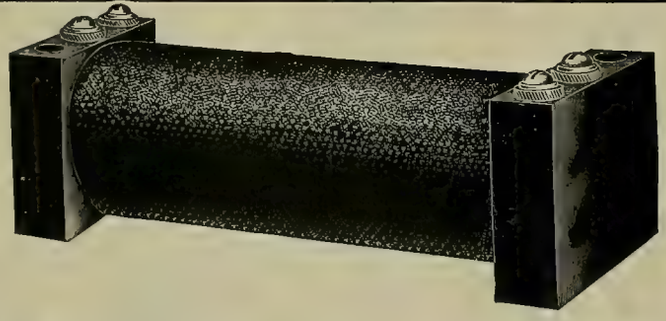

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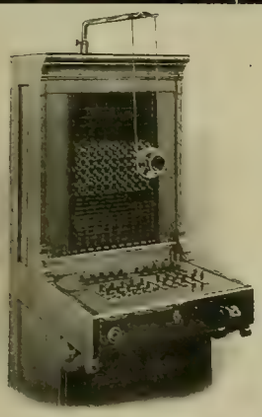

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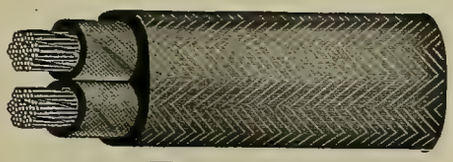

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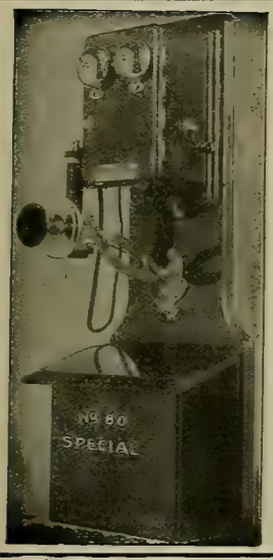

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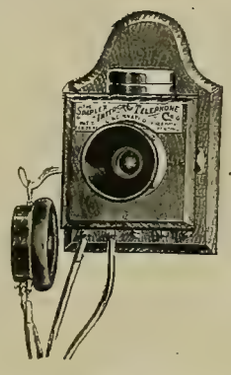

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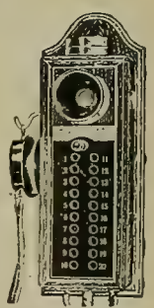

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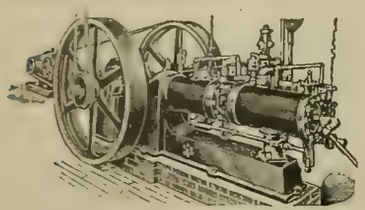

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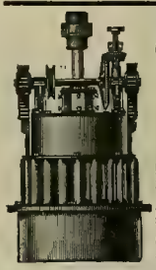

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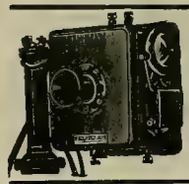

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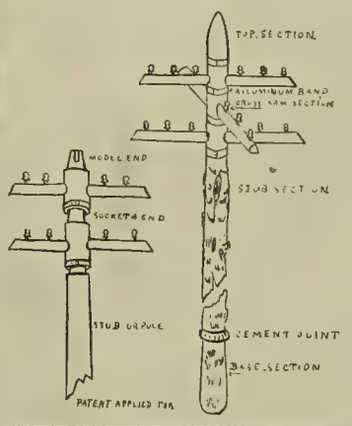

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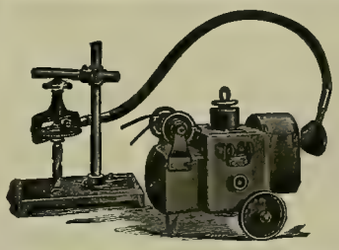

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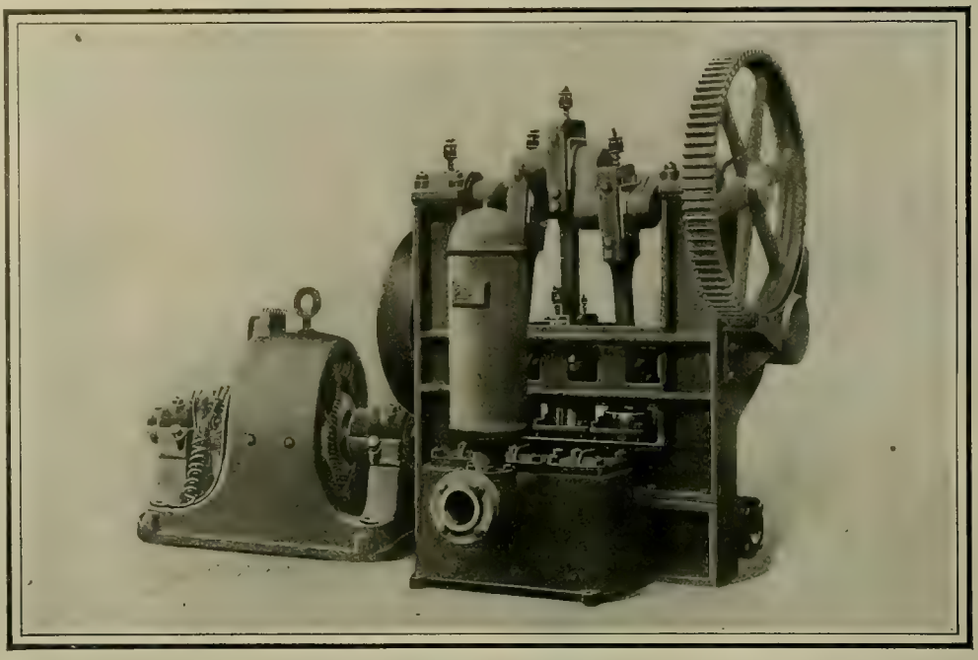

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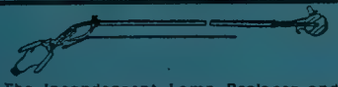

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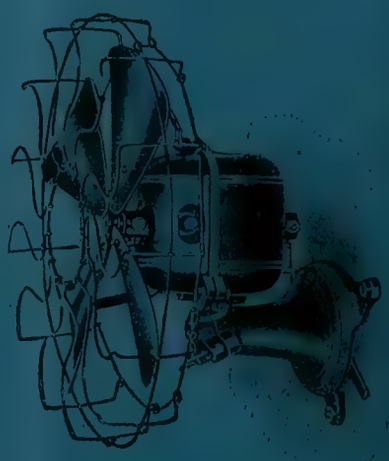

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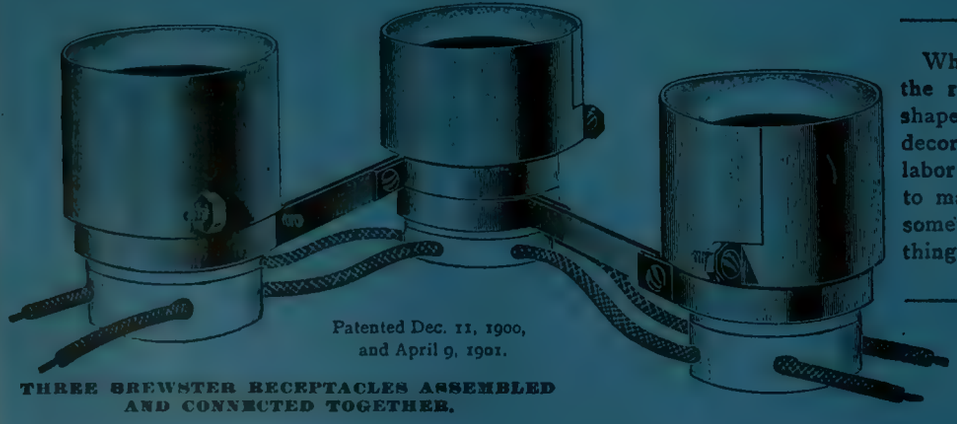

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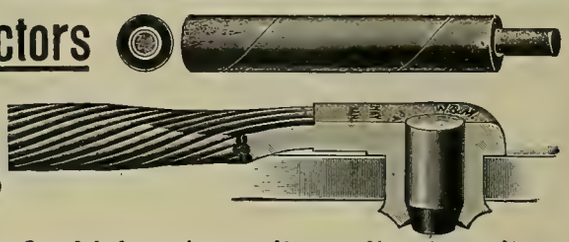

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PARAGON FAN MOTORS.

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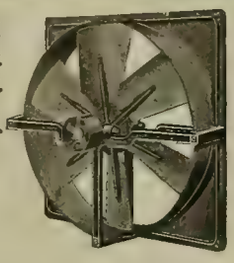
Triumph Exhaust Fan.



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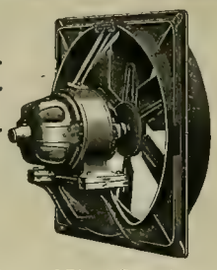

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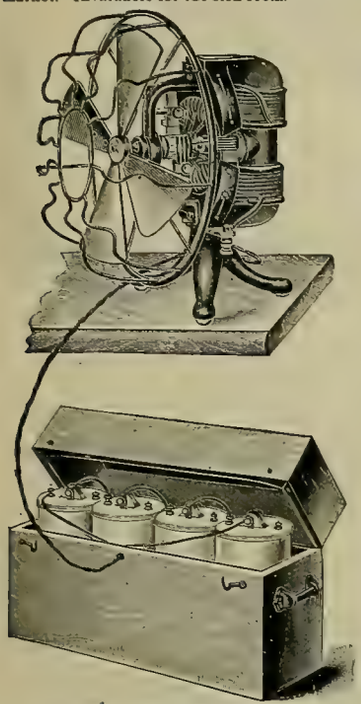

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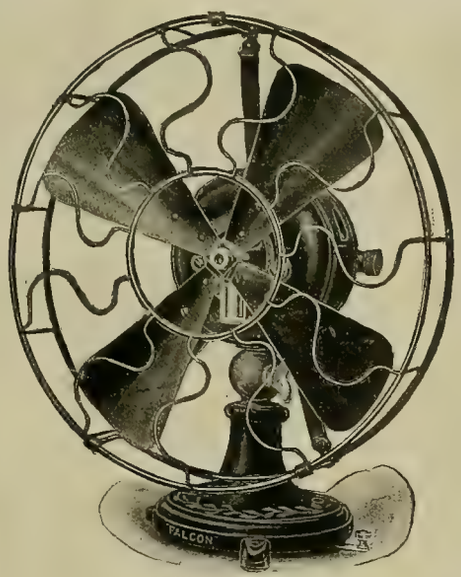

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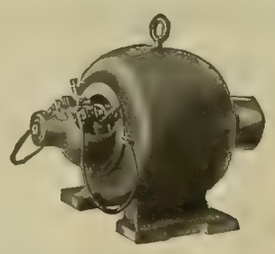

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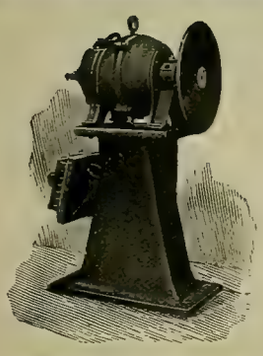

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National Tel. Equipm. Co.
Palmer Bros.
R. I. Telephone & Elec. Co.
St. Louis Elec. Supply Co.
Simplex Interior Telep. Co.
Standard Construction Co.
Standard Tel. & El. Co.
Sterling Electric Co.
Stromberg-Carlson Tel. M. Co
Strowger Aut. Tel. Exchange.
Telephone Co. of Amer., The.
Thomas, Wilcox & Dietz.
Union Switchboard Co.
Western Electric Co.
Western Elec. Supply Co.
Yurgae Signalphone Mfg. Co.

Telephone Service.
Chicago Telephone Co.

Tools.
Anderson & Sons, W. H.
Klein & Son, Mathias.
Missouri Electrical Mfg. Co.
Smith & Hemenway Co.

Torches.
Turner Brass Works.

Transformers.
Crocker-Wheeler Company.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Stanley Electric Mfg. Co.
Vindex Electric Company.
Wagner Electric Mfg. Co.
Western Electric Co.
Western Elec. Supply Co.
Westinghouse El. & Mfg. Co

Trucks, Electric Car.
General Electric Co.
Westinghouse El. & Mfg. Co

Turbine Water Wheels.
Leffel & Co., Jas.
Smith Co., S. Morgan.
Stilwell-Bierce Smith-Vaile.

Varnishes.
Sterling Varnish Co.

Vulcanized Fibre.
Vulcanized Fibre Co.

White-Washing M'ch's.
Star Brass Works.

Wire, Bare.
American Steel & Wire Co.
Besly & Co., Chas. H.
Central Electric Co.
Electric Appliance Co.
Independent Tel. Supply Co
Okonite Co., The
Phillips Insulated Wire Co.
Roebling's Sons Co., J. A.
Standard Underground C. Co
Western Electric Co.
Western Electrical Sup. Co.

X-Ray Outfits.
Queen & Co.
Willyoung, Elmer G.

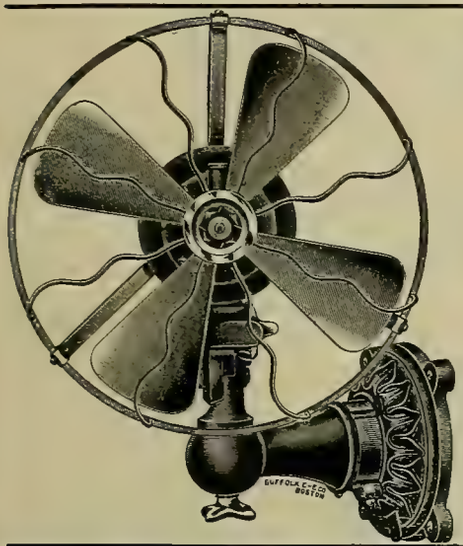
For Alphabetical Index of Advertisements See Page 3.

The "ELECTRA" Highest Grade Nuernberg Carbons are recognized as standard all the world over.

All genuine "ELECTRA" carbons are put up in packages bearing the label with the trade mark "ELECTRA."

Good carbons mean less cost for current.

All the excellence in dynamos and arc lamps counts for but little where poor carbons are used in lamps.



THERE WILL BE

A HOT TIME

IN EVERY OLD TOWN THIS SUMMER.

Keep Cool BY USING H.-C. Fan Motors.

Made for Alternating or Direct Currents, all voltages.

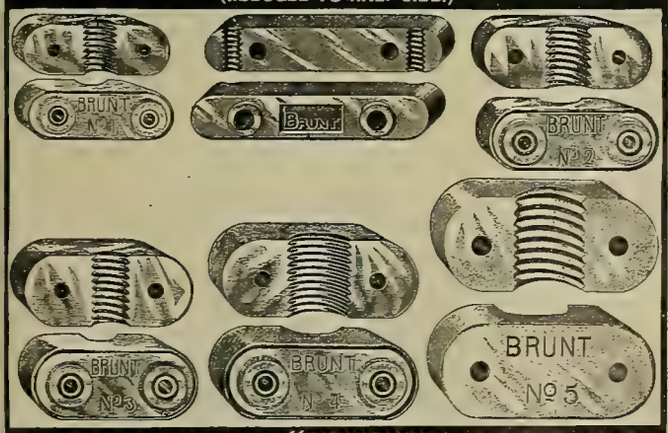
HOLTZER-CABOT ELECTRIC CO.,

Send for 1901 Catalogue and Prices. 397 Dearborn St., CHICAGO. Factory, Brookline, Mass.

A FEW OF BRUNT'S

High-Grade Porcelain Cleats.

(REDUCED TO HALF SIZE.)


BRUNT
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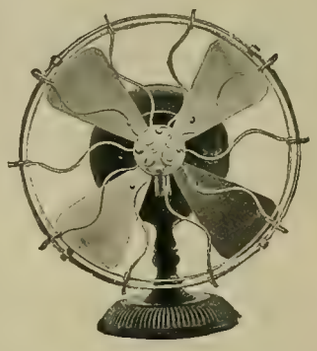
BRUNT

THE GENERAL ELECTRIC COMPANY'S

Fan Motors.

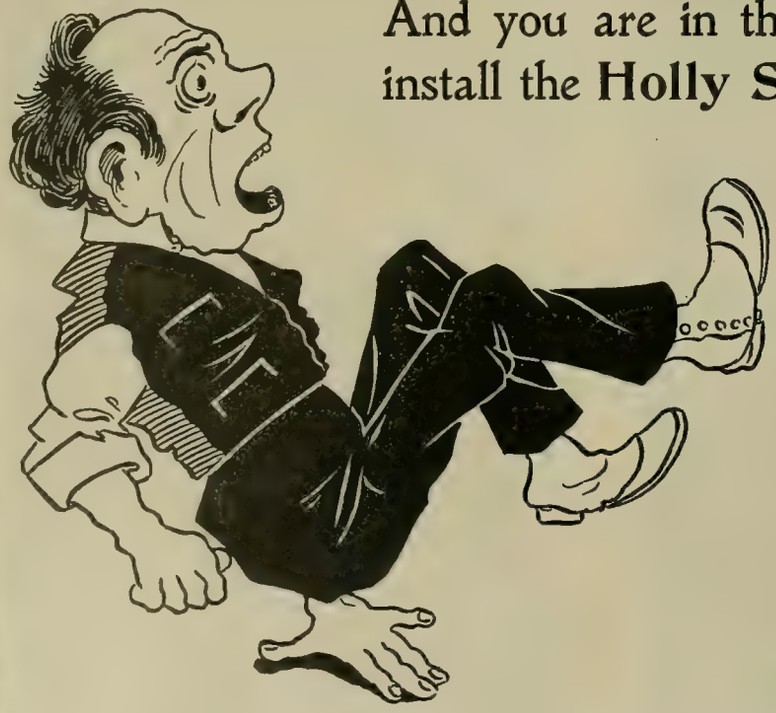


All Sizes and Styles for Alternating and Direct Current now in stock.

GENERAL OFFICE: SCHENECTADY, N. Y.

Chicago Office, Monadnock Bldg. Sales Offices in All Large Cities.

DON'T WAIT UNTIL THE CRASH COMES



And you are in the hands of the Sheriff, but install the **Holly System of Underground Steam Mains** at once, which will enable you to sell your exhaust steam for enough to pay all your station expenses and interest on the investment for steam mains, thus securing your electric current free. It is cheaper than waterpower.

WRITE FOR OUR NEW PAMPHLET GIVING FULL EXPLANATIONS. MENTION WESTERN ELECTRICIAN.

AMERICAN DISTRICT STEAM CO., LOCKPORT, N. Y.

SCALE=SCALE=SCALE=SCALE=SCALE

It does not do you any good to overlook your boilers and because there are some 3,000 ideas on the market which have been tried and have failed, is no sign it cannot be removed and kept out. There is no money, knowledge or Laboratories back of these 3,000 patent medicines.

Try a little Chemistry and Laboratory direction and see the saving in coal, boilers, etc. WRITE US.

DEARBORN DRUG & CHEMICAL WORKS,
27, 28, 29, 30, 31, 32, 33 AND 34 RIALTO BLDG., CHICAGO, ILL,

WM. H. EDGAR, President. **Telephones, Harrison 1358 and 1373.**

VINDEX TRANSFORMERS.

"There is Such a Thing as Merit= IN THE ARTICLE ITSELF

WITHOUT REFERENCE TO ITS NAME OR PRICE."

IF YOU'RE OPEN TO CONVICTION

Send to the "AD STUDIO" for a "Vindex" Catalogue.

THE MISSOURI ELECTRICAL MANUFACTURING CO.,
ST. LOUIS.

Northern Spherical Motor. Inclosed Type.

Northern Motors

are of such compact and symmetrical design that they are easily operated in any situation for any kind of work. They can be belted, geared or direct-connected to the driven machine. Our Engineering Corps has made an exhaustive study of the various wood and metal working machines in use by manufacturers for the purpose of determining the best methods of electric drive, and we have the results of years of patient investigation carefully compiled for the benefit of our customers. We have made some of the largest installations for complete electric drive in America and challenge a comparison of economical results.

We build all sizes of Generators and Motors for either Alternating or Direct Current. Ask for Bulletin No. 240.

STANLEY ELECTRIC MFG. CO.,
PITTSFIELD, MASS.

NORTHERN ELECTRICAL MFG. CO.
MADISON, WIS.

WE RECOMMEND

AFTER THIRTEEN YEARS' EXPERIENCE AS SALES AGENTS FOR PACKARD INCANDESCENT LAMPS WE CAN CONFIDENTLY RECOMMEND THEM.
THEY WILL PLEASE YOU AS THEY DO THE THOUSANDS OF USERS WE SUPPLY.

ELECTRIC APPLIANCE COMPANY,
ELECTRICAL SUPPLIES,
CHICAGO.

3/4 c. BUYS OUR NEW ENCLOSED FUSE.

ROUGH HANDLING WILL NOT BREAK IT.

FUSE WIRE PROTECTED.

ALL MICA INSULATION. SAMPLES FREE.

WE ALSO MAKE { Fuse Blocks, Lightning Arresters, Connectors, Paper Insulators, FUSE WIRE and Specialties.

THREE BIG STORES.

AMERICAN ELECTRIC FUSE CO.
New York. Chicago. San Francisco.

MICANITE CLOTH

HIGH INSULATOR FOR ARMATURES, ETC.
NON-ABSORPTIVE, FLEXIBLE and STRONG.

MICA INSULATOR CO.
"ORIGINATORS."
CHICAGO. NEW YORK.

ENGINEERING.

HERBERT A. WAGNER,
Consulting Engineer,
RAILWAY LIGHTING AND POWER PLANTS,
TIMES BLDG., NEW YORK CITY.
415 LOCUST ST., ST. LOUIS.

VOLT-AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET.
78-80 Cortlandt St., NEW YORK, N. Y.

American Vitrified Conduit Company,
MANUFACTURERS OF
VITRIFIED SALT GLAZED UNDERGROUND AND INTERIOR CONDUITS.
Contractors for Complete Installation of Conduit Systems.
General Offices: 39 Cortlandt St., N. Y.

Eldredge Battery Voltmeter,
For Testing Primary and Storage Batteries, 0 to 3 Volts.
DEAD BEAT.
The only low-price pocket instrument indicating in volts. Connecting posts have non-removable nuts. Light weight and neat in appearance.
Eldredge Electric Mfg. Co.,
Springfield, Mass., U. S. A.

YOU NEED IT!

Gale's Commutator Compound.
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, CHICAGO.

Kilfyre DRY POWDER COMPOUND

SEND YOUR NAME TO-DAY
FOR OUR NEW ILLUSTRATED BOOKLET.
Interesting, Convincing, FREE.
"KILFYRE" Blots Out Fire from Any Cause in Telephone Exchanges, Electric Light and Power Plants, Subway Manholes.
Monarch Fire Appliance Company, 27 William Street, New York City.

GENERAL INCANDESCENT ARC LIGHT CO.,
Factory and General Offices: 572-578 FIRST AVENUE, NEW YORK.
TRADE G. I. MARK.
Manufacturers of HIGH-GRADE ELECTRICAL SUPPLIES.
WRITE FOR ATTRACTIVE BULLETINS.
Branch Offices:
Chicago, Philadelphia, Boston, Cleveland, St. Louis, Milwaukee, Cincinnati, Denver, St. Paul.

G. I. INCANDESCENT LAMPS.

There is nothing cheap about the name McRoy Conduits, yet they are least expensive

McROY CLAY WORKS
BRAZIL, INDIANA
302 BROADWAY, NEW YORK
138 WASHINGTON ST., CHICAGO

THE NATIONAL CONDUIT & CABLE CO.

Manufacturers of BARE COPPER WIRE AND CABLE, PAPER INSULATED CABLES, FOR TELEPHONE, TELEGRAPH, ELECTRIC LIGHT AND POWER.
CEMENT LINED PIPE FOR CONDUITS.
Executive Offices, Times Building, NEW YORK, N. Y.

THE GORDON PRIMARY CELL.

The most improved, efficient, long lived and economic primary cell of the new century.

Extensively used for telephone, telegraph, fire and police alarm service, railroad signal work, gas engine ignition and automobiles.

Manufactured in ten different styles.

Catalogue, price-list, etc., upon application.

THE GORDON BATTERY CO.,
13 and 15 Laight Street, New York.

DEWAR BULBS FOR LIQUID AIR

Are now supplied with special silvered coating preventing Heat Radiation. Liquid Air has been kept 29 days in such a bulb. Made in all sizes up to 10 inches.

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT,
(General Electric Co.) Harrison, N. J.

FRANK N. PHILLPIS, President. C. H. WAGENSEIL, Treasurer. EUGENE F. PHILLIPS, General Manager. E. ROWLAND PHILLIPS, Vice-Pres. G. R. REMINGTON, Jr., Sec.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

New York Store, W. J. Watson, 26 Cortlandt St.
Chicago Store, F. E. Donohoe, 82 Lake St.
Montreal Branch, Eugene F. Phillips' Electrical Works.

MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

IDEAL AUTOMATIC ANNUNCIATORS.
The Best on the Market. Write for Prices.
Manufactured by
THE HEATH ELECTRIC CO.,
DETROIT, MICH.

Six Years with General Electric Company.
THOMAS J. JOHNSTON,
Counsellor at Law,
No. 66 Broadway, - NEW YORK CITY.
Patent Causes. Patent Soliciting.

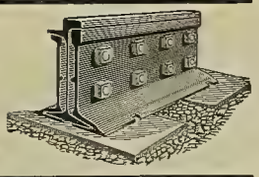
Expansion Bolts

For fastening all kinds of structure to brick and stone work
Patentee and M'f'r, ISAAC CHURCH,
Send for catalogue C. TOLEDO, OHIO.

CHAILLET, ADOLPHE A.
Consulting Electrical Engineer.
Plans and specifications for Electric Lighting and Power Plants. Designer of Electrical Machinery.
476 ELLICOTT SQUARE, BUFFALO, N.Y.

The Bossert Electric Construction Co.
—MANUFACTURERS OF—
STEEL OUTLET AND JUNCTION BOXES, SWITCHBOARDS, PANEL BOARDS, SWITCHES, ETC.
UTICA, NEW YORK.

CONTINUOUS RAIL JOINT COMPANY OF AMERICA.
General Offices: 164 MARKET STREET,
NEWARK, N. J.
Millions in use on One Hundred and Forty-Five (145) railroads in the United States, on over Seven Thousand Five Hundred (7,500) miles of track.



REFLECTORS!

Light is useless if you can't have it where you want it.

Paragon Reflectors throw the light **just where you want it.**

Our Incandescent Reflectors are neat and are superior to all others. They are green outside, glossy enamel white inside. Reflecting surface. Made in various styles and sizes. Get our catalog.

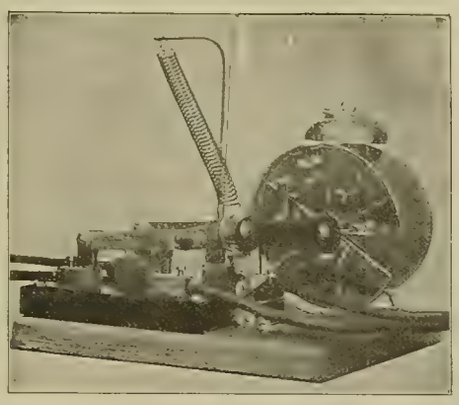
American Reflector & Lighting Co.,
271-273 FRANKLIN ST., CHICAGO.

NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Slow-Burning Wire.

Prices and Samples on Application.

Phillips Insulated Wire Co.,
Office and Factory: PAWTUCKET, R. I.



THE BEST WAY
Clock Switch

Turns out show window lights any time desired after store is closed. You only need to wind the clock. Switch is automatic. Perfectly reliable. Sent on ten days' trial.

Prices { 15 Amp., D. P., $4.50 / 25 Amp., D. P., 5.00 / 50 Amp., D. P., 6.00

Galesburg, Ill., Dec. 27, 1900.

We, the undersigned merchants of Galesburg, Ill., have in use one of the Clock Switches made by the College City Electric Company, and find it satisfactory in every way. It is easily set and does not get out of order.

The Galesburg Shoe Co., Boots and Shoes. Nelson, Marks & Co., Dry Goods.
W. A. Anderson & Co., Boots and Shoes. Anderson, Drake & Co., Wall Paper, Paints.

COLLEGE CITY ELECTRIC CO., Galesburg, Ill.

If you have the best battery that science has produced, you have a

Columbus Storage Battery.

Cells of many styles for all sorts of work.

THE PRICE IS RIGHT.

Send for our catalogue and find out. It contains lots of good information on the use and care of storage batteries.

The COLUMBUS BATTERY & SPECIALTY CO.,
COLUMBUS, OHIO.

American Bridge Company

DESIGNERS
MANUFACTURERS
AND ERECTORS OF

Steel Bridges
Steel Buildings
and All Classes of
Metallic Structures

WE have decided to carry at all our plants a large stock of Raw Material, from which we can furnish with great promptness any ordinary order for Steel Bridges, Roofs, Buildings, Columns, Girders, Beams, Channels, Angles, Plates, etc.

The facilities at our disposal and our operative system are such as to insure *most favorable quotations* and *deliveries for any part of the world.*

General Offices: 100 BROADWAY, NEW YORK

Branch Offices and Works:

Albany, N. Y.	Canton, Ohio.	Lafayette, Ind.	Seattle, Wash.
Athens, Pa.	Cleveland, Ohio.	Milwaukee, Wis.	San Francisco, Cal.
Boston, Mass.	Denver, Colo.	Minneapolis, Minn.	Salt Lake City, Utah.
Buffalo, N. Y.	Duluth, Minn.	New Orleans, La.	Sydney, N. S. W.
Baltimore, Md.	East Berlin, Conn.	Pencoyd, Pa.	Trenton, N. J.
Butte, Mont.	Elmira, N. Y.	Philadelphia, Pa.	Wilmington, Del.
Columbus, Ohio.	Groton, N. Y.	Pittsburg, Pa.	Youngstown, Ohio.
Chicago, Ill.	Horseheads, N. Y.	Rochester, N. Y.	

European Office: LONDON

ULLRIDGE, N. Y., 24-08.

WANTED.

Practical office man, lately with a large electric company as traveling auditor, desires to connect himself with an electric light or street railroad company. If desired will systematize your accounts so that monthly reports will show actual results of operation. Highest references as to ability, etc. Address "C. A.," care Western Electrician, 510 Marquette Bldg., Chicago.

WANTED.

Three 1000-light second-hand Brush arc machines and two second-hand large high-tension alternators. Address "D. G. C.," care Western Electrician, 510 Marquette Building, Chicago.

WANTED.

Position as electrician or assistant engineer by young man of good habits. Understands all kinds of wiring and line work. Five years' experience. Can furnish good references from former employers. FRANK McCULLOUGH, 634 Hitt St., Ottawa, Ill.

WANTED.

Position as superintendent or foreman of construction. Twenty years' experience in handling men. Outside construction only—building of lines, etc. Salary about $80 to begin with. Electric lighting preferred. High or low tension, transformers, block system, 3-phase, etc. Three years with Commonwealth Electric Co. Good references. H. F. BIERWIRTH, 679 Clifton Ave., Chicago.

FOR SALE OR TRADE.

Electric light plant in town of 3,000 inhabitants, county site. Have city contract for streets; business growing and splendid opportunity for someone; have compact steam plant, one arc machine and 35 K. W. alternating machine. Price, $9,000. Address "BUSINESS," care Western Electrician, 510 Marquette Building, Chicago.

FOR SALE.

Telephone plant in good shape, in a good town and one of the best telephone fields in the state. Address "TELEPHONE EXCHANGE," care Western Electrician, 510 Marquette Building, Chicago.

FOR SALE.

Alternating system with 550 lights and city contract for pumping water. In good running order. Is owned by bank and must be sold at once. For particulars address N. H. CROWELL, Sioux Rapids, Iowa.

FOR SALE.

Second-hand insulated weatherproof copper wire. No. 6, 14 cents per pound; No. 10, 15 cents per pound.

G. MATHES' SONS COMPANY,
ST. LOUIS, MO.

FOR SALE.

Lot 110-volt new fan motors at bargain prices. Old material purchased. WALSH'S SONS & CO., 280 Washington St., Newark, N. J.

FOR SALE.

Two L. D. 12 T.-H. Arc Machines, 50 lights' capacity.

Ninety-four T.-H. Arc Lamps, class M 12.

Eleven 22-foot "Cutter" Mast arms.

Four Circuit Plug Switchboard, complete.

Wood Cutouts Hoods, Hanger Boards and everything complete for a constant-current, arc-lighting outfit for a small city.

The machines and lamps in first-class condition; in fact, are in operation at the present time. Our object in selling: We wish to go on alternating system. Make us an offer. Address

TITUSVILLE ELECTRIC LIGHT & POWER CO.,
TITUSVILLE, PA.

TO AVOID MOVING TWICE,

We will make especially low prices on the following apparatus for a few days:

One 50 k. w. multipolar, Excelsior, 125-volt Generator, direct-connected to a New York Safety Engine, 12 x 13, practically new.
One 75 k. w. 125-volt multipolar, American Ball Generator, direct-connected to an American Ball Engine, complete with sub-base, used three months.
One 150 h. p. 16 x 15 Phœnix Engine.
One 300 h. p. 14 x 24 x 16 New York Safety Tandem Compound Engine.
One 100 h. p. 13 x 12 Phœnix Engine.
Two 100 k. w. 6-pole, Triumph, 110-volt Generators.
Two 50 k. w. Triumph, multipolar, 110-volt Generators.
Two 50 k. w. Jenney, bipolar, 110-volt Generators.
Two 25 k. w. Jenney, bipolar, 110-volt Generators.
One 250 h. p. Worthington Water-tube Boiler, good for 135 pounds Hartford.
Three 100 h. p., 60 x 18, Phœnix Boiler, good for 95 pounds Hartford.
Write for Price-list No. 43 for other apparatus.

ILLINOIS MAINTENANCE COMPANY,
E. H. Cheney, Mgr. 204 Dearborn St., Chicago.

TREASURY DEPARTMENT, Office, Supervising Architect, Washington, D. C., June 19, 1901. Sealed proposals will be received at this office until 2 o'clock P. M. on the 19th day of July, 1901, and then opened, for the installation of an electric freight elevator, including all labor, materials etc., for the U. S. Mint Building at New Orleans, La., in accordance with the specification, copies of which may be obtained at this office or at the office of the Custodian at New Orleans, La., at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

FOR SALE.

Electric Power Plant.

This plant was installed by the General Electric Company through the Union Iron Works, San Francisco, and was operated but a few months. The machinery is guaranteed in first-class condition, as good as new.

Will name prices f. o. b. Townsend, Montana, or delivered.

One 3-phase alternating-current generator, 500 K. W., 60 cycle with 24 poles, type A. P.; volts full load 2,400, A. M. P. 120, revolutions 300, with rheostat.

One electric generator or exciter, 12½ K. W. multiple direct current exciter, type M. P., class 4-12.5-12.75, volts 125, with rheostat.

One marble generator switchboard panel, 30"x90"x2", containing one general field rheostat, one exciter field rheostat, one station transformer, one potential indicator, one current indicator, one pilot lamp, one ground detector with plug and receptacle, three type L lightning arresters, six feeder fuse blocks, one double pole exciter switch, two single pole switch brake 2,000 volt switches, iron angle frame.

100,000 feet, more or less, No. 2 B. & S. copper wire on reels.

One large lot of electrical fixtures and fittings.

Two Pelton Water Wheels, 350 H. P. each.

The generator is direct connected with two Pelton water wheels, 750 H. P. If to be steam driven, will furnish new outboard bearing, shaft and flexible coupling under plans of General Electric Company.

For full information and prices, apply to
CHAS. E. BILLIN & COMPANY,
1545 Marquette Building, - - CHICAGO.

FOR SALE

(No reasonable offer refused.)

One Armington & Sims Engine, 14 in diameter, 13 in. stroke, with pulleys 66 in. diameter by 15½ in. face.
One Deane Independent Condenser, 12 in. x 16 x 18, 300 H. P.
One piece 5½ in. shafting, 18 ft. 6 in. long, with companion flanges one end.
Three floor hangers, with self oil boxes, for 5½ in shaft, 39 in. drop and adjustable all round.
Three granite capstones for hangers.
Two friction clutch pulleys, 66 in. dia. by 18½ in. face, 36 in. friction with wheel, collar, toggles and shoes complete.
One clamp iron pulley, 66 in dia., 10½ face to clamp on 8½ in. quill.
One bracket quill for floor hanger mentioned above.
One clamp iron pulley, 44 in. dia., 8½ in. face for 5½ in. shaft.
One clamp iron pulley, 44 in. dia., 5½ in. face for 5½ in. shaft.
One clamp iron pulley, 44 in. dia., 5½ in. face, 8½ in. bore.
One A 12 T. H. alternating current generator, 125 cycles — 1000 volts — 60 amperes. Wooden base in operative condition.

All the above goods are for immediate delivery and f. o. b. cars Newton or Watertown, Mass.

For delivery about September 15th we have:

One A 120 T. H. alternating current generator. 125 cycles — 1000 volts — 100 amperes compound wound with iron base.
One A 12 T. H. alternating current generator. 125 cycles — 1000 volts — 60 amperes with wooden base.
One 60 K. W. Stanley Transformer step up. 125 cycles, 1000 volts to 2000 volts.
Seven Station switchboard G. E. transformers, 125 cycles, 350 watts, 1040 to 52-104 volts.
One 5 K. W. Exciter T. H. 110 volts.

ELECTRICAL DEPARTMENT,
NEWTON & WATERTOWN GAS LIGHT CO.
NEWTON, MASS.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO

FOR SALE.

One	30-k. w.	General Electric	alternator.
One	60-k. w.	" "	"
One	75-k. w.	" "	"
Two	120-k. w.	" "	"
One	30-k. w.	Westinghouse	"
One	45-k. w.	"	"
Two	60-k. w.	"	"
One	60-k. w	"	" 60 cycle.
One	75-k. w.	"	" 60 "
One	120-k. w.	"	" 60 "
One	240-k. w.	"	"133 "

Send for our **Monthly Bargain Sheet**, with net prices on machines in stock at our works. All apparatus fully guaranteed.

SECOND-HAND NATIONAL ALTERNATOR.

Alternator and Exciter Self-Contained.
Surface Wound, Not Compounded.
133-1,000 Volts, 30 Amperes.
30 K. W. Self-Oiling Bearings.
Speed, 1,500 Revolutions per Minute.
No. 514 Type, Paper Pulley, Sub-Base and Jack Screw.
In Good Condition.

ADDRESS

FREDERICKTOWN ELECTRIC AND MFG. CO.,
FREDERICKTOWN, MO.

INVENTIONS FOR EUROPE.

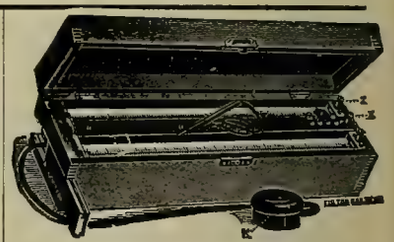
Engineers of standing and acquaintance in Europe wish to arrange for handling several good inventions abroad. We want such as are adapted for the organization of companies, etc. Liberal propositions made. ZERBE CO., Engineers, 11 Broadway, New York.

SECOND-HAND

Dynamos and Motors.

We invite correspondence with those wishing to buy or sell.

SCHUREMAN & HAYDEN,
140 S. Clinton St., Chicago.



A Direct Reading Ohmmeter.

Ohmmeters, Ammeters, Voltmeters.

Special Electrical Machinery.

F. B. SAGE & BRO.,
Successors to American Electric Specialty Co.,
128 Liberty St., New York City.
New York Agents Wirt Electric Co. Rheostats and Brushes.

BECKER BROTHERS

39-43 W. WASHINGTON ST., CHICAGO.

—REPAIRS—

For Everything Electrical, including NATIONAL ELECTRIC CO.'S MACHINES.

Manufacturers of the Celebrated "Perfection" **Brushes for Dynamos and Motors.**

Write for Our Prices on CORLISS ENGINES.

24 x 44 x 48 Allis Cross Compound.
28 x 60 Allis Corliss.
26 x 48 Fishkill Corliss, R. H.
26 x 48 Fishkill, L. H.
26 x 48 Rankin & Fritsch Corliss.
24 x 48 Allis Corliss.
24 x 42 Rankin & Fritsch Corliss.
20 x 48 Harris Corliss.
20 x 48 Wheelock Corliss.
20 x 42 Hamilton Corliss.
18 x 42 Wright Corliss.
16 x 42 Harris Corliss.
18 x 42 Rankin & Fritsch Corliss.
14 x 24 Cooper Corliss.
12 x 36 Harris Corliss.
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One 18x28 Nicols-Burr.
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One 15x16 Ball.
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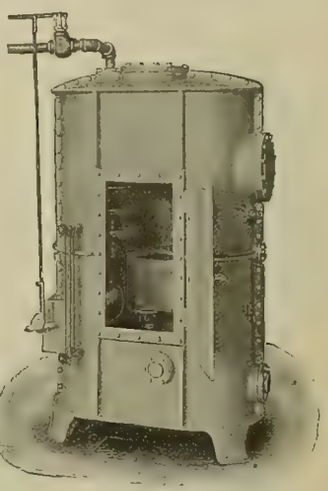

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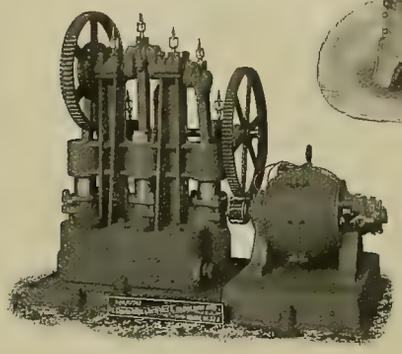

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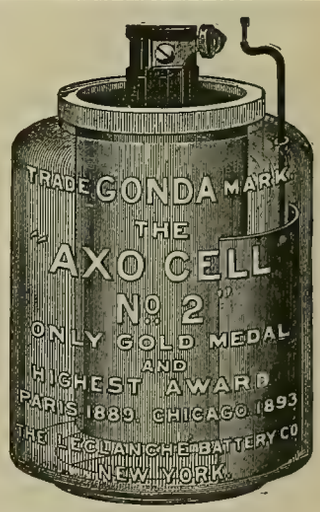

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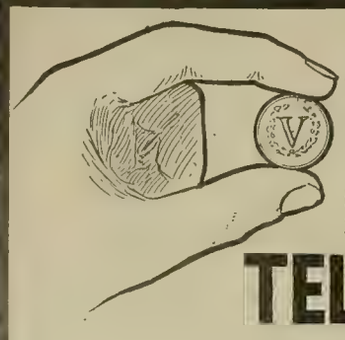

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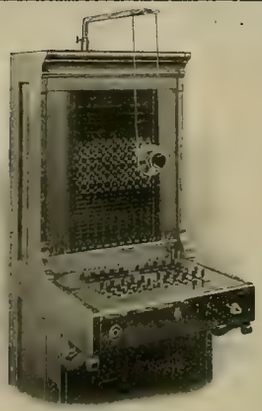

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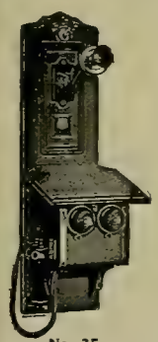

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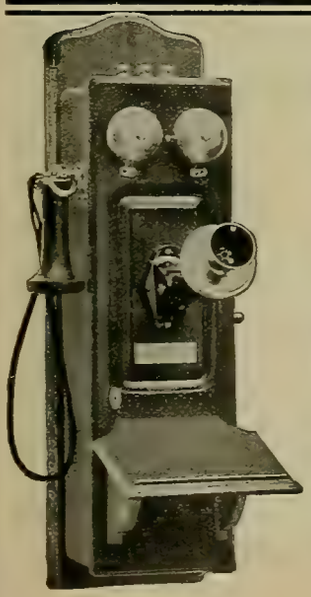

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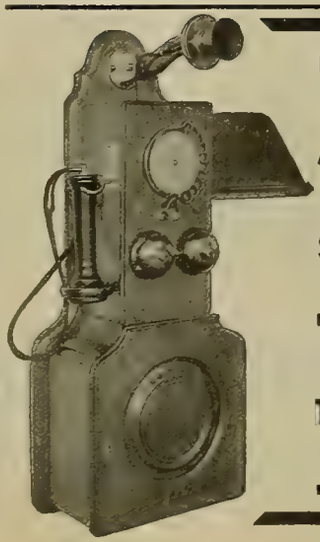

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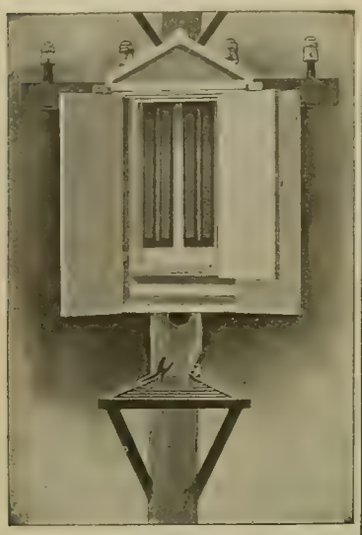

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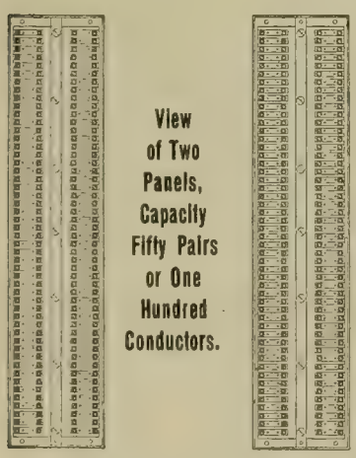

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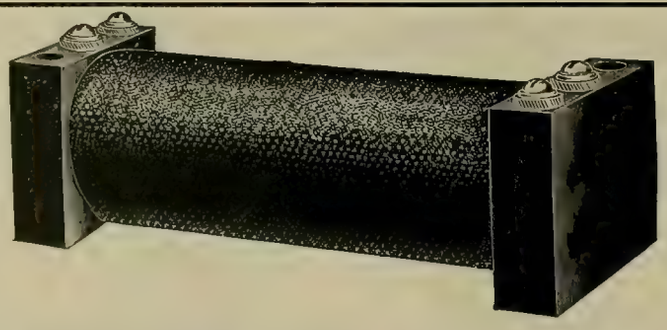

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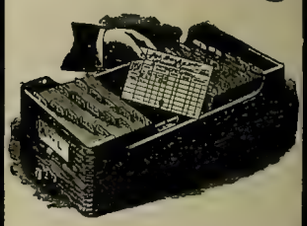

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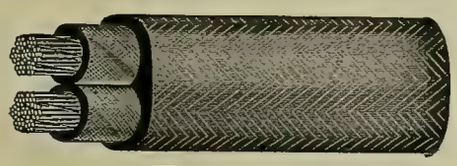

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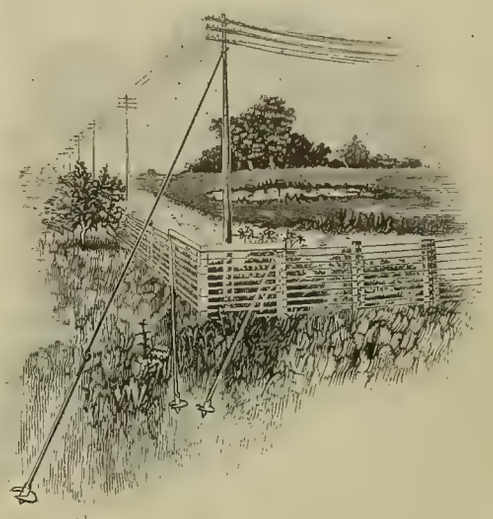

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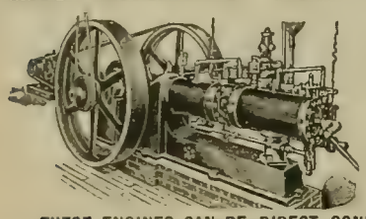

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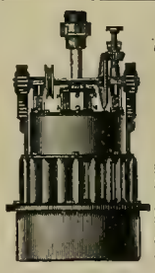

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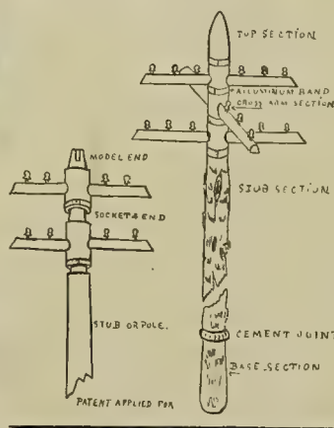

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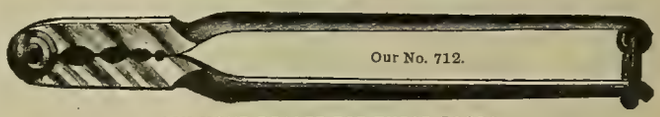

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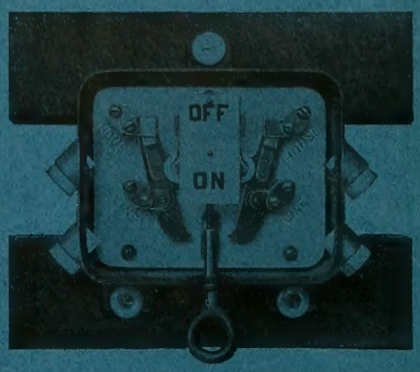

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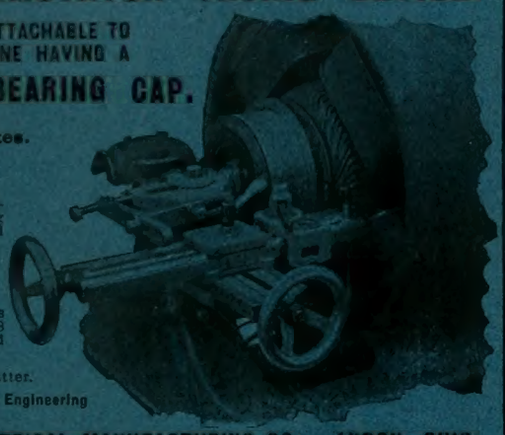

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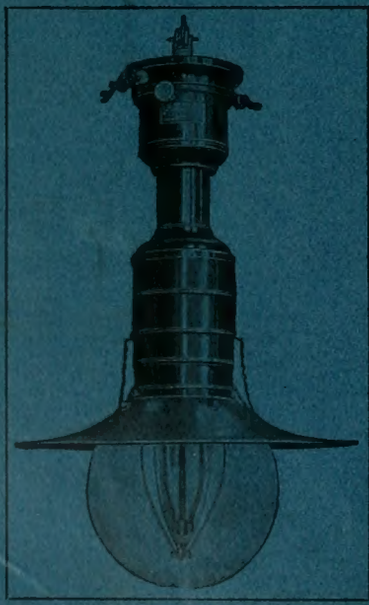

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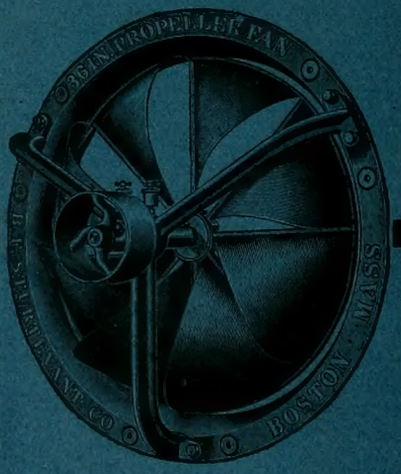

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